

The Manhattan Project



Abstract

On July 16, 1945, the world entered the nuclear age with the detonation of the first atomic bomb. This day will be remembered forever, much like the events that occurred in Hiroshima and Nagasaki. However, the history of the Manhattan Project remained classified for many years.

The Manhattan Project

- Code name for the development of the Atomic Bomb.
- Project took place in New Mexico.
- Named after the Manhattan Engineer District of the US Army Corps of Engineers, based in New York City, where much of the early research was done.
- The project lasted 4 years, between 1942 - 1946, and cost about \$1.8 billion.
- The project marked the beginning to an era of nuclear weapons and scientific discoveries.

The Manhattan Project

The project produced three bombs:

1. "Gadget", was used as a test model;
2. "Little Boy", was detonated over the city of Hiroshima;
3. "Fat Man", was detonated over the city of Nagasaki [link](#)

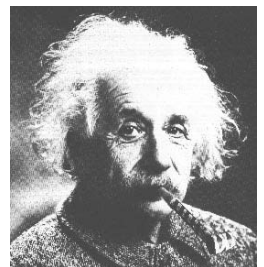
Key Players: Leo Szilard

- Expelled from Germany for being Jewish.
- Moved to England and conceived the idea that a nuclear chain reaction was possible.
- Was convinced that the United States had to study fission.



Key Players : Albert Einstein

- With the help of Leo Szilard, Einstein convinced President Roosevelt that Germany may be using uranium and fission research to create a new type of super bomb.
- Einstein helped the United States to begin the same type of research of uranium and fission that was occurring in Germany.



Key Players : Neils Bohr

- Neils Bohr theorized that U 235 was the most stable element that could withstand a chain reaction.
- It was his "droplet model" theory that paved the way for fission. Basically, this theory stated that if a neutron hit the heavy nucleus of an atom, a fission reaction might be initiated.



Key Players : Enrico Fermi

- Built a small reactor in Chicago, under the squash courts of the university.
- Created the first controllable chain reaction at his lab.



Key Players : Glen Seaborg

- He and others discovered the isotope Plutonium-238
- Developed a process for separating weapons-grade plutonium from uranium in nuclear reactors
- Glen Seaborg was never involved in the Project, though his discovery of Plutonium became quite useful.



Key Players : Richard Feynman

- Developed much of the mathematics behind atomic bombs.
- Figured out key mathematical equations such as the amount of fissionable material needed to achieve an explosion
- Critical Mass



Key Players : J. Robert Oppenheimer

- Received his Ph.D. from German Göttingen University in theoretical physics.
- In 1943, he became the scientific director for the Manhattan Project.
- Involved with every step of the project.



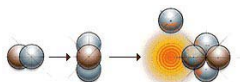
Key Players : Leslie Groves

- General Leslie Groves was the military manager for the Manhattan Project.
- Groves' aggressive management style and determination were key factors to the success of the Manhattan Project.



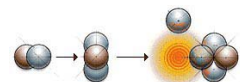
Fusion Bomb

- More commonly known as the Hydrogen Bomb.
- A fusion explosion starts with a fission reaction, but it gets its power from the combining of the nuclei of several hydrogen isotopes to produce helium nuclei.



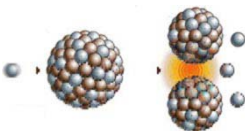
Fusion

- A second type of nuclear reaction where nuclei combine to form a large nucleus. During this reaction, energy is also released.



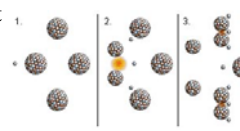
Fission

- A reaction in which a neutron causes the nucleus of an atom to split in two fragments. This reaction also causes the release of energy as well as more neutrons.



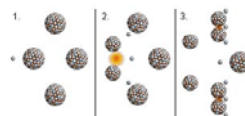
Fission chain reaction

- A chain reaction occurs when the neutrons released during fission cause other nuclei to split and release more neutrons. The process is repeated; large amounts of energy are released during this reaction.
- Like Dominoes



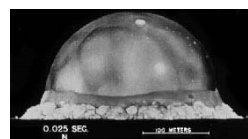
The Chain Reaction

- This chain reaction takes place in only millionths of a second.
- The amount of power released during this chain reaction is about several hundred million volts of energy which is released at detonation.
- Gamma radiation given off, the deadliest form known to man.



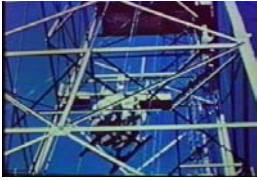
Testing the Bomb

- Scientists selected an isolated section of land near Alamogordo, New Mexico.
- Trinity Test site.
- Gen. Groves scheduled the test for July 16, 1945.
- It was recorded that Fermi upset Gen. Groves by wondering out loud if the explosion would ignite the atmosphere.



Testing the Bomb

- The explosion was much more powerful than they had originally expected.
- The explosion was equivalent to about 20,000 tons of TNT.



Testing The Bomb



<http://people.howstuffworks.com/nuclear-bomb.htm/printable>

Testing The Bomb



Fission Bomb: Little Boy

- Gun-Triggered Fission Bomb
- Uranium Bomb
- <http://science.howstuffworks.com/nuclear-bomb4.htm>

Fission Bomb: Fat Man

- Implosion Triggered Fission Bomb
- Plutonium Bomb
- <http://science.howstuffworks.com/nuclear-bomb5.htm>

Dropping the Bombs

- On August 6, 1945, a B-29 "Flying Fortress" named the Enola Gay dropped the uranium bomb known as "Little Boy" over the city of Hiroshima.
- The explosion was equivalent to 18,000 tons of TNT.
- Instantly, 66,000 people were killed and over 69,000 people were injured. Due to the radioactive fallout, many more people died.

- By the end of 1945, it was estimated that 140,000 people died in Hiroshima as a result of the explosion.
- Radiation was a major factor after 1945. Between 1946 and 1951, over 60,000 people died from radiation related illnesses.
- Unfortunately, the US decided to drop a second bomb three days later.

Dropping the Bombs

On August 9, 1945, a second B-29 "Flying Fortress" named the Bock's Car dropped the plutonium bomb known as "Fat Man" over the city of Nagasaki.

- This mission was plagued with problems. This plane took off with a small fuel tank. There were several clouds over Nagasaki, making targeting difficult. With no fuel left and a break in the clouds, the decision was made to drop the bomb. It missed by over a mile.

Dropping the Bombs

- The bomb still managed to destroy half the city as well as the near by mountains.
- Even though the plutonium bomb was more powerful than the uranium bomb, casualties were less because the bomb missed.
- Instantly, 39,000 people were killed and over 25,000 people were injured .
- By the end of 1945, it was estimated that 70,000 people died in Nagasaki because of the explosion.

Conclusion

- The Manhattan Project changed all of our lives. It changed the history of mankind and civilization.
- The ultimate lesson learned is that scientists, and ultimately citizens, must take responsibility for their actions.
- Science should be use for the improvement of our lives and not for our destruction.
- Further information:
<http://www.me.utexas.edu/~uer/manhattan/index.html>
 – Video, Enola Gay: Rain of Ruin