

THE MANHATTAN PROJECT:
WHAT MADE IT SUCCEED and
WHY IT PROBABLY CAN NEVER BE REPEATED

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 [During the Manhattan Project (from May 25, 1943) a Jr. Chemist, Tennessee Eastman Corp., Y-12 Plant]

A Talk Given Several Times to Civic Clubs like Breakfast Rotary.

Good Morning! It's so nice to come talk to Breakfast Rotary again! I want to begin and close my remarks today with a few comments about the History Channel's TV "Modern Marvels" documentary on the Manhattan Project that was aired last June. I wonder how many of you have seen it? The producers came here about a year ago taped interviews with ten of us Ridgers¹ and compiled a total of about 8.5 hours of videotape. In their final product 6 months later, only 7 of us appeared for a grand total of about 2 minutes! Jeanie yawned once and missed my whole appearance! But they did use a lot of the background information we gave them.

Those very able video producers are part of a generation who never lived through the awful War against Germany and Japan, so they view the Manhattan Project through a very different lens than those of us who every morning for six long years read dreadful headlines day after day and every night huddled over our radios listening to Lowell Thomas, Gabriel Heatter, and Edward R. Murrow.

Their video has some very fine parts. The way they handled the history leading up to the Manhattan Project was the best of any of the treatments I've ever seen. As for the Project part itself, it tells the story of the work at Los Alamos, NM and that of its scientists well. But not many viewers would gather from this tape how much greater were the challenges in number and size at Oak Ridge in supplying the critical mass of U-235 for the first bomb. To put the effort here in better perspective, consider the cost. Out of the 2 billion dollar total cost of the Manhattan Project, 63 cents of every dollar was spent for the work here in Oak Ridge, 21 cents at Hanford, 4 cents at Los Alamos efforts. Our challenge to separate the U isotopes like theirs of making a weapon with it, required unorthodox approaches and great risk-taking in science and engineering. We had our Nobel Laureates too: Ernest Lawrence at Y-12, Harold Urey & Bill Libby at K-25, and Glenn Seaborg who came here every week to visit the Clinton Labs, now ORNL. The huge Y-12 and K-25 plants alone cost 13 times as much as the cost of Los Alamos – 990 million vs. 74 million.² In the summer of 1945 there were 33,000 people at Y-12 & K-25 working to separate the uranium 235 compared to the 2,500 at Los Alamos.³ Of course when you're making a video for the public they want action and violence, our work at Oak Ridge was a dogged 24/7 effort for 2.5 years that never once culminated in a single day's event like the Trinity Test at Alamogordo that was so dramatic and so well filmed for posterity back in 1945.

¹ –Alvin Weinberg, Bill Madia, Joanne Gailor, Dick Smyser, Don Trauger, John Gillette, Ed Westcott, Joe Dykstra, Jim Hackworth, and myself.

² By the end of 1945 – Data from the official history (vol I) by Hewlett & Robinson, page 723.

³ Op.cit. The cost of Y-12 and K-25 to end 1945 was \$478 + \$512 = \$990 million vs. \$74 million for Los Alamos. The total cost of the MP thru 1945 = \$ 1,889,604,000. Thru 1946 = \$2,170,647,000.

People in 1945 were 22,000 at Y-12, 11,000 at K-25 = 33,000 vs. 2,500 at Los Alamos, latter # from Video.

It would take a lot more time than I have to tell you what was not in the 50 minutes video about the equally urgent, equally heroic stories of the wartime years of either Y-12 or of K-25, each of which was highly uncertain from their first designs, demanding brand new science, never before heard of materials like K-25's new fluorocarbons and interhalogens. K-25 was especially fantastic – one enormous vacuum-tight marvel. But instead of telling either of those plant's fantastic stories, what I'd like to address is a question I've often been asked about the Manhattan Project and that is this: **“How was it ever possible to accomplish so very much *brand new* science and technology in so short a time?”**

Did it accomplish ‘So much’? Decidedly so. The Y-12 and K-25 ventures represented the first-ever production-scale separation of the isotopes of any heavy element anywhere in the world. The Graphite Reactor at Clinton Labs was the first-ever nuclear reactor to produce plutonium on a gram scale.

Was it really done so fast? – Yes. Each of the three main segments – uranium isotope separation at Oak Ridge, plutonium production at Hanford, and weaponization at Los Alamos – were accomplished in 2 yrs 5 mos. from ground breaking! The first time anything is done is the hardest for any such achievements, because you never know what will and what won't work. Here's one way to gauge our accomplishment. A British physicist and spy at Los Alamos, Klaus Fuchs, gave the Russians the design of the plutonium implosion weapon tested at Alamogordo in July 1945, and under orders from Stalin himself that his scientists and engineers not to try to improve on our design but just to produce an exact duplicate, it took the very able Russians FOUR years to do what we did in 2.5 years! ⁴ Yes, the Manhattan Project accomplished its mission in an incredibly short time.

So how was it possible? Here are some reasons I've been reflecting on.

One reason for its success was the choice of Gen. Leslie R. Groves as the boss, not only because of his intelligence and personal skills, but because he was given and then took full responsibility for the entire project. The organizational decision to put the whole U.S program under him with full support from our top government was a major difference between our atomic program and the programs in Germany, Japan, and Russia.

Groves had great skill and insight in selecting outstanding performers, contractors and individuals like his superb second-in-command, Kenneth D. Nichols, who I think has never gotten all the credit he deserves. Nichols was Groves COO and ran the far-flung Manhattan Project from his office in Oak Ridge. He knew Groves better than anyone else. Sometime after the War, pressed for his opinion of Groves at a National War College conference, Nichols responded:

“Gen. Groves is the biggest SOB I have ever worked for. He is most demanding. He is most critical. He is always a driver, never a praiser. He is abrasive and sarcastic. He disregards all normal organizational channels . . . he constantly meddled with my subordinates. He ruthlessly protected the overall project from other government agency interference, which made my task easier. He is extremely intelligent. and he has the guts to make timely, difficult decisions.” He went on about twice this long, ending with this: **“if I had to do my part of the atomic bomb project over again and had the privilege of picking my boss, I would pick Gen. Groves.”**

⁴ Saying that they started in July 1945 to August 1949. We know they started well before that, so it really took them more than four years.

Second: Masterful corporate recruitment and delegation. In his first four months on the job (Sept, Oct, Nov, Dec. 1942) because of the War, Groves was able to enlist the help of top corporations with strength in chemistry and chemical engineering to sign on as their patriotic duty, and partnered each of them with the top university scientists that had been doing the R&D. For instance, to build and run Y-12's electromagnetic separation plant he enlisted Tennessee Eastman (a subsidiary of Eastman Kodak) to implement the R&D being done by the E. O. Lawrence team at California, and Stone & Webster of Boston to do the demanding A/E work for Y-12. For K-25 he enlisted Union Carbide to work with the team of scientists at Columbia with M.W. Kellogg (Kellogg Corp.) to do their engineering design. And for the Plutonium Project at Hanford (incl. their pilot graphite reactor in OR) Groves talked E.I. DuPont into working with Arthur Holly Compton's team at the Univ. Chicago. Now what this meant was the immediate injection into the Manhattan Project of a huge cadre of senior professionals of all the needed disciplines into the project, people who knew how to get things done in high technology fields, and who were already organized to work together! By summer 1943, only six months into the Project, Groves had many thousands of people Q cleared and already hard at work, scientists, engineers, and architects designing exotic equipment, and construction workers already building plants and towns. What an extraordinary ramp-up.

Third, not in importance, but in timing, was the availability of almost new sites for building the needed facilities at Oak Ridge, Hanford, and Los Alamos. One thing the Army Engineers (whose Project this was) were experts at doing was what then most needed to be done: – building roads, guard fences, putting up towns, living quarters and all the infrastructures required in a big hurry.

A **fourth** and big reason things were done faster than usual, to be honest, was because of the Secrecy this wartime Project demanded. Groves decided early on to compartmentalize every part of the Project. No one knew any more than needed to do their job. As a Jr. Chemist at Y-12 I knew what my group's job was in building 9203, but nothing about all those other buildings, let alone what was going on elsewhere. This secrecy worked to a great advantage in decision-making and saving time. A well-informed small group at the top made decisions on the crucial questions, there was no need for the different plants to keep people informed, get buy-in with the Administration, Congress, or to gather stakeholder input. It sure saves time not having to "sell" plans or decisions to others. And your boss knew everything he needed to know about his responsibility, so you could almost always count on getting yes or no answers to your questions, not well I'll think about it, or I'll run it up the line. Decisions got made a lot quicker.

A **fifth**, maybe even more important factor was the availability of money. Groves virtually had a blank check. If anything was wanted to keep the program on schedule or that might speed it up; it was bought, not studied. We working level people wrote up our work in Lab Notebooks for patent purposes and review by our bosses, but spent no time on budget presentations, writing proposals or even purchase requisitions! To order something I just made a list and took it up to Sally in the front office! The only forms we ever saw were time cards, and forms to account for every milligram of U-235. Yes, having all the money the Manhattan Project needed certainly made a big difference in the time things took and in how much was done.

Still another factor of real importance was the Project's top priority status. Throughout WWII, every business with a wartime contract clamored for basic materials – almost all in short supply. The priority system was the tool government officials used to get things done in the right order, and when push came to shove, the Manhattan Project had that AAA priority, a big club.

But, you know, I believe **the most important reason** so much got done so fast was that everyone from Gen. Groves on down to the operators on all three shifts had a common purpose – to do whatever they could seven days a week to help end the war. Nobody ordered us to work extra long and extra hard; we instilled that in ourselves by reading the papers each day and hearing on the radio every night of the atrocities and the killing of our countrymen and allies in North Africa, on the beaches in Normandy, on the infamous Bataan Death march in the Philippines, in the jungles of Burma, and on islands in the Pacific whose names we had never heard before, and now can never forget. This is what is so hard to get across to the next generation. I’ve had a hard time describing it to my own kids– that patriotism that made you work so hard, keep secrets, put up with the shortages, and live with rules you often did not understand. It was all “to help win the War.”

Our country glimpsed a kindred spirit in a few weeks following the horrific attacks of September 11, last year, an outpouring of that patriotic feeling: “What can I do to help?” But during WWII we read about awful horrors somewhere week after week for six long years (1939 to 1945). A **million** American boys were killed or wounded in the three years and nine months our nation was at war. I lost my best boyhood friend who was piloting a bomber over Germany; both of my wife’s brothers were in the Services, almost everyone you worked with knew someone who had lost family members.

So then, what did those two atomic bombings that marked the success of the Manhattan Project mean to us here in Oak Ridge? Nobody I knew felt any glory in the deaths of the 100,000 Japanese at Hiroshima any more than we gloried in the deaths of about that same number in the fire-bombing of Tokyo a few months before on the night of March 10th—a bombing that burned out 16 square miles of Tokyo, 4 times the area burned out at Hiroshima.⁵ What we did take pride in was that the shock of the Manhattan Project’s success had finally caused their reluctant Emperor to stand up to his die-hard militarists and insist on bringing **their** War to an end at last. A war **they** started against us at Pearl Harbor, one that had earlier seen their savage attacks on China that resulted in a now all but forgotten 14 million Chinese dead, mostly civilians. That six year World War that **we** helped stop had involved a nearly incomprehensible total of 54 million people killed by other humans!

So instead of ending the Manhattan Project story as the History Channel did in their video, highlighting the Japanese victims of our atomic bombs, I would have preferred an ending more in accord with Rotary’s Four Way Test, one more fair to all the victims of that war on both sides— one that simply proclaimed the **role** of the Manhattan Project in stopping that war’s terrible killing and restoring blessed peace once again. **It’s that** role that caused those of us in Oak Ridge waking up on the morning of August 14th, 1945 to rejoice so when we saw this special edition of *The Knoxville Journal*. (Display that newspaper, printed on red paper with an **8-inch** tall banner headline: P E A C E.)

And then finally, instead of framing the post-war legacy of the Manhattan Project as the History Channel Video does in terms of Los Alamos developing even more powerful thermonuclear bombs, how I wished they had framed our legacy in terms of the dawn of a new era of peaceful applications of nuclear science in which I’m proud to say Oak Ridge led the way -- in producing radioactive and stable isotopes that have brought the world so many benefits in medicine, agriculture, and industry; uses we still enjoy today. And later on Oak Ridge again led the way (ORNL & K-25) in giving to the world nuclear research reactors and power plants whose clean

⁵ 140,000 were killed or seriously wounded by the firestorm caused by 334 B-29s from Tinian each carrying six tons of incendiaries. 1,000,000 were wounded. 16 sq. miles of the city were burned out. Night 3/9-10/45 *Tibbets, Return of the Enola Gay, page 195. Rhodes, Making the Atomic Bomb, page 597-600.*

electric power - though not yet acceptable to the public in this country - has been welcomed and beneficial to so many countries of the world including Japan – yes our war-time enemy, but for a half century since, such good friends. Those and the freedom of the world from World War III for sixty years is what I believe should be honored as the real legacies of the Manhattan Project.

Thank you.

