America's Greatest Projects - Project Mercury

An Online Continuing Education Course for Engineers

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America's Greatest Projects – Project Mercury

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This course chronicles the events and achievements of American engineers and scientists who had the responsibility for placing the first American into outer space. It summarizes the concepts and planning by NASA (National Aeronautics and Space Administration) and other involved agencies, and describes the design efforts necessary to provide the equipment and the technical structure to allow our early astronauts to orbit above the earth's surface. This is the fourth in a series of Twentieth Century projects that overcame major technological challenges and were on the forefront of engineering innovation. The course details the contributions of the many engineers, manufacturers, and contractors, and their remarkable foresight. Future courses are planned for the **America's Greatest Projects and Their Engineers** series.

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Introduction

A. Activities Leading to the Space Race

1. The Cold War

Following the end of World War II, during which the United States and Russia had become unlikely allies against German aggression, the two nations entered into an often-bitter confrontation that became known even to this day as the **Cold War**. Led by brutal dictator Josef Stalin, Russia had unilaterally annexed most of the Eastern European nations, including the eastern half of Germany, which surrounded Berlin. Furthermore, the Russians had managed to infiltrate key segments of the Manhattan Project, the development by the United States of the first atomic bomb, including having a spy network at the Los Alamos, New Mexico laboratories. Their espionage efforts were so effective that they, subsequently becoming the Union of Soviet Socialist Republics (USSR), had tested and begun accumulating their nuclear arsenal by 1949.

Because most Americans had developed a deep distrust of the Russians and the spread of their communist propaganda, President Harry Truman and Congress had adopted a philosophy of "containment" toward the USSR. When North Korea, inspired and motivated by the USSR, invaded the democracy of South Korea in 1950, most Americans believed that the U.S. should intervene. During the Korean conflict, which involved the United States defending South Korea against communist North Korea as well as the Chinese Red Army between 1950 and 1953, the USSR stayed out of the war. However, they used that period to solidify their hold on the nations of Eastern Europe and to enhance their nuclear capabilities. In July of 1953 a somewhat uneasy truce was reached between North and South Korea to end the Korean conflict, with the line of demarcation being the imaginary 38th Parallel.

President Dwight David Eisenhower had been a staunch opponent of the USSR under Josef Stalin ever since Ike had been the leader of the American Expeditionary Forces during World War II. Eisenhower had witnessed first-hand the atrocities that Stalin had perpetrated on the German population, the people of the Baltic nations that his troops had overrun, and the hundreds of thousands of his own citizens and political opponents in Russia. Despite Stalin's death and the nearly simultaneous end of fighting in Korea in 1953, the U. S. Congress became more concerned than ever about the further spread of Communism around the world as well as within the United States. They adopted an intense, far-reaching anti-communist policy which included Congressional hearings and affected thousands of Americans whose careers were jeopardized. During this period of turmoil in the United States in the mid-1950's, the Soviet leaders, led by their new premier Nikita Kruschev, continued to expand their communist agenda around the world.

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Meanwhile the French, recognizing that the nuclear "Arms Race" between the United States and the USSR might be spinning out of control, had proposed an International Geophysical Year. The IGY would be an effort by engineers and scientists from around the world to collaborate on some of the latest technological achievements in the fields of space travel, radar, and computerization. The IGY was to be held beginning on 01 July 1957, and was to last through 1958. Sixty-eight nations were invited to participate and to sponsor relevant projects. Only one nation (Mainland China) refused to participate, their reasoning being that the island nation of Taiwan had also been invited.

2. Rocket Pioneers

Dr. Robert H. Goddard

Robert H. Goddard was born in Worcester, Massachusetts in 1882, the only surviving child of a family with over two hundred years of New England heritage. He grew up in an era of exciting new technology such as the implementation of electric generation in the cities, the beginnings of telephone coverage throughout the Northeast, and the invention of the "horseless carriage". He showed an early interest in astronomy, and even began to pursue his dream of space flight before the Wright Brothers flew their first plane at Kitty Hawk.

Although he suffered in his early life from pleurisy and other childhood diseases, Goddard's health improved sufficiently in his latter teen years, and he was able to graduate from Worcester Polytechnic Institute with a B.S. degree in physics. He eventually enrolled at Clark University, also in Worcester, where he focused his studies on aerodynamics and mechanics, and received his Ph.D. in physics in 1911. As an instructor at WPI, Goddard began his lifelong career of developing new and more efficient rocket designs, believing that one day man would travel into outer space. All rockets for the previous several centuries had been solid-fuel rockets, using gunpowder as the primary fuel whereby even the most modern solid-fuel rockets performed in a similar manner: the rocket motor consisted of an igniter near the top of the rocket, a dry propellant charge, and a sealable nozzle at the bottom. The charge was, of course, contained within a heavy-duty casing, and the thrust from the rocket's gas discharge was controlled through the fixed or adjustable nozzle.

Goddard realized that there were significant limitations and inefficiencies with solid-fuel rockets. He countered this centuries-old design by proposing the concept of liquid-fuel rockets, whereby the fuel would be liquid hydrogen and the oxidizer would be liquid oxygen. After three years at WPI Goddard filed his first patent in 1914, citing the liquid-fuel rocket for its much higher efficiency and its much greater opportunity to send objects into outer space. His belief that rockets would someday propel instruments and other devices high enough into the earth's atmosphere to escape its gravitational field was met with skepticism by most of the world's

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engineers and physicists. HIs detractors were of the opinion, later disproved by Goddard, that rockets could neither be adequately controlled nor would they provide thrust when they escaped the earth's atmosphere.

His further supposition that these objects would then be able to orbit the earth subjected Dr. Goddard to significant ridicule. Nevertheless, Goddard continued to pursue his passion for rocket development over the next two decades, meeting with both failure and success. In 1935 his team produced the first rocket to travel faster than the speed of sound, and two years later they sent a rocket into the atmosphere that reached an altitude of more than nine thousand feet. Along the way Dr. Goddard provided written reports of his numerous liquid-fuel rocket trials and tests, but died an unfortunate and early death in 1945 after having received more than ninety patents during his career. In his later years prior to his death Dr. Goddard had spent most of his time working with the U. S. Army, while developing rocket-based military weapons such as the bazooka and other armor-piercing devices.

Hermann Oberth

A contemporary of Dr. Goddard but thousands of miles away, Hermann Oberth was born in 1894 in the part of Austria- Hungary which is today Romania. At the age of eighteen he began the study of medicine, but a few years later he was drafted into the Imperial German Army, and was assigned to the infantry division on the Eastern Front against Russia. By the end of World War, I he had abandoned his study of medicine and focused his studies on physics. Oberth was an early advocate of space flight, and had written a lengthy book on liquid-fueled rockets and space flight. However, Oberth's work had met the same ridicule as Goddard's writings. His dissertation on the subject to receive his doctorate at the University of Berlin was completely rejected as being delusional and too "Utopian" and, thus, he never received his doctorate.

Nevertheless, Oberth continued to espouse space travel and was recognized for his expertise with liquid-fueled rockets, becoming a founding member of the amateur rocket society known as the Spaceflight Society in the late 1920's. One of the young members of the society that he tutored with his design of liquid-fueled rockets and his numerous sketches and designs of two-stage rockets was Wernher von Braun, who was then just eighteen years old. Because of the worldwide depression during this period, Oberth placed his further rocket activities on hold and became a high school physics and mathematics teacher to support his family over the next several years.

During his teaching career Oberth never lost his desire or his dream to eventually see a man land on the moon, and occasionally was hired by movie producers as a consultant to form design concepts of space age rocket ships that eventually became reality. Oberth was finally summoned in 1941 to Peenemunde, the Nazi-Germany designated rocket preparedness base in

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northern Germany. There he worked alongside von Braun to develop the Aggregate (A-series) rocket program. Following the implementation of the V-2 rocket program in late 1943, Oberth was assigned to the solid-fuel rocket division to design anti-aircraft rockets for the German military. At war's end, he and his family were given asylum in a small town near Nuremberg, which became part of the safe zone of post-war occupied Germany.

Oberth was permitted by the U. S. government to travel between the safe zone in Germany and the USA for the next fifteen years. He was assigned to von Braun at the Redstone Army Arsenal in Huntsville, Alabama in the early 1950's where he assisted in the development of rockets and space technology. He returned to Germany after five years, but returned to the U. S. in 1960, working as a technical consultant to the Convair Corporation on the Atlas Rocket Program. In his later years, he espoused alternative energy sources such as wind turbines, believed in UFO's and the existence of life in other solar systems, and published books on these subjects prior to his death in December 1989 at the age of 95.

Dr. Wernher Von Braun

Dr. Wernher Von Braun was born in Germany in 1912, the second of three sons of a German nobleman and an aristocratic mother. Growing up in Post-World War I Germany, he was the equivalent of a child prodigy, being able to play both the viola and classical piano. However, as a teenager he developed a love for astronomy and all but abandoned his musical career. Instead, he focused his studies on physics and mathe eas of study in which he had initially struggled.

In 1930, he was inv cket club just a few miles south of his home i years, and had developed several different sty fired off into the atmosphere. The me ced by the physicist Hermann Oberth. In club members had managed to fire off n e of them reached altitudes of greater th erth's research and some familiarity with the ex by Dr. Goddard, the club was never able to ach in the U. S.

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Regardless, the club w lter Dornberger, a military representative ender following World War I, the Germ n their ability to manufacture military-g at abstract conclusion that rockets were not considered to weapons and, therefore, were not subject to the Treaty, the Weimar Republic established an army rocket base at Kummersdorf, about twenty-

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