The Creation of the Atomic Bomb:
The Manhattan Project

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Physicist Enrico Fermi works independently in Rome, while the team of Fritz Strassmann and Otto Hahn are working in Berlin. They experimented with the identified barium in the residue after bombarding uranium with neutrons.¹ Later, their work produced a variety of radioactive substances, most of which could not be identified at first sight. What these scientists had been seeing was not understood. This had been completely new, the splitting of the uranium nucleus into two parts, forming a different element. Puzzled over the results, physicists Lise Meitner and Otto Frisch identified and then explained that the splitting process releases a tremendous amount of energy.² Frisch titled this fission, after the Latin word meaning split. This new discovery enlightened scientists, Americans rushed to study the fission process. Despite the discovery, Szilard was worried, for the fission breakthrough jolted his belief in the possibility of a sustainable chain reaction that could then release great quantities of energy.³ This energy could then be turned into an atomic weapon. If this information fell into the wrong hands, it could be devastating. The development of the atomic bomb was a triumph in scientific discoveries for America, but many would soon come to realize the full extent of what they have created. A once supreme and respected discovery later became the culprit to the death of millions. Key aspects of the creation of the atomic bomb are the Einstein-Szilard letter, Enrico Fermi’s pile, and the Army’s help in creating facilities and plans for the production of plutonium and uranium.

Einstein-Szilard Letter (1939)

Leo Szilard, with Hungarian physicists Eugene Wigner and Edward Teller, agreed President Franklin D. Roosevelt, must be warned of Nazi Germany’s plan on creating the world’s first atomic bomb. For they were not well known, the three needed someone to help head warning to FDR. So, the three enlisted the support of the infamous Albert Einstein. Wigner, Teller and Szilard used Einstein's reputation to gain attention. The four met at Einstein's summer home on Long Island to compose a letter to FDR, beginning with the following:

“Some recent work by E. Fermi and L. Szilard, which has been communicated to me in manuscript, leads me to expect that the element uranium may be turned into a new and important source of energy in the immediate future. Certain aspects of the situation which has arisen seem to call for watchfulness and, if necessary, quick action on the part of the Administration. I believe therefore that it is my duty to bring to your attention the following facts and recommendations: “

The group then went on to explain that atomic energy could be made into atomic bombs of mass destruction.

On August 2 1939, the letter, calling action to nuclear research, was dated and signed by Albert Einstein. From there, Alexander Sachs, a Wall Street economist and unofficial advisor to

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the President, delivered the letter- the letter arrived on October 11, 1939.\textsuperscript{6} Hitler's invasion of Poland a month prior added urgency to the letter.\textsuperscript{7} With the letter in President Roosevelt's hands, he understood, with the help of Sachs, the urgency of the matter.\textsuperscript{8} It appeared most likely that America would be starting atomic bomb weapons research.

Within the first week of meeting with Sachs, Roosevelt appointed Lyman J. Briggs, the head of The National Bureau of Standards, to be head of The Advisory Committee of Uranium. The organization was to study the feasibility of a nuclear chain reaction, and the possibilities of using atomic energy for the potential defense of the country.\textsuperscript{9} On October 21 1939, Briggs invited three Hungarian scientists to attend the committee, along with the civilian and military representation. There, Szilard explained the ideas of producing a chain reaction of uranium, and the estimated destruction force of an atomic bomb.\textsuperscript{10} Issued November 1, 1939, by the Advisory Committee of Uranium, they recommended to the President that uranium oxide be provided for continued research and development.\textsuperscript{11} At this point in time, President Roosevelt had begun to foresee serious affairs on the matters of this subject.

By late 1940, the atomic bomb did not seem to be the priority of most. In late 1941, the events that took place had changed that. A British committee, code name MAUD, organized to

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envisage the development of an atomic bomb. MAUD had concluded that the development of a U-235 bomb was not only possible, but could be concluded in a minimum of three years.\textsuperscript{12} Facilities to separate enough U-235 to fuel a line of the bombs would be an estimated cost of €5,000,000, or $5,646,525\textsuperscript{-} this report was officially released in October 1941. Yet, somehow America received it seven months prior.\textsuperscript{13} This report jolted key American administrators and scientists that they should commit to building an atomic bomb. Advised by Vannevar Bush, Roosevelt made the decision that this bomb was their top priority.

**Pearl Harbor (1941)**

On December 7th, 1941 Japanese planes bombed Pearl Harbor Naval Base.\textsuperscript{14} The United States had been in shock, what was known to be just a European war turned into a worldwide catastrophe. The following day, December 8th, President Franklin D Roosevelt delivered a speech to Congress. He called it, “a day that will live in infamy”, with that, he requested that Congress declare war on Japan.\textsuperscript{15} The Senate concluded their vote 82-0, and the House of Representatives was 388-1. Italy and Germany declared war on the United States three days after.\textsuperscript{16}

Through 1941 and 1942, the majority of bomb-related research was conducted at university centers, by scientists. These universities included Princeton, Chicago, Berkeley and

\begin{itemize}
\item \textsuperscript{12} *The Making of the Atomic Bomb.* Simon & Schuster, 1986
\item \textsuperscript{16} Gorman, Jacqueline Laks. *Pearl Harbor*. Gareth Stevens Publishing
\end{itemize}
An added urgency had been brought upon Americans after the Pearl Harbor bombing. A tremendous amount of key administrators and scientists began to recognize that a successful bomb program would put the outcome of the war to their advantage.

In early 1942, a discovery at Chicago Metallurgical Laboratory (Met Lab), by Enrico Fermi, would further the creation of the atomic bomb. Scientists left and right had been brought together to this central location to develop chain-reacting piles (nuclear reactors) for plutonium production, as well as to construct methods for extracting plutonium from the irradiated uranium. A total of four methods were considered for the splitting of plutonium. At the time, the bismuth phosphate process had shown the most promise when splitting U-235 and U-238. This process had been used to extract plutonium from irradiated iridium, taken from nuclear reactors. The following August, scientists at the Met Lab isolated the first weighable amount of plutonium. On December 2, 1942, at Stagg Field, Chicago Pile 1 (CP-1), Fermi’s pile, produced the first self-sustaining nuclear reaction. Arthur H. Compton, Walter Zinn, Herbert Anderson, Leo Szilard and Eugene Wigner are some of the many scientists at Chicago that made this pile possible. Construction of the first atomic pile, planned by Enrico Fermi, began on November 16, 1942, beneath an abandoned rackets court on Stagg Field. This location had been chosen because of the reassurance Fermi gave scientists that the probability of an accident was minimal. Though many knew the risk, no one informed the university administration about the

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17 Rhodes, Richard. *The Making of the Atomic Bomb*
experiment. The pile had not been an elegant sight, being composed of an elliptical mass of dark graphite, used as a moderator, with a timber scaffolding surrounding it. Bars had been cut perfectly to fit closely together. Some were alternated with dead uranium, fuel for nuclear the reactor, in the layers of the pile, each block drilled to take two five-pound uranium pellets. Others, scientists incorporated slotted bricks of graphite to form 14-foot channels for control rods of cadmium covered wood. Cadmium absorbed neutrons and kept the fission process contained.

Just seventeen days after construction began on the pile, December 2, the final phase of CP-1 was ready. On the scaffolding surrounding the pile, scientists stood ready, equipped with cadmium solution to subside the process of fission should something go wrong. Then, at 9:54am, Fermi instructed that the control rods taken out. Neuron counters clicked increasingly as the rods left its core. This process took most of their afternoon, for the rods had to be inched away slowly. The clicking of the neuron counter roared, for it could not count fast enough. Fermi had let the pile run for four and a half minutes, at 0.5 watts, before shutting it down. There, these scientists had just witnessed the first ever self-sustaining nuclear chain reaction. Success, America had achieved in creating a working nuclear reactor.

**The Army and the Bomb**

With a two-billion-dollar funding for the project, the creation of an atomic bomb was within reach. Vannevar Bush, head of OSRD (Office of Scientific Research and Development), obtained the consent of FDR to place the manners of the development and production of the

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bomb in the hands of the Army. The Army Corps selected Col. James C. Marshall to begin the process of building facilities for such project. The name, “The Manhattan Engineer District” was the select name for this top secret project, the placement of Marshall's office in Manhattan led to the name. In the fall of 1942, Leslie R. Groves, the Army Corps of Engineers officer, was dubbed the head of the Manhattan project. During this time, Groves had just finished building the Pentagon in a timely manner and on budget. For a reward, he was put in charge of the Manhattan project, given a fund of $2 million. Theatrical physicist Leslie R. Groves had been the ideal selection. Groves stated, “If I can’t do the job, no one man can.” On September 18, 1942, Groves was promoted to general and took command of the Manhattan project.

With Groves in charge, the project had taken new light. Within a month of being in charge, he ordered an important stock of uranium ore from Belgian and purchased land in Tennessee for a bomb fuel manufacturing site. The key figures in the management of the project included Vannevar Bush, James Bryant Conant Groves, and Col. James C. Marshall. They were in charge of “all large-scale aspects”, as Bush put it. Marshall soon realized they would need to acquire a great amount of assistance in order to achieve creating the bomb. Groves, who later accepted more and more responsibility for the Manhattan Project, had become mainly a supervisor for the production of the bomb. A new Military Policy Committee (MPC) was created by Bush, with the help of Secretary of War Henry Stimson. The committee included

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one representative from the Navy, Army and the Office of Scientific Research and Development (OSRD).\textsuperscript{31} This committee became an overall director of the Manhattan Project, to oversee all serious affairs.

Going into late 1942, bomb research turned into the beginning of production. Oak Ridge, Tennessee housed power plants and huge factories for the production of the bomb fuel U-235. For the production of plutonium fuel, it took place in Hanford, Washington, and Los Alamos, New Mexico for bomb assembly and production.\textsuperscript{32} Los Alamos had also been Groves’s choice for where the final bomb would be developed. Oppenheimer, as a director, had the responsibility to foresee the design and production of a well-working atomic bomb. Through the winter and spring of 1942-1943, Los Alamos became to take shape into a complex laboratory that would later develop the world's first atomic bomb. Barahacks like houses had been developed at Los Alamos to soon house key scientists for the production of the bomb. A single house, constructed of cement and asbestos walls, could be accomplished every thirty minutes because of Skidmore and Owings & Merrill, architecture firms, and engineers at Stone & Webster.\textsuperscript{33}

Oppenheimer’s staff and the Theoretical Physics Division, later, habited these buildings to be closer to the laboratory. As the project progressed at Los Alamos, Oppenheimer had to bring in additional scientists to assist in figuring out how this atomic bomb will function. Hans


Berhe, a successful nuclear physicist, came to Los Alamos to lead the Theoretical Physics Division in 1943.\(^{34}\) As time furthered, thousands of scientists would be employed at Los Alamos.

President Roosevelt and British Prime Minister Winston Churchill meet on several occasions during the Second World War. On one specific occasion, in London, July 1943, Roosevelt and Churchill signed a document that would enlist Great Britain's help in the Manhattan project.\(^{35}\) The following December, those from the British Mission began to arrive at Los Alamos. The first was mainly nuclear scientists, such as Frisch, who led an Anglo American group that was first to demonstrate the critical mass of U-235, and E. Bretscher who already sought out nuclear weapons.\(^{36}\)

**Trinity- The Final Results (1945)**

As research progressed, in the spring of 1943, Oppenheimer and his staff established priorities for the bomb. These tasks were to assemble a critical mass, determine the best materials for a fission bomb, and find a way to assemble an explosive package. Los Alamos scientists and experts set their hopes on plutonium, implosion-type bomb.\(^{37}\) This works when the core of subcritical plutonium is surrounded by several thousand pounds of high-end explosives. The inner workings are placed in such a way that the HE inwards, crushing the plutonium core, turning into a sub-critical state.\(^{38}\)

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\(^{36}\) Fakley, Dennis C. "The British Mission." LANL


The “Gadget” was set to detonate 210 miles south of Los Alamos, at the Alamogordo Bombing and Gunnery Range in the barren, Jornada Del Muerto Desert, nicknamed Trinity by Oppenheimer. This location was chosen for its lack of wind, isolation and its flat plane. Three observation bunkers had been set north, south and west of the detonation site, at ground zero. These bunkers were to measure key aspects of the explosion. Ultimately, Los Alamos scientists wanted to measure symmetry of the implosion and the amount of energy released. Norris Bradbury, an American physicist working at Los Alamos, confirmed the feasibility of the plutonium bomb. A concern of many in the administration was the spread of radioactivity, so, in preparation, the army stood ready to evacuate people in surrounding areas.

The “Gadget” detonated at 5:30 am sharp, releasing 18.6 kilograms of force. Instantaneously, the once white sand turned into jade, green glass, named trinitite because of its location. 38,000 feet into the air, a multi-colored mushroom cloud surged into the air in just seven minutes. Where the tower holding The “Gadget” once stood, a half mile across by eight feet deep crater was formed. Witnessing scientists and administrators, now, fully realized the extent of what they had created. The nuclear age had officially begun.

Annotated Bibliography

Primary Sources

"Basic Research at Los Alamos." *U.S. Department of Energy,*
Accessed 8 Feb. 2019. The U.S. Department of energy provided great information on scientific research at Los Alamos. Assembling a critical mass, at first, was difficult. Enrico Fermi took charge of these experiments and became one of the top priorities at the New Mexico Laboratory. Along with that, they would need to find an explosive package for the Gadget.

nsarchive2.gwu.edu/nukevault/ebb525-The-Atomic-Bomb-and-the-End-of-World-War-II/. Accessed 12 Dec. 2018. The National Security Archive gave a substantial amount of information about the bombs, "Fat Man" and "Little Boy". I learned that "Fat Man" was a plutonium-type bomb, and weighed nearly 10,000 pounds. Also, "Fat Man" was sixty inches in diameter and 128 inches long. For the bomb "Little Boy", I was informed that was a uranium gun-type and was detonated over Hiroshima. This bomb was twenty eight inches in diameter and 120 inches long. The National Security Archive also provided a great amount of primary photos of the bombs, and their outcomes.

"Early Uranium Research." *U.S. Department of Energy,*
discovering information on the early stages of uranium research, in America. I learned about uranium-235 and -258 and their purposes in the atomic bomb. Also, I was informed that the two isotopes had to be split, so only U-235 would be used. This source was excellent for finding out the science behind the bomb.

"Einstein's Letter." U.S. Department of Energy,

www.osti.gov/opennet/manhattan-project-history/Events/1939-1942/einstein_letter.htm. Accessed 31 Dec. 2018. The U.S. Department of Energy supplied great information on Einstein's letter. I learned that on October 11th, 1939, Sachs delivered and explained Einstein's letter to Roosevelt. Also, I learned that on the 19th, it was suggested that a committee be set up, consisting of civilian and military representatives, to study uranium. This had been the first decision of many that led to the Manhattan Project.

"Einstein-Szilard Letter." Atomic Heritage Foundation, 2006,

www.atomicheritage.org/key-documents/einstein-szilard-letter. Accessed 31 Dec. 2018. The Atomic Heritage Foundation is a source that supplies great information. On this page, I was able to read the letter in which Einstein and Szilard wrote to President Roosevelt. This source helped me understand what they were talking about in the letter, and what they said. Also, the pairs finding became great information I could use in my project.

Fakley, Dennis C. "The British Mission." LANL,

the United Kingdom, was Frisch and E. Bretscher. Many of those from The British Mission worked on bomb assembly. General Groves, Hans Berthe and other key administrators though that without their collaboration with the British, the outcome of the bomb would have been less superior.

"Fermi on Chicago Pile- 1." *Atomic Heritage*,
Atomic Heritage Foundation provided primary information on Enrico Fermi's pile and how it was helpful. The experiment was built so it would proceed at a slow rate. Arthur H. Compton, Walter Zinn, Herbert Anderson, Leo Szilard, Eugene Wigner are just some of the many scientists that worked hard at Chicago to make this nuclear reaction possible.

Gorman, Jacqueline Laks. *Pearl Harbor*. Gareth Stevens Publishing. "Pearl Harbor" provided me with great insight on the day of the Pearl Harbor bombing, and its effects. On December 7, 1941, on a sunny Hawaiian morning, Japanese naval bases attacked Pearl Harbor. This bombing had been, "a wakeup call to Americans", for the European war had turned into a full-fledged world war. At Pearl Harbor, 159 plans were damaged and 180 destroyed. For the United States, a loss of 2,335 service men and women were killed, and 1,178 injured.

Accessed 18 Jan. 2019. Osti.gov contributed excellent information on the Bismuth Phosphate Extraction process and where some of these chemicals had been made. At
Hanford, they worked to separate plutonium from spent fuel. These scientists had to work to use one of the three processes known for doing so. Going to the Bismuth Phosphate Extraction, I learned that it is caused by crystal lattice sites for the phospace.

"Manhattan Project Begins - 1942." Atomic Heritage Foundation, www.atomicheritage.org/history/manhattan-project-begins-1942. Accessed 3 Feb. 2019. Atomic Heritage Foundation presented great information on the Military Policy Committee, and their contribution to the Manhattan Project. Bush, with the assistance of Secretary of War Henry Stimson, created this committee. One representative from the Navy, Army and the Office of Scientific Research and Development (OSRD) had been included in this party. Bush believed this committee would remedy the problems of the Manhattan Project.

"The Maud Report." U.S. Department of Energy, www.osti.gov/opennet/manhattan-project-history/Events/1939-1942/maud.htm. Accessed 18 Jan. 2019. The MAUD report presented a substantial amount of information on the MAUD report issued in 1941. This British study claimed they had correctly purified critical mass of Uranium-235 and could begin the assembly of an atomic weapon. Vannevar Bush had received a copy of this report from the National Defence Research Committee. The MAUD also estimated that a critical mass of ten kilograms would be enough to create a large explosion.

paper. I learned that, at Columbia University, Fermi-Szilard's pile had been under
construction by 1940. Along with that, I learned that a large amount of graphite was
needed to make the bombs. Natural uranium was also key to creating a successful
self-sustaining nuclear reaction. I also learned about the various amounts of experiments
done on such piles and bombs.

Publication Data, 1986. The Making of the Atomic bomb book provided a great amount
of information on the creation of the atomic bomb, and the science behind it. Also, this
source provided an immense amount of primary photographs that were substantial in
seeing what everything looked like. This book went into detail when describing the
Einstein- Szilard letter, and how they wrote it. I also learned the background of
physicists working on the Manhattan project, and how they helped our nation.

"Roosevelt and Churchill: A Friendship That Saved the World." *National Park Service*,
gave great information on the agreement between Great Britain and the United States of
America during World War Two. The pair meet on several occasions during the war, to
discuss the matters of a war strategy. At President Franklin D. Roosevelt's home in Hyde
Park, Churchill and he discussed an agreement that would partner the two countries in the
creation of an atomic bomb.

Sheinkin, Steve. *Bomb*. Roaring Brook Press. "Bomb" was a great source in finding information
on the Manhattan Project. This book covered from the beginning, when President
Roosevelt read Einstein's letter, to the race to Trinity, I learned that when placed
alongside a radioactive material, a uranium atom split in two before the eyes of German scientists. This discovery, along many other, pushed the race to create the atomic bomb. Trinity Site. National Park Service, www.nps.gov/whsa/learn/historyculture/trinity-site.htm. Accessed 1 Feb. 2019. The National Park Service provided great information on the Trinity Site, and what happened on the day the Gadget was dropped. To begin, the bomb was placed atop a 100ft steel tower that was ground zero. Wooden observation centers, protected by concrete and earth, were placed 5.7 miles from ground zero.

"Trinity Site- World's First Nuclear Explosion." Energy, www.energy.gov/management/trinity-site-worlds-first-nuclear-explosion. Accessed 25 Jan. 2019. This website provided a great amount of information on the Trinity testing in 1945. To begin, the "Gadget" produced 18.6 kilograms of force when hitting the floor of the New Mexico desert. The bomb was hoisted atop a 150-foot tower. This nuclear explosion occurred on July 16, 1945. When the bomb hit the white sand of New Mexico, it instantaneously turned into green glass.

"The Trinity Test." U.S. Department of Energy, www.osti.gov/opennet/manhattan-project-history/Events/1945/trinity.htm. Accessed 23 Jan. 2019. The U.S. Department of Energy's article on the Trinity test site provided great information on the matter. To begin, I learned that many doubted that the bomb would detonate. The name Trinity, for the testing site, was chosen by Oppenheimer from a poem written by John Donne. Three observation bunkers, for the explosion, were placed 10,000 north, west and south of the detonation site, to measure key aspects of the explosion. Also, they were to record the measurements of the fireball.
"Who Build the Atomic Bomb?" Atomic Heritage Foundation, 16 June 2014, www.atomicheritage.org/history/who-built-atomic-bomb. Accessed 11 Dec. 2018. The Atomic Heritage Foundation gave great information about the making of the atomic bomb. I learned that the making of this bomb took twenty-seven months. Interestingly, over one hundred Nazis refugees contributed immeasurably to the effort. Over thirty states were used as "factories", for they supplied resources that were put into the Manhattan project.

Secondary Sources
"51f. The Manhattan Project." U.S. History, 2008, www.ushistory.org/us/51f.asp. Accessed 31 Dec. 2018. U.S. History provided some of the greatest information on the matter of the Manhattan Project. To start, I was very interested to find out that Albert Einstein fled Nazi persecution, before coming to America, and Enrico Fermi had escaped Fascist Italy. After living in America, the two made a name for themselves, then eventually decided FDR should be warned about the bomb-related efforts of Nazi, Germany. Fermi event went to Washington to express the concerns of his to the government, but no one listened. That's when himself and Einstein wrote a letter to FDR.

Beyer, Don E. The Manhattan Project: America Makes the First Atomic Bomb. Edited by Barbra Silbredick Feinberg, 1991. "The Manhattan Project" provided a lot of notable information. This book went into great detail on the Einstein-Szilard letter, how FDR received it, and his reaction. Then, it goes on to explain the various amounts of research going on in Columbia, Chicago, Berkley and Princeton research centers. Until, the
bombing of Pearl Harbor. From then on, it was urgent to create the atomic bomb for a
defense mechanism of the united states. So, a committee is created to create this bomb.

"Building the 'Secret Cities.'" National Trust for Historic Preservation, 20 June 2016,
savingplaces.org/stories/building-the-secret-cities-pre-fab-architecture-of-the-manhattan-
information on the "Secret Cities" of Los Alamos. To begin, an average of seventeen
houses a day was created with the help of architecture firm Skidmore, Owings & Merrill,
and engineers from Stone & Webster. These houses were created with cement and
asbestos walls, with varied layouts. These barahacks-like buildings housed key scientists
and administrators for The Manhattan Project.

"Chicago Pile-1." Atomic Heritage, 1 Dec. 2016,
Heritage Foundation provided me with a great amount of information on Enrico Fermi's
pile, along with its construction. It had been created under the bleachers on Stagg Field,
at Chicago University. In the freezing cold, scientists created this pile, that soon would
soon create the world's first self-sustaining nuclear reaction. They had stacked bricks of
graphite, cut perfectly, on crude wood paneling. Some had been drilled with holes to be
fit with either dead uranium or uranium. Fourteen foot control rods had also been
carefully placed in the contraption, so if anything were to go wrong, they had a backup
plan.

"How Many People Died at Pearl Harbor during the Attack?" Pearl Harbor Visitors Bureau,
visitpearlharbor.org/faqs/how-many-people-died-at-pearl-harbor-during-the-attack/.
Accessed 8 Dec. 2018. The Pearl Harbor Visitors Bureau provided great information on the Pearl Harbor bombing. To begin, the total number of people killed is 218 from the army, 109 from the marines, 2,008 naval personnel, 68 civilians, with a total of 2,603. The total of the wounded came to 1,133 people. Lastly, the total Japanese losses was 55 men.

Jones, Vincent C. *Manhattan: The Army and the Atomic Bomb*. 1985. This source provided astounding information on how the army helped with the Manhattan Project. I learned about the Military Policy Committee and how they were to report any on their findings. Bush, Bryant, Constant and Groves had been in charge of all large scale aspects. The army was to help foresee all of the action, as well to build new structures if needed.

Lange, Greg. "United States Declares War on Japan on December 8, 1941." *HistoryLink*, 11 Jan. 2004, www.historylink.org/File/5635. Accessed 20 Dec. 2018. HistoryLink was an amazing source when finding out information on the declaration of war on Japan, and the following actions. ON December 8, 1941, America declared war on Japan. Just after 8:30 on this day, a national radio broadcast of Roosevelt stated that America was declaring war on Japan. In the House of Representatives, only one person voted no on the war against Japan. Later, this would be one of the biggest wars in American history.

"Metallurgical Laboratory, University of Chicago, Illinois." Atom Archive, www.atomicarchive.com/History/sites/Metlab.shtml. Accessed 10 Jan. 2019. Atomic Archive provided me with a great amount of information on the "Met Lab", and how it helped with the findings for the atomic bomb. This lab had been a central location for scientists from all over to meet. Here is where "piles" had been designed. Also, at Met Lab, the first weighable amount of plutonium was created, this was a very big deal. From there, they could now use Fermi's Pile.

"Norris Bradbury." Atomic Heritage Foundation, www.atomicheritage.org/profile/norris-bradbury. Accessed 2 Feb. 2019. Norris Bradbury, according to the Atomic Heritage Foundation, was to oversee the production of the first atomic bomb and helped at the Trinity Site. Bradbury was assigned to Project Alberta, which oversaw the production of the bombs and their delivery. Also, he helped tremendously at the Trinity Site, for he confirmed the feasibility of a plutonium bomb. Without the help of Bradbury, the Trinity testing may not have gone as expected.

Recchiuti, John Louis. "The Manhattan Project and the Atomic Bomb." Khan Academy, 2018, www.khanacademy.org/humanities/us-history/rise-to-world-power/us-wwii/a/the-manhattan-project-and-the-atomic-bomb. Accessed 10 Dec. 2018. Khan Academy offered a substantial amount of information about who created the first atomic bombs in the Manhattan Project and the bombing of Hiroshima and Nagashima. To start, I learned that the when the atomic bomb hit the two large cities, it created a genocide of over 210,000 people. Also, interestingly, I learned that Albert Einstein, in October 1939, wrote a letter to President Roosevelt stating that Nazi Germany had already started work on an atomic
bomb. As the Manhattan project commenced, years later, six thousand scientists and engineers from leading universities and industrial research labs were at work on the development of the world’s first-ever nuclear weapon.

Rhodes, Richard. The Making of the Atomic Bomb. Simon & Schuster, 1986. "The Making of the Atomic bomb provided a tremendous amount of information and quotes of the Manhattan Project. To begin, I learned that as early as 1939, scientists and administrators had already sought the possibility of an atomic bomb, but it wasn't until the Pearl Harbor attack that the United States acted upon this idea. Going further ahead in the timeline, I learned that MAUD saw a great future in the development of the atomic bomb.

"The S-1 Committee." Atomic Heritage, 27 Apr. 2017, www.atomicheritage.org/history/s-1-committee. Accessed 8 Feb. 2019. Atomic Heritage displayed great information regarding the Uranium Committee. They were to determine the feasibility of a nuclear chain reaction. On November 1, 1939 the group recommended that a large amount of uranium oxide for continued research and development be given to them.

Serne, R. J., et al. "Laboratory-Scale Bismuth Phosphate Extraction Process Simulation to Track Fate of Fission Products." Pacific Northwest National Laboratory, Feb. 2007, www.atomicarchive.com/History/mp/p4s26.shtml. Accessed 17 Jan. 2019. Pacific Northwest Laboratory provided me great information on the Bismuth Phosphate Process. This process was used during the Manhattan Project to split plutonium from irradiated iridium. This splitting process was created at California, Berkeley by a scientist
named Stanley G. Thompson. Finding this process was key in the creation of the atomic bomb.

"The Story of the Atomic Bomb." eHistory, ehistory.osu.edu/articles/story-atomic-bomb. Accessed 10 Dec. 2018. In this source, I learned a great amount about the scientists working at Los Alamos, and their discoveries. Some of these scientists included Albert Einstein of Germany, Neils Bohr of Denmark, Pierre and Marie Curie of France and Leo Szilard of Hungary. In the early 1900s, these scientists started studying the structure of the atom. Also, this site conformed to me that President Roosevelt was serving his presidency at this time.

"Timeline: Road to Hiroshima." National Public Radio, 5 Aug. 2005, www.npr.org/templates/story/story.php?storyId=4785786. Accessed 12 Dec. 2018. This timeline provided a great understanding of the chronological order of the events with World War Two. To start, in 1942, Robert Oppenheimer was appointed by President Roosevelt to be in charge of the Manhattan project. Then, on May 7th, 1945, Germany surrendered, ending the war in Europe. On July 16th, 1945, the bombs were dropped on Hiroshima and Nagashima. On August 15th of the same year, Japan surrendered, concluding the second world war.

"Gadget", it was shaped like a large steel globe. At 5:29:45, Gadget detonated between the force of 20 and 15 kilograms. The Atomic Age had officially begun.

"The Uranium Committee." Atomicarchive, www.atomicarchive.com/History/mp/p2s1.shtml. Accessed 8 Feb. 2019. Atomicarchive provided substantial information on The Uranium Committee. This committee was created by President Roosevelt in response to needing help on uranium research by the government. Roosevelt enlisted Lyman J. Briggs, the head of the Bureau of Standards, to be head of this organization. Briggs held The Uranium committee first meeting on October 21, 1939, containing both military and civilian representatives.