America's Greatest Projects and Their Engineers II

Course Number: PM-04-105

PDH: 4

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The Manhattan Project

Introduction

A lot has been made about the fact that the two atomic bombs dropped over the Japanese cities of Hiroshima and Nagasaki, while they likely brought a quick end to World War II, also killed nearly 130,00 Japanese civilians as well as an estimated 20,000 Japanese soldiers. Unless your Uncle Tony was a part of the U. S. Infantry that battled the Japanese in the Pacific Theater and suffered the trauma and deprivation at the hands of the heinous Japanese military, you might wonder if there could have been a better (more humane) way to end the war. Indeed, that is a fair question to ask about the carnage that was wreaked on the mostly innocent Japanese population. However, this course deals with the achievements and successes of the many engineers and scientists who put their lives on temporary hold in order to assure that the worst criminal in world history, Adolph Hitler, would never have the opportunity to reign supreme. The Japanese, because of the arrogance and stubbornness of their military leaders, became the unwitting victims of American determination and ingenuity.

This course traces technological events leading up to the dropping of the first two atomic bombs on Japan, including the ideas and the attempts by other nations to develop similar weapons that could ultimately make them the world's strongest military powers. Course describes efforts of many individual U. S. engineers and scientists to achieve this engineering feat.

Outline

A. Early Events

B. The United States Plan

C. U. S. Race to Completion

D. Result/Summary

A. Early Events

Beginning of Hitler's Reign

Hitler had come into power in Germany in early 1933 as the leader of the Nationalist Socialist (Nazi) Party, and almost immediately adopted two objectives:

1. Rid Germany (Deutschland) of Jews and take their money and possessions.
2. Conquer all of Europe between Russia and the Atlantic Ocean.

Interestingly Hitler came into power as the chancellor of Germany at the same time that Franklin D. Roosevelt became President of the United States. The Great Depression was at its height and affected unemployment throughout the world. President Roosevelt did his best to reduce unemployment, inaugurating numerous conservation and social programs during the 1930's, one of which we discuss in a previous course. Nevertheless, Roosevelt had little success in reducing the high unemployment rate in the United States. Hitler on the other hand was successful over a period of five or six years in reducing the unemployment rate in Germany by nearly 85% through the purging of Jews and other minorities and the implementation of other nefarious actions. While Hitler was wreaking havoc in Eastern and Western Europe, British and American leaders tried to ignore his activities, placate his actions, and remain neutral.

Hitler's plans for putting the German population back to work were far more ruthless than most civilized nations could fathom. By ridding Germany of its Jewish population and confiscating their vast resources of wealth, Hitler was able to have access to hundreds of millions of marks in order to build up his military machine. In addition, he dissolved all union activities, requiring all workers to join and pay dues to his National Socialist Party, used forced labor where necessary, and socialized all businesses and manufacturing facilities so that all profits flowed into his government treasury. During the period from 1936 through 1938 he also eliminated any dissension in his military ranks by removing and imprisoning any generals who took an opposing viewpoint to his genocidal policies.

A. Early Events

Germany in the 1930's had some of the great minds in the engineering and science fields, including Otto Hahn and his assistant Fritz Strassmann. They discovered that the uranium atom when bombarded with neutrons would actually split. Hahn studied industrial chemistry and worked in Montreal and London for several years before finally returning to the University of Berlin. While in Berlin Hahn teamed up with Lise Meitner, a Jewish physicist from Austria and one of the few women in all of Europe with a Ph. D. During the 1930's these three were

dedicated to identifying the products of neutron bombardment of uranium and what higher - numbered elements would be created.

Unfortunately, Dr. Meitner had to leave Berlin suddenly in 1938 because the Nazis were placing into captivity all known or suspected Jews, and she found a safe haven in Copenhagen. While there Dr. Meitner and her nephew Otto Robert Frisch named the process **nuclear fission** by analogy with biological fission living cells, describing it as an exothermic reaction which was capable of releasing large amounts of energy in both kinetic energy form as well as electromagnetic radiation. News of the splitting of the atom was made known in the United States in early 1939, which captured the imaginations of engineers and scientists in the U. S. and around the world. At that time the simple explanation was that in order for fission to produce energy, the total binding energy of the resulting elements must have higher energy than that of the starting element.

Almost ironically as well as fortuitously, none of these scientists ever became engaged in nuclear weapons research during World War II. Dr. Hahn later won the Nobel Prize for chemistry in 1944, and was genuinely surprised that not only had he won the award for his discovery but also that nuclear bombs had been developed from the discovery.

Leo Szilard, Physicist

Physicists and scientists in the U. S. and Great Britain had grave concerns regarding the discovery of nuclear fission in Germany in 1939. Leo Szilard, a displaced physicist from the University of Berlin was one of several physicists and scientists who were very vocal about the possibility that the Germans might be the first to build an atomic bomb. Szilard was a Hungarian Jew who had been born in Budapest, started out as a Civil Engineering student, then switched majors to study physics at the University of Berlin. There he worked and collaborated with such notables as Albert Einstein and Max Plank.

Szilard left Germany in 1933 due to the rise of Hitler and the Nazis in Germany and the beginnings of their anti-Semitic policies. He first studied and worked at Oxford University in London before moving to the United States in the late 1930's to accept a teaching position at Columbia University. At that time Szilard joined with several other scientists to formulate a letter detailing their experiments that had resulted in creating vast amounts of energy by bombarding uranium with neutrons, and were leery that the Germans would use the technology to build an atomic bomb. They then convinced Einstein, a Jew who had been in the U. S. since the rise of Hitler in 1933, to write a letter to President Franklin D. Roosevelt concerning the possibility that the Germans would be able to build an atomic bomb. Roosevelt received the letter shortly after the Germans invaded Poland, took the matter seriously, and convened a meeting with Szilard, Einstein, and several of his military aides. Even though war would not be declared on the U. S. by Germany for another two years, and despite the skepticism of his military that a bomb could ever be created out of uranium, Roosevelt formed a board for the purpose of investigating whether transforming atomic energy into a bomb for

military purposes could be achieved. To the president's credit, he listened to his experts and had the foresight to acknowledge their concerns.

Maintaining Neutrality

While Hitler continued to build up the vast German army and to enter into alliances with Japan and Italy, the other world powers consisting of America, Great Britain, and France continued to remain neutral. Continuing his objective of mastering all of Eastern and Western Europe, Hitler annexed Austria to Germany in the spring of 1938. After signing a non-aggression treaty with France and Great Britain, he promptly broke that accord by invading Czechoslovakia in March of 1939. Later that year he signed an accord with Russian Dictator Josef Stalin whereby Russia would attack Poland from the east, with Germany taking over the western half of Poland and Russia the eastern half. Since both Great Britain and France had guaranteed Polish sovereignty, this was a risk that Hitler was apparently willing to take. When Germany invaded Poland in early September of 1939, both Western European countries immediately declared war on Germany, which was the official start of World War II. When Russia invaded Poland from the other side two weeks later, the same two nations also declared war on Russia.

The Nazi Blitzkrieg continued in 1940, with Germany invading Norway and Denmark in April and France and Belgium in May. Within five weeks of the German invasion, the French signed an armistice of sorts with Germany, which gave the German military access to all of France as well as a foothold on the western shore of the English Channel. Only Great Britain, partly because of their remoteness to the European continent and partly because of their tenacious leader Winston Churchill, was able to resist the German occupation. The German Luftwaffe bombed London and other major cities in England mercilessly for several months, but the English never wavered.

Following the invasion of France and realizing the well-known fact that millions of Jews as well as hundreds of thousands of Poles and Slavs were being enslaved, tortured, and killed, the United States began acting on several fronts. Roosevelt had formed an investigative board following the revelation that German engineers and scientists had discovered a potential weapon that could alter the power structure of the entire world. While on the surface the United States seemed determined to avoid any conflict with Germany, the U. S. was initiating several other activities that would prepare the country for war while concurrently exploring the possibility of an atomic bomb.

In June, 1940 Roosevelt established the National Defense Research Committee with Vannevar Bush as its chairman. Bush and a team of academics, as well as representatives from both the U. S. Navy and the U. S. Army were responsible for pursuing wartime projects that were non-lethal in nature. The committee set up a laboratory at MIT, and developed such leading-edge technologies as a general-purpose digital electronic computer and a mobile radar fire control system for antiaircraft guns.

At the specific urging of Bush, Roosevelt formed the Office of Research and Scientific Development in June, 1941. The ORSD, with Bush as its director, was funded by Congress and had the authority to develop weapons and technologies with or without military approval. Part of the ORSD's responsibility under Bush was to brief the president on the progress with uranium enrichment and to also give an account of the recently initiated British atomic bomb project. To control the U. S. project Roosevelt created another group that included Vice President Henry A. Wallace, Secretary of War Henry Stimson, Chief of Staff of the Army General George Marshall, and Bush. He later rejected the notion of a joint atomic bomb research project with the British, considering it to be a potential security risk.

Vannevar Bush

Vannevar Bush was born in Everett, Massachusetts in 1890. He attended Tufts University, where he received both his Bachelor of Science and Master's degrees in 1913, already having patented his first of numerous inventions. He received his doctorate in electrical engineering jointly from both MIT and Harvard. Bush was known for his early work in analog computers, and founded the company now known as Raytheon when he was thirty-two years old. He spent a considerable amount of his early career at MIT, where he became vice president and dean of the MIT School of Engineering in 1932.

Bush initially moved to Washington, DC in 1938 as president of the Carnegie Institution of Washington, and later became chairman of the National Advisory Committee for Aeronautics. He was appointed by President Roosevelt as chairman of the National Defense Research Committee, and coordinated the activities of more than six thousand engineers and scientists in various warfare applications. Bush was named as director of the Office of Scientific Research and Development, and his diplomacy and initial planning helped to establish the beginnings of the atomic bomb research efforts. His familiarity with American physicists and chemists was a key ingredient in the preparation of the necessary programs to provide atomic bomb making materials. Bush supported the U. S. Army over the U. S. Navy in pursuing the atomic bomb project, and expressed his concern that the federal government was not giving the project a top priority. Furthermore, his anxiety was exacerbated when the responsibility for the project was assigned to Leslie Groves, a mere colonel in the U. S. Army at the time.

Bush continued to drive the atomic bomb project in 1942, bringing in new research personnel such as Robert Urey from Columbia, but there was indecisiveness over how many pilot plants should be constructed and where they should be built. He remained perturbed by the lack of priority given to the project, which he felt would delay the implementation and testing of the project by several months. The final action by Bush occurred at a meeting with Major General Brehon Somervell, the commander of the Army's Service and Supply Construction Division. At that meeting in September of 1942, Somervell had appointed then Colonel Leslie Groves, who was about to be promoted to Brigadier General, as the project director, citing his abilities to "get the job done". Somervell mentioned two of Groves' recent projects, attributing the success of the military camps and the Pentagon Building to Groves. Although Bush was not necessarily opposed to Groves personally, he felt that the bomb project should be assigned to a civilian

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