The History of the Twentieth Century
Episode 391
“The Manhattan Project”
Transcript

[music: Fanfare]

“The deep things in science are not found because they are useful; they are found because it was possible to find them.”

J. Robert Oppenheimer.

Welcome to *The History of the Twentieth Century*.

[music: Opening War Theme]

Episode 391. The Manhattan Project.

Vannevar Bush was born on March 11, 1890 in Everett, Massachusetts. His father, Richard Perry Bush, was a Universalist minister. His mother, Emma Linwood Paine, came from a prominent Massachusetts family.

Vannevar earned Bachelor’s and Master’s of Science degrees from Tufts University in 1913, and was awarded a Ph.D. in engineering jointly by Harvard University and the Massachusetts Institute of Technology in 1916. During the First World War, he worked with the US National Research Council on a project to detect submarines.

After the war, he joined the faculty of MIT in the electrical engineering department. He invented a thermal switch, which is an electrical switch that automatically turns itself off when its temperature rises above a given point, then turns itself back on again after the temperature goes lower. Such a device is useful as a safety measure to cut power to equipment that is overheating. It was also the basis of the thermostat, a household device that turns the heater on and off as needed to keep your home at a comfortable temperature automatically. Demand for these devices was high, and they made Bush a wealthy man.

He also invented an analog device that could solve differential equations, and my hat’s off to him for that. I can’t even solve differential equations anymore.

In 1924, Bush teamed with a group of inventors to market another new invention, a voltage regulator tube. This is a device that maintains a voltage at a constant level and was key to the manufacture of home radio receivers that could operate off of household electricity. This invention arrived just as the radio craze was taking off and made a lot of money for the company Bush and his investors created to manufacture and sell these tubes, which eventually was called Raytheon.

In 1932, Bush became dean of the MIT School of Engineering. In 1938, he was appointed president of the Carnegie Institution, which controlled an endowment dedicated to funding scientific research. One of his first steps in that position was to defund and eventually shut down a eugenics research project the Institution had been funding. Good for him, but Bush was far more interested in hard science and had little use for humanities or social science. He also defunded the Institute's archeology program, which was a major blow to archaeology in the United States.

Just weeks after that appointment, Bush was tapped for a job with the National Advisory Committee on Aeronautics, a US government office that oversaw aeronautical research in the United States.

After Germany invaded Poland in 1939, Bush became concerned about the state of scientific research for national defense. His experience with the National Research Council during the last war left him feeling that the US government was not properly prepared to direct research with military applications in time of war. In 1940, he prepared a draft proposal for the creation of a National Defense Research Committee. Once the Germans invaded France, he sought a meeting with President Roosevelt to discuss the proposal, which was held on June 12, the day the German Army was approaching Paris and French civilians were fleeing the city. It took only fifteen minutes to persuade Roosevelt to approve the proposal, initially to be supported with emergency funds allocated to the President.

The council consisted of five eminent American scientists, plus one representative each from the Army and the Navy. The five scientists were Karl Taylor Compton, president of MIT, James Conant, president of Harvard, Frank Jewett, chairman of the board of Bell Laboratories, and Richard Tolman, dean of the California Institute of Technology graduate school.

Two months later, in August 1940, Bush and his people met with the Tizard Mission, a team of British representatives who came to America to share British military research with the United States. I told you the story of the Tizard Mission and of Bush's involvement, in episode 337. When the British showed the Americans the cavity magnetron, Bush created the Radiation Laboratory, based at MIT, to further research into radar. Within a year, the Radiation Laboratory was testing radar systems that could be carried aboard aircraft and radar fire control systems which could be used to aim anti-aircraft guns.

On the other hand, when American mathematician Norbert Wiener approached Bush about the possibility of building a digital computer, Bush turned the project down on the grounds that it would not be possible to perfect such a device before the end of the war. He was right about that, but only because his rejection of the project delayed its start by three years.

In June 1941, the National Defense Research Committee was superseded by a new Congressionally-created Office of Scientific Research and Development, still directed by Vannevar Bush. This new office was much more lavishly funded than its predecessor and empowered to fund and direct numerous research projects of military significance, including improved fuzes and detonators, new types of military vehicles, radar equipment, and new medical treatments. That last category included penicillin.

Let me say a few words about penicillin before I move on. In 1928, the Scottish physician Alexander Fleming, working at St. Mary's Hospital in London, first demonstrated experimentally that a certain type of mold called *penicillium* secreted a substance which he called penicillin that was deadly to bacteria. It took ten years of research to learn how to grow the mold and extract, purify, and store the penicillin. Experiments on animals determined that penicillin could destroy bacteria in the body of a living creature while producing no adverse effects on the animal itself. By this time, 1941, the potential of penicillin seemed limitless. The only catch was figuring out how to produce it in commercial quantities. That was the problem the Americans were determined to solve. Wounded soldiers died at least as often from infections in the wound as from the wound itself, so a drug that could quickly and safely cure bacterial infections could potentially save millions of lives.

You may recall back in episode 307, which I released on Christmas Day 2022, exactly two years ago (how about that?), I told you the story of the letter written by Leo Szilard and signed by Albert Einstein, delivered to President Roosevelt in the fall of 1939, shortly after the German invasion of Poland, expressing the fear that Germany was working on an atomic bomb and urging the US government to do the same. Roosevelt was convinced and took action.

But I didn't tell you exactly what action he took. His Administration created a Presidential advisory committee. These are a common feature of American government; Presidents can and do create advisory committees on any number of subjects. These committees receive government funding and are assigned to study policy options and make recommendations to the President.

This particular committee was called the Advisory Committee on Uranium. It was set up in the National Bureau of Standards under the supervision of Lyman Briggs, a 65-year-old engineer who was head of the Bureau. This committee moved very slowly, much to the irritation of Leo Szilard, who later said he believed the committee's glacial pace cost the US atom bomb project a year of lost time.

One of the research projects the committee funded was led by expatriate Italian physicist and Nobel laureate Enrico Fermi at Columbia University. In his days as a researcher in Italy, Fermi had discovered that some materials were able to slow down the free neutrons given off by some radioactive materials. This is a critical insight. It was the discovery that fissioning uranium atoms give off neutrons that opened up the possibility that uranium could be used to create a chain reaction of the sort first envisaged by Leo Szilard in 1933. If a fissioning uranium atom gave off, say, two neutrons, and each neutron triggered fission in two more uranium atoms, and then those two atoms gave off enough neutrons to split four uranium atoms…well, you get the picture. From an infinitesimal beginning would come a cascade of splitting atoms releasing enormous amounts of energy: an atomic bomb.

In 1939, Fermi was one of the few prominent atomic physicists who questioned whether an atomic bomb was possible. His own research at Columbia involved further study of those materials that slow neutrons down. In our time, we call these neutron moderators. Slowing neutrons down is useful because that makes it more likely that the neutron would be captured by a uranium atom, a necessary step in maintaining a chain reaction. Ideally, the neutron moderator would not absorb neutrons itself; it would merely reduce their speed.

Fermi wasn't thinking about bombs; he was thinking about the other great promise of atomic physics, the atomic power plant. A practical atomic power plant would need some way to regulate the rate of energy production. Neutron moderators would be just the thing. By inserting or removing a neutron moderator, you could control the rate at which your uranium is fissioning. It would be like driving a car. Push this pedal to move forward, push that one to slow down.

Fermi demonstrated that carbon, in the form of graphite, made a good neutron moderator, and the Uranium Committee was sufficiently impressed to offer him eight tons of uranium and forty tons of graphite with which he could continue his work.

Special graphite had to be ordered from the National Carbon Company, a US corporation that produced most of the graphite used in the United States, primarily in electric arc lights and in the company's Eveready batteries. Commercial graphite had too many impurities, especially boron, but the company was able to make a grade of graphite suitable for Fermi's experiments.

The trickier part was getting uranium. Uranium ore was at the time known as *pitchblende*. This English word dates to the seventeenth century and was derived from a German term that means something like "unfortunate deception." It got this name because it resembled lead ore, but did not contain lead, or anything else considered useful at the time.

Pitchblende could be found in the mountains of Czech lands, and commercial uranium mining began there in 1840. One hundred years later, those mines were under the control of Nazi Germany, which had banned the export of uranium.

The German ban on uranium exports was a source of grave concern among atomic physicists in Western countries, as it hinted at Nazi interest in atomic bombs. Those fears grew worse when Germany invaded Norway, because Norsk Hydro, a Norwegian hydroelectric company, operated a plant in Telemark that produced heavy water. It was in fact the world's only commercial source of heavy water. You'll recall that heavy water consists of water molecules that contain deuterium, an isotope of hydrogen.

Heavy water showed promise as another possible neutron moderator. After the Germans occupied Norway, they controlled not only Europe's only source of uranium, but the only source of heavy water as well. This was certainly cause for alarm. Was it even a coincidence? Some in the UK and the US wondered if securing control of that Norsk Hydro plant was one of the reasons Germany invaded Norway. Perhaps it was the most important reason.

These developments strongly suggested that the Germans were working on their own atomic bomb, and that is one scary thought. The Nazis had already demonstrated their indifference to mass killings of civilians, and in 1940 they were conducting a bombing campaign over Britain like nothing the world had ever seen before. Obviously, if the Nazis obtained an atomic bomb, they would have no qualms about using it on a major city. And in 1940, it seemed obvious that city would be London.

Fermi and other American researchers would need uranium, and lots of it, to study atomic fission. With the Czech sources unavailable, the Uranium Committee cast about for an alternative source. There were uranium mines in the Western United States and Canada at this time, but the ore from those mines was poor; uranium in the rock amounted to less than one part per thousand.

As luck would have it, there were 1,200 tons of high-quality uranium ore sitting in a warehouse on Staten Island, in New York City. The ore belonged to a Belgian firm called Union Minière du Haut-Katanga, or UMHK. The company name translates as "Mining Union of Upper Katanga."

UMHK was founded in 1906, shortly after the Belgian government took control of the Congo away from King Leopold II. I told you the story of King Leopold II and how he was able to wrangle personal control over the Congo region from the international community and proceeded to extract an enormous fortune from it, while killing millions of people in the process. That was in episodes 19 and 20.

Upper Katanga is the extreme southeastern corner of the Congo, the remotest region of a country the interior of which was until recently regarded by Westerners as impenetrable. "Darkest Africa," it used to be called. But Katanga, for geological reasons I won't go into, contains rich deposits of metal ores. The combination of rich ores and cheap labor made mining Katanga quite lucrative, even after you factor in the difficulties and expense of shipping it out of Katanga. Needless to say, the huge profits went not into Congolese pockets, but into Belgian pockets. And also British pockets; a British corporation owned a 30% stake in UMHK.

UMHK made most of its money mining copper, but in Katanga they also mined tin, zinc, cobalt, gold, manganese and many other metals. And it mined uranium ore. They weren't so much interested in uranium as in the small quantities of radium found in the ore, as radium atoms are a by-product of the radioactive decay of uranium atoms. Radium was in commercial use in those days in patent medicines and other quack remedies, including radium toothpaste. You may recall that the dying Sun Yat-sen was treated with radium as a last-ditch effort to beat the liver cancer that killed him in 1925. But the principal use of radium was to make glow-in-the-dark paint. It was the radioactive decay of the radium mixed in that made the phosphorescent paint glow. This paint was primarily used on the faces of clocks and wristwatches and the women who painted the dials suffered gruesome illnesses. I talked about that in episode 246.

Anyway, UMHK was the source of over 80% of the world's production of radium, and that's what this ore in Staten Island was meant for. UMHK also had an additional 3,000 tons of uranium ore on site at the mine in Katanga. The US government bought up every bit of it that could be found, with the assistance of the UK government, which had some sway over the company, as it was part-British owned.

At Columbia University, Fermi and his team took bricks made of uranium and bricks made of graphite and stacked them to form the first crude nuclear reactor. "Atomic pile," was what Fermi called it, as it was a literal pile of bricks. Their experiments demonstrated that you could generate energy with large quantities of uranium and control the rate of generation by using graphite as a moderator.

You can use a reactor like this to generate power. You see, when uranium atoms decay, that produces energy, some of which manifests in the form of heat. Put enough uranium together and you can generate heat that could be used, say to produce electricity, in the same way that heat from burning coal or oil can be used.

But generating heat is peacetime stuff. The question at hand is whether it is possible to initiate an atomic chain reaction that will produce an explosion, and if so, whether it is possible to use this process to build a practical atomic bomb.

Uranium can't do this. Or at least, the most common isotope of uranium can't do this. That would be U-238 as they say. The 238 represents the mass of the uranium nucleus measured approximately in number of protons plus neutrons it contains.

Almost all naturally occurring uranium on Earth is U-238; 99.3% to be exact. Most of what's left, 0.7% is U-235, which, as its designation suggests, is three neutrons short of an atom of U-238. U-238 is the most stable isotope of uranium, with a half-life measured in the billions of years. An atom of U-238 decays by emitting an alpha particle, which turns the atom into Th-234, which is also radioactive and will break down further.

U-235 also decays by emitting an alpha particle and turning into Th-231. But what physicists Otto Hahn, Fritz Strassmann, Lise Meitner, and Otto Frisch discovered between them, it that when the nucleus of an atom of U-235 is struck by a neutron, that will break the nucleus apart into two new nuclei, of Kr-92 and Ba-141. It will also release a huge amount of energy. And if you do the math, you'll see that 92 and 141 add up to 233, not 235. The other two particles, are released as free neutrons. These neutrons might then strike two other U-235 nuclei nearby, producing more energy and more free neutrons, and there's your chain reaction.

U-238 will not do this. By now you may be wondering what does happen when a neutron strikes a U-238 nucleus. That can get complicated, but the short and sweet answer is it changes into Pu-239. You may recall from episode 337 that a team of physicists at the University of California Berkeley Radiation Laboratory led by Glenn Seaborg did this and discovered neptunium and plutonium in early 1941. You may also recall how upset the British got that the Americans were talking openly about such an important finding in wartime. Of course, it wasn't yet wartime for the United States.

So neutron bombardment can transmute uranium into plutonium. Pu-239 to be exact. Atomic theory suggested that odd-numbered isotopes are the ones most likely release neutrons and would therefore be the best candidates to produce a chain reaction and make an atomic bomb.

All this is theory and lab work, and it's a big jump from discovering that certain isotopes are susceptible to chain reactions to a functioning atomic bomb. Getting from the one place to the other would require the biggest engineering feat in history.

[music: Bach, *Prelude in B♭Major*.]

If you want to build an atomic bomb, the first question you need to consider is how much fissile material do you need to achieve critical mass, that is, the mass sufficient to trigger a chain reaction. Small quantities won't do, because the released neutrons might escape the material altogether rather than split other atoms, which is what you want.

In 1939, most physicists guessed that if a sustained chain reaction was even possible, it would require a mass measured in tons. That doesn't necessarily rule out building an atomic bomb, though it does rule out building a bomb that can be delivered by an airplane. You may recall that the letter written by Leo Szilard, signed by Albert Einstein, and delivered to President Roosevelt, acknowledged this problem, but pointed out that even such a very large bomb could be delivered to a city on board a ship and detonated in the harbor, which would be sufficient to destroy the city. In other words, size doesn't matter.

But researchers Rudolf Peierls and Otto Frisch, working in Birmingham, England, produced a memorandum in March 1940 that laid out the calculations and showed that the critical mass for an atomic bomb was not measured in tons, but in kilograms. Around ten kilograms, they reckoned, or about 22 pounds. This is certainly small enough to be carried by an airplane. In Britain, this discovery let to the formation of the MAUD Committee to further investigate the production of atom bombs. A few months later, the Tizard Mission came to the US to share British research in a number of war-related fields, including this one.

The British discovered that the Americans were working on their own atom bomb project, but that it was not as advanced as the British one. They shared Peierls's and Frisch's conclusions with the Americans, but it seemed the people to whom they gave that information did not fully appreciate how important it was, so they did not forward it to the American researchers who would have realized how important it was. It took almost a year, and further prodding from the British, before this crucial information reached the right people: at the Uranium Committee and the Berkeley Radiation Laboratory.

Bush requested an assessment of what was known so far about atom bombs, the probability that such a weapon could be built, and a timeline for how long it would take and what would be required. He turned to Arthur Compton, chair of the physics department at the University of Chicago. Compton was a Nobel laureate; he had been awarded the prize in 1927 for his discovery of the Compton Effect. Just briefly, the Compton Effect occurs when a photon collides with an electron. The collision causes the electron to move and deflects the path of the photon, like one billiard ball striking another off center. The stationary ball begins moving in one direction; the ball that struck it moves in a different direction. This is important because it can't be explained if you assume that light is a wave. This is strictly particle behavior, so it serves to demonstrate that light has the characteristics of both a wave and a particle.

In May, Compton delivered his report. He judged it would take three to five years to separate enough U-235 to build one bomb, but he was optimistic that an atomic pile of the kind Fermi was experimenting with could produce plutonium at a faster rate, perhaps no more than a year after the reactor begins operation. As for building the first bomb, Compton felt that would take a few more years. Let's say 1945.

On June 28, 1941, President Roosevelt signed an executive order to create the Office of Scientific Research and Development, or OSRD, to be led by Vannevar Bush. This office would oversee scientific research and engineering projects with military applications, including much of what the Tizard Mission had shared with the Americans. The Uranium Committee became a section within this office; it was redesignated the S-1 Committee to obscure its purpose.

On December 7, 1941, the military forces of the Empire of Japan attacked the American naval base at Pearl Harbor, as well as the Philippines, Malaya, and Hong Kong. Four days later, Nazi Germany and Fascist Italy declared war on the United States.

American research into atomic bombs suddenly took on a much greater urgency. On December 18, the S-1 Committee held a meeting chaired by Vice President Henry Wallace to review what had been accomplished so far.

I said earlier that the first question related to building an atom bomb was critical mass: how much fissile material would be needed. The second and third questions are these: should the fissile material be U-235 or Pu-239, and how can you produce those isotopes in the kilogram quantities necessary to build a bomb?

These questions are related. Which of these isotopes is easier to produce might well be the determining factor in deciding which to use. But so far, researchers had not been able to isolate these isotopes in anything more than very small quantities under laboratory conditions. Producing either of them in kilograms would be rife with problems.

But they are different problems. First, consider U-235. It is an isotope mixed in small quantities along with U-238. In 1940, the use of physical and chemical processes to separate different materials was commonplace. For example, you smelt metal from ore by melting it. The metal, being denser than rock, sinks to the bottom of the molten material. Then you skim off the molten rock and there's your metal. You distill liquor by taking advantage of the fact that ethanol has a lower boiling point than water. You might separate two combined materials by a chemical reaction using a chemical that dissolves one of them but not the other. Remember those North American uranium mines I mentioned a few minutes ago? The concentration of uranium in their ore was about the same as the concentration of U-235 in uranium, but the mines were able to smelt the ore and produce uranium in commercially viable quantities.

But here's the problem: none of these processes will be able to separate two isotopes of uranium. They are both uranium atoms, with the same number of electrons, 92, so they will react chemically in exactly the same way. Their physical properties are the same; they melt at the same temperature, for example. They are different only in that the atoms of U-235 have a slightly smaller mass. This means you have to come up with a process that essentially pulls the uranium apart into individual atoms, then sorts them by mass.

In principle, there were multiple ways to do this. You might make uranium into a gaseous compound—somehow—and use a centrifuge to separate the heavier U-238 gas from the lighter U-235 gas. You might ionize uranium atoms and accelerate them through a magnetic field, which would bend their trajectory; the U-235 atoms, being less massive, would bend a little farther, separating them from the stream of U-238 atoms. You might draw gaseous uranium through a microporous membrane. Lighter atoms would pass through the membrane more easily than heavier atoms.

At first glance, separating plutonium from uranium looks a lot easier. Plutonium is a different element from uranium, therefore it should be possible to use more conventional chemical techniques to separate them. The catch here is that plutonium was only discovered last year and then only produced in a very small quantity. No one knew what the chemical properties of plutonium might be, and you would need to understand those before you could think about ways of separating it chemically.

Also, large-scale plutonium production would require an atomic pile, which raises questions about the choice of neutron moderator. Graphite, or heavy water?

Ernest Lawrence and his team at the Berkeley Radiation Laboratory were looking into the feasibility of electromagnetic separation of uranium isotopes. A team at Columbia University were investigating separation using centrifuges or diffusion through a membrane.

The prospect of using heavy water as a neutron moderator was being investigated by Harold Urey, also at Columbia. It was Urey who discovered deuterium in 1932, so this was right up his alley. Arthur Compton at the University of Chicago was investigating the chemical properties of plutonium and the feasibility of graphite as a nuclear moderator.

That's a lot to take in, so let me summarize. We haven't even gotten to the question of how to build the bomb yet. We need to know whether uranium or plutonium would be the better choice for the fissile material, and for either element, we would need to work out the best way to produce it in quantity out of several possible processes, all of which look promising, but none of which have ever been tried.

It was like they were at the top of a flowchart and had to make multiple decisions and work down the decision paths and hope that by the time they got to the bottom of the page, they reached the space marked "atom bomb" and not the space marked "you've wasted large sums of money and years of time and accomplished little or nothing."

At this time, as far as anyone on the Allied side knew, the Germans could very well be working on their own atomic bomb, and might have as much as a two-year head start. Vannevar Bush had become convinced that the question was no longer whether an atom bomb was possible. It was now a question of when the first one would be produced, and who would produce it. The urgency of the situation demanded that the US to press ahead as quickly as possible along every one of these lines of research. If no one could say which route was the one that led to the atom bomb, then the US must try all of them.

Bush sent Roosevelt a copy of Compton's report and a recommendation that work begin on designing facilities for the production of U-245 and Pu-239. Roosevelt sent Bush's letter back to him with the notation, "V.B. OK. I think you had best keep this in your safe. FDR."

Plans were laid for a research and production timetable and designs were considered for the production plants. In May, the S-1 Committee approved the construction of three plants which would attempt to separate uranium isotopes by three different methods, plus a plant for producing heavy water, and a facility that would house the pile that would produce the plutonium. They allocated eighty million dollars to begin the work.

Organizing multiple construction projects was beyond the abilities of a group of physicists. Until now, it had been the US Navy that had taken the lead in funding atomic research, but only the US Army had the necessary expertise in large construction projects, so Bush recommended the US Army Corps of Engineers take on that responsibility.

US Army chief of staff George Marshall appointed General Wilhelm Styer of the Corps of Engineers to serve as liaison with the S-1 committee. Styer was a West Point graduate and a veteran of the last war. He had also served in Pershing's campaign in Mexico in pursuit of Pancho Villa. From Pancho Villa to atom bombs in one career. These were interesting times.

The Stone and Webster Company, an engineering firm, got the contract to build the first plant, in Oak Ridge, Tennessee. This plant would house the atomic pile used to produce plutonium. Oak Ridge was chosen because it was in a remote area, but had access to water for cooling and plentiful electricity, thanks to the Tennessee Valley Authority.

But General Marshall didn't like Bush's plan to build different plants to attempt uranium separation using different methods. Too expensive, he said. It would take vital resources away from the war effort. The two compromised on a plan that would construct the plants in stages over two years.

Styer appointed Colonel James Marshall to head this new program. Marshall, who was no relation to the Army chief of staff, was then head of the Corps of Engineers' Syracuse District. The new program was at first designated the DSM District. DSM stood for Development of Substitute Materials, a coy reference to the atom bomb project. Marshall set up an office in New York City, close to the Manhattan offices of Stone and Webster.

One of Styer's staff officers, a Colonel Leslie Groves, took exception to the name of the new district, on the basis that it sounded a little mysterious and was likely to draw attention and questions, which was the last thing this project needed. Since the Corps of Engineers generally named its districts after the city in which its headquarters was located, as in Syracuse District, Groves proposed the name be changed to Manhattan District.

It soon became apparent that Colonel Marshall was in over his head. The project was too big, and he understood little about atomic physics. He didn't know how or why to build these plants and had difficulty prioritizing the projects according to the agreement between General Marshall and Vannevar Bush. Also, he was a field officer and had little experience with the Army's bureaucracy.

Bush quickly became dissatisfied with the pace of Marshall's efforts and asked that someone more aggressive be given the assignment.

In September 1942, a new officer was appointed head of the Manhattan District. It was none other than Styers' staff officer, Colonel Groves. Groves was told, "The Secretary of War has selected you for a very important assignment…if you do the job right, it will win the war." Groves winced and said, "Oh, *that* thing." He was disappointed. He was hoping for a combat assignment.

Styer had Groves promoted to brigadier general, as it was thought that the name General Groves would impress these professor types more than would Colonel Groves. Colonel Marshall was made his deputy.

One of the first decisions the new general would have to make was to appoint a physicist as director of what was designated Project Y. This is the group that would design and build the bomb, and they would have to be scientists, not soldiers. The obvious names were the three senior researchers already at work on the project: Columbia’s Harold Urey, Chicago’s Arthur Compton, or Berkeley’s Ernest Lawrence.

None of them especially wanted the job; they were all needed in the labs where they were already working, and it was not clear any of them had the managerial experience to run such a big project. But Compton had a suggestion. Robert Oppenheimer, a Berkeley professor who worked with Lawrence. Both Compton and Lawrence thought highly of him. A few months ago, the two of them had arranged to get Oppenheimer a seat on the S-1 Committee.

In October 1942, Groves and Oppenheimer rode together on the New York Central’s flagship train, the 20th Century Limited, an elite express train service that ran from Chicago to New York. They spent all night aboard the train talking about the project. Groves was impressed with Oppenheimer, a polymath who could speak knowledgeably about a wide range of topics. By the time the train reached Buffalo, Groves could see that Oppenheimer had the sort of broad expertise that would be required to lead Project Y.

There were issues with Oppenheimer. He was less senior an academic and hadn’t even won a Nobel Prize yet, unlike Urey or Compton or Lawrence. And there were security concerns. Oppenheimer was not himself a Communist, but he associated with people who were, including his brother, his wife, and his mistress.

Nevertheless, Groves was convinced he needed Oppenheimer. He used his authority as head of the Manhattan District to waive these objections and get Oppenheimer the security clearance he would need to lead Project Y.

Project Y was originally planned to be based at the University of Chicago or at the Oak Ridge site, but those plans were discarded in favor of a more remote location. Oppenheimer, who owned a ranch in New Mexico and was fond of riding horses there, recommended the area near his ranch. It was remote but accessible, and far enough away from the American coasts or major cities, which would enhance security.

The site selected was the top of a mesa where was located a private ranch school for boys called Los Alamos. The Federal government already owned much of the land in the region. The school itself and some nearby private residences were purchased by the US government in November 1942, and here the Project Y laboratory was established in April 1943. Oppenheimer told Groves he figured he would need fifty researchers and fifty technicians to operate the lab. Groves figured that if Oppenheimer said one hundred people, he should plan for three hundred people. In fact, by December 1943, the population of the site had exceeded 3,000.

There is, of course, more to this story, but we'll have to stop here for today. Thank you for listening. This episode is my Christmas gift to you, my listeners, and I hope you enjoyed it. I'll be back with a regular episode next Sunday.

Oh, and one more thing. J. Robert Oppenheimer has just entered this story, and of course I will have more to say about him when we return to the Manhattan Project—which was never its official name, by the way. But I could hardly mention him without acknowledging the 2023 biographical film *Oppenheimer*, directed by Christopher Nolan and starring Irish actor Cillian Murphy in the title role. The film was released through Universal Pictures.

But what can I say? You probably know all about it. It's a great film, and reasonably accurate historically, allowing for a touch of artistic license. It was one of the highest-grossing films of that year and was nominated for 13 Academy Awards. It won seven, including Best Picture, Best Director for Nolan, Best Actor for Cillian Murphy and Best Supporting Actor for Robert Downey, Jr. For all three of them, it was their first Academy Award, and as of the date I release this episode, stands as the highest-grossing biographical film and the highest-grossing film about the Second World War.

[music: Closing War Theme]