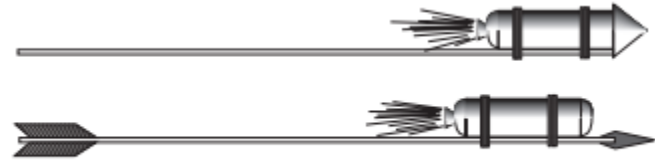


The History of Rocketry

The date reporting the first use of true rockets was in 1232. At this time, the Chinese and the Mongols were at war with each other. During battle, the Chinese repelled the Mongol invaders by a barrage of “arrows of flying fire.”



Chinese Fire-Arrows

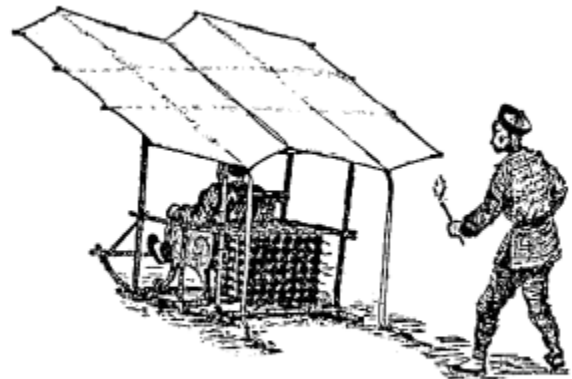
These fire-arrows were a simple form of a solid-propellant rocket. A tube, capped at one end, contained gunpowder. The other end was left open and the tube was attached to a long stick. When the powder ignited, the rapid burning of the powder produced fire, smoke, and gas that escaped out the open end and produced a thrust. The stick acted as a simple guidance system that kept the rocket headed in one general direction as it flew through the air.



Chinese soldier launches a fire-arrow.

By the 16th century rockets fell into a time of disuse as weapons of war, though they were still used for fireworks displays.

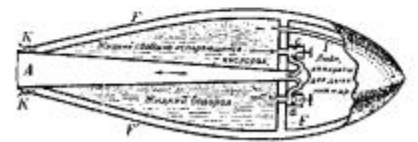
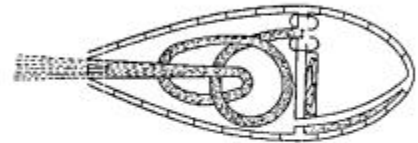
A Chinese official named Wan-Hu assembled a rocket-powered flying chair. He had two large kites attached to the chair, and fixed to the kites were forty-seven fire-arrow rockets. On the day of the flight, Wan-Hu sat himself on the chair and gave the command to light the rockets. Forty-seven rocket assistants, each armed with torches, rushed forward to light the fuses. A tremendous roar



Legendary Chinese official Wan Hu braces himself for "liftoff."

filled the air, accompanied by billowing clouds of smoke. When the smoke cleared, Wan-Hu and his flying chair were gone. No one knows for sure what happened to Wan-Hu, but if the event really did take place, Wan-Hu and his chair probably did not survive the explosion. Fire arrows were as apt to explode as to fly.

In 1898, a Russian schoolteacher, Konstantin Tsiolkovsky (1857-1935), proposed the idea of space exploration by rocket. In a report he published in 1903, Tsiolkovsky suggested the use of liquid propellants for rockets in order to achieve greater range. Tsiolkovsky stated that only the exhaust velocity of escaping gases limited the speed and range of a rocket.



Tsiolkovsky Rocket Designs



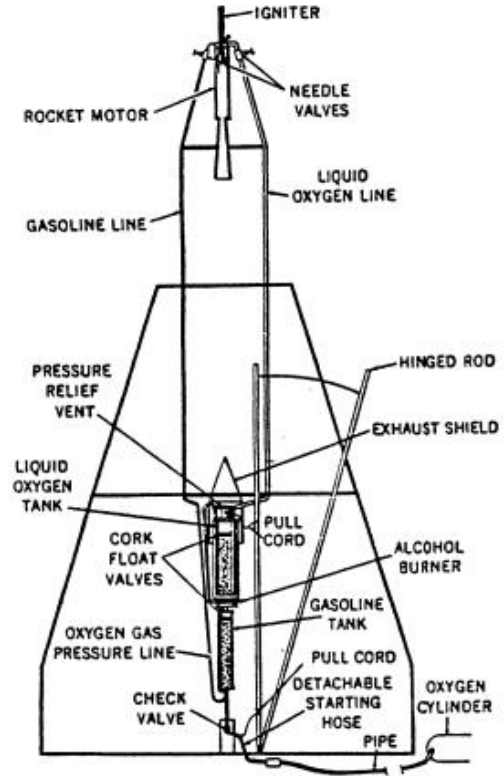
Dr. Robert H. Goddard makes adjustments on the upper end of a rocket combustion chamber in this 1940 picture taken in Roswell, New Mexico.

Early in the 20th century, an American, Robert H. Goddard (1882-1945), conducted practical experiments in rocketry. He had become interested in a way of achieving higher altitudes than were possible for lighter-than-air balloons. Goddard reached several conclusions important to rocketry. From his tests, he stated that a rocket operates with greater efficiency in a vacuum than in air.

While working on solid-propellant rockets, Goddard became convinced that a rocket could be propelled better by liquid fuel. No one had ever built a successful liquid-propellant rocket before. It was a much more difficult task than building solid propellant rockets.

Fuel and oxygen tanks, turbines, and combustion chambers would be needed. In spite of the difficulties, Goddard achieved the first successful flight with a liquid propellant rocket on March 16, 1926.

Fueled by liquid oxygen and gasoline, the rocket flew for only two and a half seconds, climbed 12.5 meters, and landed 56 meters away in a cabbage patch. By today's standards, the flight was unimpressive, but like the first powered airplane flight by the Wright brothers in 1903, Goddard's gasoline rocket became the forerunner of a whole new era in rocket flight.



Dr. Goddard's 1926 Rocket

Launching men to the moon required launch vehicles much larger than those available. To achieve this goal the United States developed the Saturn launch vehicle. The Apollo capsule, or command module, held a crew of three. The capsule took the astronauts into orbit about the Moon, where two astronauts transferred into a lunar module and descended to the lunar surface.



A fish-eye camera view of a Saturn 5 rocket just after engine ignition.