

Robert Goddard Engineering Commentary

In 1899, when Robert Goddard decided to develop a rocket powerful enough to carry people into space, he faced a nearly overwhelming problem. Solid-fuel rockets had been used as fireworks and war weapons for many years, but none of them were nearly large or powerful enough for spaceflight. As early as 1909, Goddard began considering more efficient propellants, including liquid fuels, ion propulsion, solar energy, and magnetic repulsion. The only one that seemed even possible at the time was liquid propellants, but the challenges of designing and building such an engine seemed so difficult that Goddard continued to try to find ways to make solid fuels more effective.

In his first patent, which was granted in 1914, Goddard included the idea of using liquid propellants, almost as a footnote. The main design described in the patent actually featured an engine that would fire a long, rapid succession of gunpowder explosions to propel a rocket.

After years of work, Goddard began seriously considering a liquid-propulsion system around 1920. Then he had to solve the problems of designing and building such a powerful rocket. In particular, he faced these challenges:

1. Design and build a chamber that could withstand the heat and pressure of the combustion of the fuel and oxidizer.
2. Design a nozzle that would most effectively channel the exhaust gases.
3. Decide which fuel to use.
4. Develop a system to inject the fuel and oxidizer into the combustion chamber.
5. Solve the problems of rocket flight guidance and stability.
6. Develop an effective parachute deployment system.
7. Design the engine and propellant tanks to have minimum weight and maximum strength.
8. Develop launch equipment and procedures that ensured safety.

During Goddard's most productive ten years of rocket development (1930–1932 and 1934–1942), he conducted many static test firings of his rocket engines and attempted 48 actual rocket launches. Only 31 of those made their way out of the launch tower, and many of those flights experienced malfunctions. Rather than becoming discouraged, though, Goddard concentrated on learning from the “valuable negative information” revealed by the failures.

[Insert information about the engineering contests.]