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Father of Rocketry

Ralph E. Jennings

father of rocketry

By Ralph E. Jennings

(EDITOR'S NOTE: The author is indebted to Esther C. Goddard for making available to him pictures and information which have never before been published. In a letter to Mr. Jennings, Mrs. Goddard stated: 'I am delighted that you plan to dedicate the second issue to my late husband and his work on rockets." SPACE Journal takes pride in presenting to its readers some hitherto unpublished material concerning the life and work of a great American scientist.)

THE FIRST FLIGHT of a liquid oxygen-gasoline rocket was obtained on March 5, 1926, in Auburn, Mass., and was reported to the Smithsonian Institution May 5, 1926. . . . The rocket traveled a distance of 184 feet in 2.5 seconds, as timed by stop watch, making the speed along the trajectory about 60 miles per hour." Thus wrote Robert Hutchings Goddard in his second Smithsonian report, "Liquid-Propellant Rocket Development." What seemed to be an insignificant event actually marked the birth of a new era. For when Robert Goddard's rocket traveled 184 feet, the distance was a step forward in seven-league boots by Man in his long struggle up from darkness toward mastery of his environment.

In the words of Harry F. Guggenheim, president of the Guggenheim Foundation, Dr. Goddard "was just as surely the father of modern rockets as the Wright Brothers were of the airplane." He was certainly the greatest experimental pioneer in this subject—not a mere dabbling inventor, but one who understood the principles involved and was capable also of developing the necessary theories, as was to be expected from a man with his successful academic career.

Born on October 5, 1882, in Worcester, Mass., young Goddard attended school in Boston and then entered Worcester Polytechnic Institute, obtaining a B.S. degree in 1908. He was a physics instructor at Worcester until 1911, during which period he acquired his M.A. and Ph.D. After two years as a research fellow at Princeton University, he went to Clark University where he was successively an instructor, assistant professor, and professor of physics.

While at Clark, Dr. Goddard set down some recollections which began: "Owing to the widespread interest which is certain to arise later regarding space navigation, or

Dr. Robert H. Goddard making adjustments at the upper end of the rocket combustion chamber. Around the chamber are small coils of copper tubing for vaporizing liquid nitrogen in order to produce pressure for the fuel tanks and for operating controls. Pumps were used for the liquid fuels. Photographed in 1940.

Dr. Goddard stands beside the launching frame before the world's first flight of a liquid-propellant rocket on March 16, 1926.

interplanetary studies, it seems worthwhile to note the development of the writer's ideas and experiments upon the subject. . . ."

Dr. Goddard never published these notes. What he published principally were his patents and two reports to the Smithsonian Institution, the product of years of independent and methodical experimentation. What he did not publish were his speculations on space flight—because he thought more of them, not less of them. At one point, he filed these speculations away in a friend's safe and marked them: "To be opened only by an optimist."

They are now being opened, in the course of preparing Dr. Goddard's biography. Mrs. Goddard is engaged in editing his experimental notes for publication. Scientists and laymen alike will be interested in Dr. Goddard's resume of some of these speculations which he set down between 1904 and 1908 while he was an undergraduate at Worcester. "I bought a number of green-covered notebooks," he wrote, "and started to make a systematic record of suggestions. . . . The suggestions were very diversified, and concerned the possibility of using the magnetic field of the earth; shooting material to a 'space ship' by means of electric, and other, guns; an airplane operated at high speed by the repulsion of charged particles; artificially stimulated radio-activity; artificial atoms of great energy, consisting of moving positive and negative charges; propulsion in space by repulsion of charged particles; reaction against displacement currents in space; repulsion of highly heated material particles at the focus of parabolic mirrors; the use of solar energy, by light devices, on a 'space ship;' the idea of the multiple charge rocket; the use of liquid propellants; and several other plans." A summary of 26 methods was written on December 28, 1909.

The launching tower and observation shelter at the Ward Farm, Auburn, Mass. Photograph taken on July 17, 1929.

Like other men of vision who have made valuable contributions to fundamental and his important work were little known during his lifetime. In the course of his pioneering investigations, Dr. Goddard achieved many "firsts" in rocket research, any one of which would be sufficient to assure him a permanent place in the history of modern science and engineering.

Dr. Goddard in his laboratory at Clark University with the rocket tested on May 4, 1926. This rocket is the second model of a liquid-propellant rocket first flown on March 16, 1926.

Among the principal ones are the following:

1. He developed the basic idea of the bazooka in 1918 during World War I. The weapon was not used until World War II.

2. He developed a rocket motor using liquid fuels and used it in a liquid-fuel propelled rocket in 1926.

3. He was the first to shoot a rocket faster than the speed of sound.

4. He developed a gyroscopic steering apparatus for rockets ten years before it was developed in Europe.

5. He was the first to use vanes in the blast of the rocket motor for steering rockets.

6. He patented the idea of "step-rockets."

7. He developed the mathematical theory of rocket propulsion and flight.

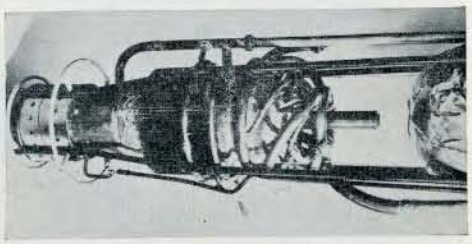
8. He first proved, both mathematically and by actual test, that a rocket will work in a vacuum.

When the United States entered the first World War, Dr. Goddard volunteered his services and was given the task of exploring the military possibilities of rockets. He succeeded in developing a trajectory rocket which fired intermittently, the charges being injected into the combustion chamber by a method similar to that of the repeating rifle. He also developed several types of projectile rockets intended to be fired from a launching tube held in the hands and steadied by two short legs—much like the bazooka of World War II.

These weapons were demonstrated quite successfully at Aberdeen Proving Grounds on November 10, 1918, before representatives of the armed services. However, the armistice on the following day put an end to the war and also to immediate interest in these weapons.

Many a great man owes much of his success to the loyalty, devotion, and encouragement of a woman who is vitally interested in his career. These qualities were brought into Dr. Goddard's life by Esther Kisk whom he married in 1924. She took an active interest in his experiments and served as the official photographer of his tests.

Dr. Goddard's research and experiments during the next two decades were summarized in two papers, "A Method of Reaching Extreme Altitudes" and "Liquid-Propellant Rocket Development." These two famous reports did much to establish on a world-

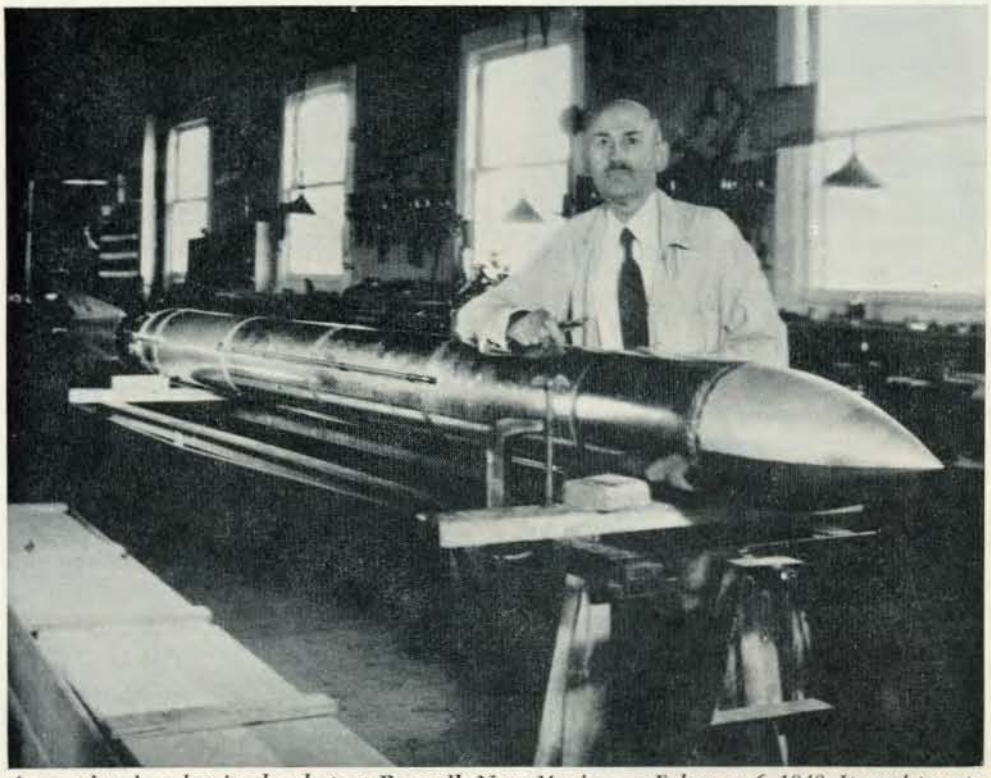


A rocket tested on July 20, 1927. Note the similarity of arrangement to the V-2.

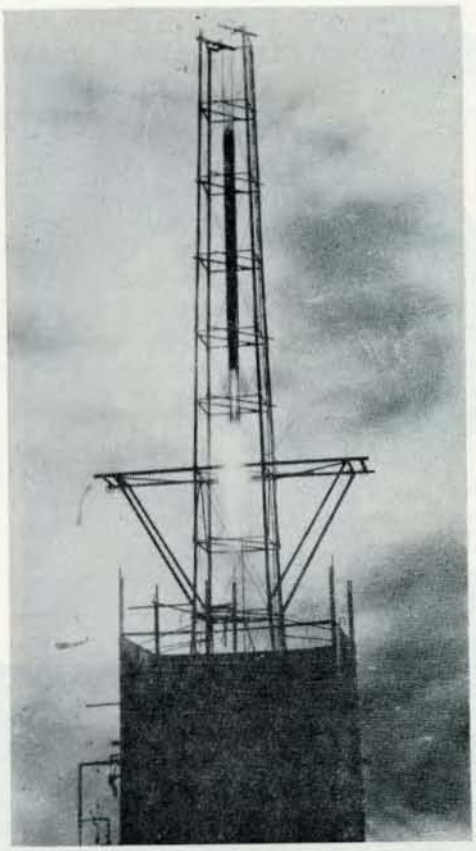
wide basis the scientific and engineering values in rocket and jet propulsion research.

Dr. Goddard even made some tests to find out how much powder would be required to make a flash visible at a distance of 2¼ miles, and from this he calculated that a rocket weighing about 3¼ tons would be required to carry sufficient flash powder to make a visible flash on the moon. He went on to make the further rather vague statement (Goddard's italics): "This plan of sending a mass of flash powder to the surface of the moon, although a matter of much general interest, is not of obvious scientific importance. There are, however, *developments of the general method under discussion, which involve a number of important features not herein mentioned,* which could lead to results of much scientific interest. These developments involve many experimental difficulties, to be sure; but they depend upon nothing that is really impossible." It may be arrived at by conjecture that the unspecified developments might be taken to include manned interplanetary travel.

Dr. Goddard's precocious talents and prophetic writings are analogous to those of Leonardo da Vinci whose original and daring theories might well have revolutionized the thought of his day had they been extracted earlier from his voluminous manuscripts, which remained unpublished until recent times. Dr. Goddard's proposal to explode a load of flash powder on the moon set off a Roman Holiday among newspaper men. The idea of a blinding man-made flash on the moon captured the imagination of the public. And to compound the excitement, this was not the insane proposal of the stereotyped paranoid scientist of comic strip lore who surrounded himself in his slum attic with bubbling caldrons of green mist. It was the idea of a disciplined, psychologically well-adjusted teacher of physics. It was the proposal of a man who



A completed rocket in the shop at Roswell, New Mexico, on February 6, 1940. It used pumps for fuels and was approximately 22 feet long.



The beginning of a flight on March 17, 1938. The launching tower shows a catapult arrangement.

had earned his Ph.D. in his own field and who as a commissioned officer had improved signal rockets for the Navy. In addition, Dr. Goddard's work had the blessings of the Smithsonian Institution.

A few months after Dr. Goddard had been elected to the Board of Directors of the American Rocket Society, he died on August 10, 1945. "The life-work of Goddard," wrote the directors, "both as a scientist and a man, will always remain a brilliant inspiration to those who are privileged to carry on his endeavors, and to every other bold explorer on the frontiers of science. In time to come, his name will be set among the foremost of American technical pioneers."

Fifty years ago, in January, 1907, Goddard as a student at Worcester Tech received rejection letters from three highly esteemed American magazines on an article which presumed to suggest that atomic energy would one day propel a rocket into interplanetary space. One editor replied: "The speculation is interesting, but the impossibility of ever doing it is so certain that it is not practically useful. You have written well and clearly, but not helpfully to science as I see it. . . . I return the paper with thanks."

Speculation on whether our generation will live to see the predictions of Robert Hutchings Goddard become realized facts is not of paramount concern. But whether there is to be an aggressive continuation of fundamental research in a climate of tolerance is the concern of every living American. It is imperative that such a climate include aid, encouragement, and proper recognition for men like Goddard who in spite of technical difficulties, disbelief, and ridicule persist with dogged resolution until they realize their aims. The true fulfillment of our hopes for a peaceful and better world lies in the fruit of their labors.

A Goddard rocket in flight on August 26, 1937.