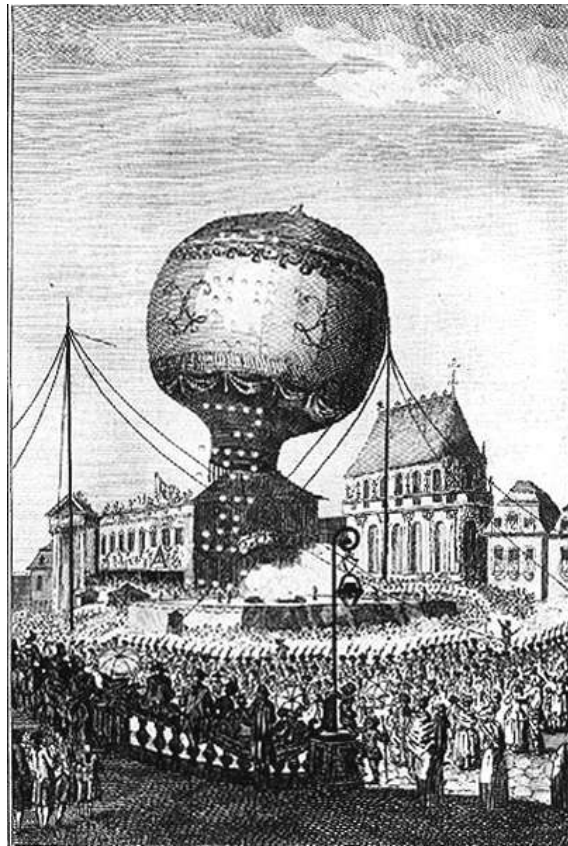


Early Balloon Flight in Europe

The first public demonstration of a lighter-than-air machine took place on June 4, 1783, in Annonay, France, when Joseph and Jacques Montgolfier, two brothers who owned a paper mill, sent up an unmanned hot-air balloon. They had observed that smoke tended to rise and that paper bags placed over a fire expanded and also rose, pushed upward by the hot air. They concluded that if they could only capture what they thought was a unique gas inside an enclosed lightweight bag, this container or bag would rise from the ground. Etienne Montgolfier carried out the first experiment at Avignon, France, in September 1782, proving their theory to be sound. They had rediscovered the theory of buoyancy, which the Greek mathematician and philosopher Archimedes had discovered in the second century B.C.E.

Their original test balloon was made of paper and linen and opened at the bottom. When flaming paper was held near the opening, the bag, called a 'balon', slowly expanded with the hot air and floated upward.

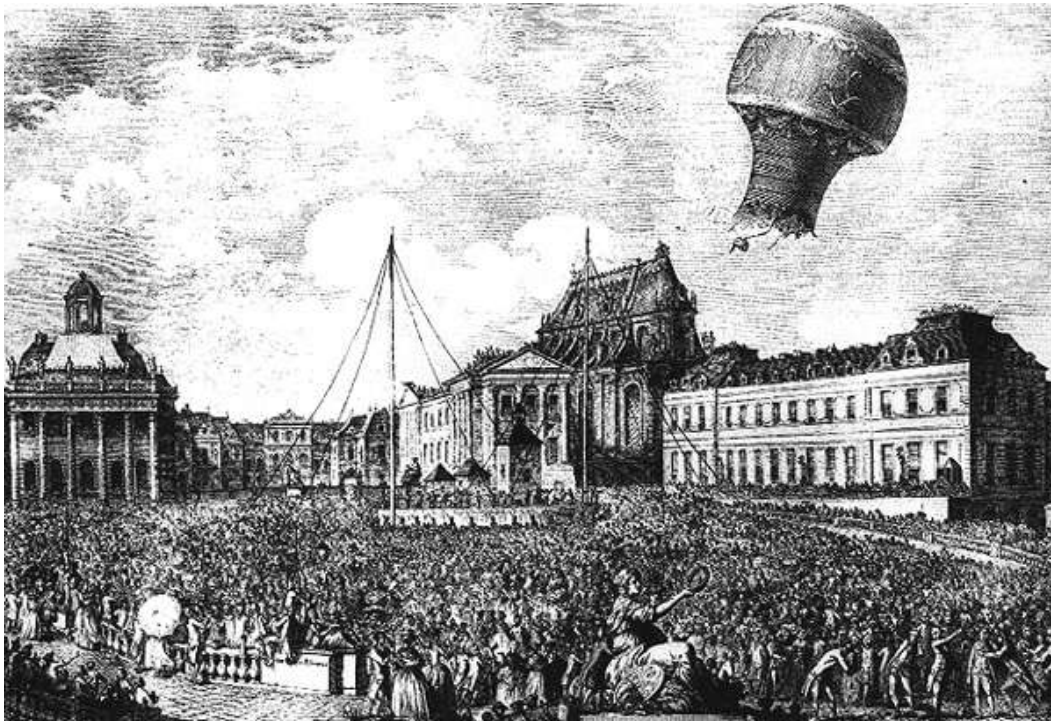
The brothers tested balloons ranging in size from 40 cubic feet (1.1 cubic meters) to 650 cubic feet (18.4 cubic meters). The balloons rose from 90 feet (27 meters) to 600 feet (183 meters) in the air. After concluding that their experiment worked, they finally built a large cloth and paper balloon 10 meters in diameter and tested it on June 4, 1783, in the marketplace at Annonay. The balloon, from then on called a *Montgolfiere*, rose about 2,000 meters (6,562 feet) into the air.



The first passengers ascend into the air, September 19, 1783, in Annonay, France. Photo: National Air and Space Museum, Smithsonian Institution

After their success, the brothers went to Paris and built another larger balloon. On September 19, 1783, in Versailles, the Montgolfiers flew the first passengers in a basket suspended below a hot-air balloon—a sheep, a rooster, and a duck. The flight, which lasted eight minutes, took place in front of Louis XVI, Marie Antoinette, and the French court, as well as a crowd of about 130,000. The balloon flew nearly 2 miles (3.2 kilometers) before returning the occupants safely to earth.

The next major milestone occurred on October 15, 1783, when the brothers constructed a hot-air balloon that, at the end of a tether, rose 84 feet (25 meters) into the air with its first human passengers, Jean-François Pilâtre de Rozier, perhaps accompanied by the Marquis d'Arlandes. (Authorities differ on whether the marquis went on this first flight.) With a capacity of 60,000 cubic feet, Pilâtre de Rozier stayed aloft for almost four minutes. A short while later, on November 21, 1783, the first confirmed aeronauts, de Rozier and d'Arlandes, made a free ascent in a balloon and flew from the center of Paris to the suburbs, about 5.5 miles (9 kilometers) in some 25 minutes. On January 19, 1784, a huge hot-air balloon built by the Montgolfiers carried a total of seven passengers to a height of 3,000 feet (914 meters) over the city of Lyons.



*The first passengers ascend into the air,
September 19, 1783, in Annonay, France.
Photo: National Air and Space Museum,
Smithsonian Institution*

At the time, the Montgolfiers believed they had discovered a new gas, which they called 'Montgolfier gas' that was lighter than air and caused the inflated balloons to rise. In fact, the gas was merely air, which became more buoyant as it was heated. The balloon rose because the contained air was lighter and less dense than the surrounding atmosphere, which pushed against the bottom of the balloon.