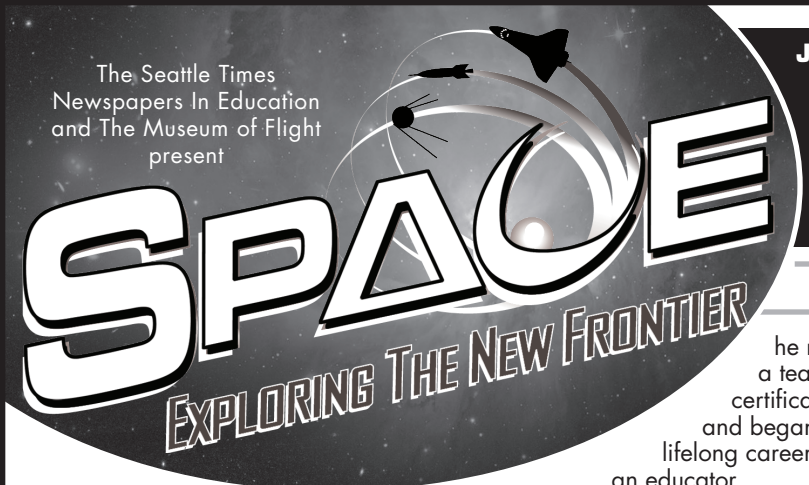


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present



Join us every Tuesday and Thursday as we trace the history of space exploration — from early fiction in world literature to the accomplishments of real-life rocket and space scientists. Series runs through December 11 (no run date: November 22).

IMAGE: Diagrams of Tsiolkovsky's space rockets.

he received a teacher's certificate and began his lifelong career as an educator.

Virtually ignored during much of his lifetime, Ksiolkovsky wrote both science fiction and treatises on rocket propulsion. His article "The Investigation of Outer Space by Means of Reaction Apparatus," published in 1903, introduced the idea of using liquid propellants as rocket fuel and also discussed the condition of weightlessness.

Tsiolkovsky never built an actual rocket, but his vision for exploring outer space in his drawings, novels and scientific papers influenced a new generation of Russian engineers and scientists. For Tsiolkovsky the goal of space exploration was to achieve universal happiness for humans and any other beings found in the universe. One of his most famous quotes is, "The Earth is the cradle of humanity, but mankind cannot stay in the cradle forever."

### Oberth: A Trailblazer

While Tsiolkovsky worked in relative obscurity, Romanian Hermann Oberth became the most famous physicist in 1920s Germany, creating a huge national interest in rocketry and space travel. Born on June 25, 1894, Oberth was fascinated early on with the technical problems presented by rocket travel. As a young boy, he calculated the acceleration of an object under the Earth's gravitational pull and found his calculation for escape velocity — 11.2 kilometers per second — to be in agreement with his hero, Jules Verne. Oberth also conducted his own unique experiments on human tolerance and g-force by jumping into a swimming pool from different heights and positions and recording his reactions.

At 16, Oberth designed his first rocket on paper. During this time, he began his study of medicine, later switching to physics after World War I. In 1922, his doctoral dissertation on the science of rocketry was rejected. Undaunted, he had the paper published privately. The success of this work, titled "The Rocket into Interplanetary Space," led to an offer from the famous German silent-film director Fritz Lang. Oberth accepted the offer to be the rocket consultant for Lang's new motion picture "The Woman on the Moon." The popularity of the film cemented Oberth's reputation.

Although Oberth did achieve a successful liquid fuel rocket launch in March 1935, his main influence is as a scientific writer. Of the three great pioneers of rocketry, he presented the most comprehensive theories, challenges and solutions for space travel.

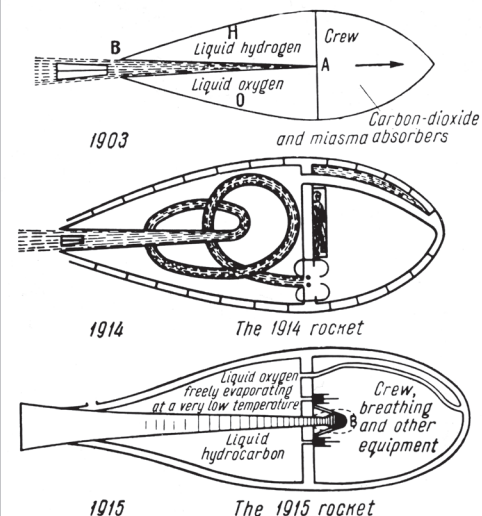
### Goddard: A Rocketeer

On March 16, 1926, on a small Massachusetts farm, the first successful liquid fuel rocket was launched into the cold winter air. Achieving an altitude of 41 feet, the rocket flight lasted 2.5 seconds. A balding, 44-year-old physicist named Robert Goddard had shown for the first time that rockets powered with a mixture of gasoline and liquid oxygen could go up into the lower atmosphere.

Like Oberth's, Goddard's boyhood was filled with dreams of space flight.

At 17, he had an epiphany while climbing in a cherry tree on the Goddard family property: "On the afternoon of October 19, 1899, I climbed a tall cherry tree at the back of the barn ... I imagined how wonderful it would be to make some device which had even the possibility of ascending to Mars ..."

Tsiolkovsky and Oberth were primarily theorists; Goddard was an inventor.



In 1914, he submitted two patents which described the Goddard rocket: a combustion chamber and nozzle; a method to send propellant into the combustion chamber for giving either continuous or discontinuous force; and the use of a series of rocket stages that are jettisoned as the propellant inside them is used up.

With the help of famous aviator Charles Lindbergh, Goddard was able to secure modest financial backing from the wealthy Guggenheim family for his rocket development. Relocating to Roswell, New Mexico, a climate and topography more favorable for flight testing, Goddard and his team built and tested rockets for much of the 1930s, with decidedly mixed results.

Secretive and working in relative isolation, Goddard's legacy is not as clear as Hermann Oberth's. But there is no doubt his dogged refusal to accept defeat, and his positive ability to learn from failure, has been an inspiration to future rocket scientists.

# MORE TO EXPLORE

★ This week's article tells the story of three men who were very influential in the development of rocket science. Search The Seattle Times for stories about advances in technology today. Then choose one article on the topic and write a summary of the story.

## Tsiolkovsky, Goddard and Oberth

### Three Fathers of Rocketry

By Richard Wallace, The Museum of Flight

Jules Verne's brilliance as a writer of scientific adventure stories impressed more than the general reading public. Three gifted men, working independently in three different countries, were inspired by Verne's novel "From the Earth to the Moon." Konstantin Tsiolkovsky was a self-taught, Russian schoolteacher. Robert Goddard, an American, and Hermann Oberth, a Romanian, were professors of physics. Each explored how rockets could be designed and used for space travel. Today, they are considered to be the "fathers of rocket science."

### Tsiolkovsky: An Early Visionary

A cosmic thinker who imagined the three-stage rocket, space stations and the colonization of other worlds, Konstantin Tsiolkovsky was born on September 17, 1857 in a small Russian village south of Moscow. At the age of 10 or 11 he took a winter-time ride on a toboggan sled. Afterward, catching a cold, he fell ill (some sources say he contracted scarlet fever). Although he soon recovered, he found himself nearly deaf.

At 16, Ksiolkovsky went to Moscow. Studying in the city's many libraries, he taught himself physics, chemistry, astronomy and literature. In 1879,



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Next time:  
**Physics of Rocketry**