difference between the gas inside the envelope and the atmospheric air outside. Neither super-pressure balloons nor Rozière (a type of gas-hot air hybrid construction) balloons are discussed.

Gas ballooning was once the most common form of aviation in the United States. Today, due to the costs involved, gas flights are most frequently undertaken for training, competition, or record breaking purposes. Short, recreational gas flights, while not unheard of, are much less common than hot air.

The History of Gas Ballooning

The first gas balloon flight occurred just a few weeks after the first manned balloon flight of Jean-François Pilâtre de Rozier and the Marquis d'Arlandes. While the Montgolfiers were experimenting with hot air balloons, the Robert brothers and Jacques Charles were also experimenting with gas balloons.

The first gas balloon was small (13 feet in diameter) and was filled with what was called "inflammable air." *[Figure 11-1]* It generated 35 pounds of net lift and, when set free, remained aloft for 45 minutes and traveled 15 miles. Its final, sudden descent was attributed to a rupture in the balloon.

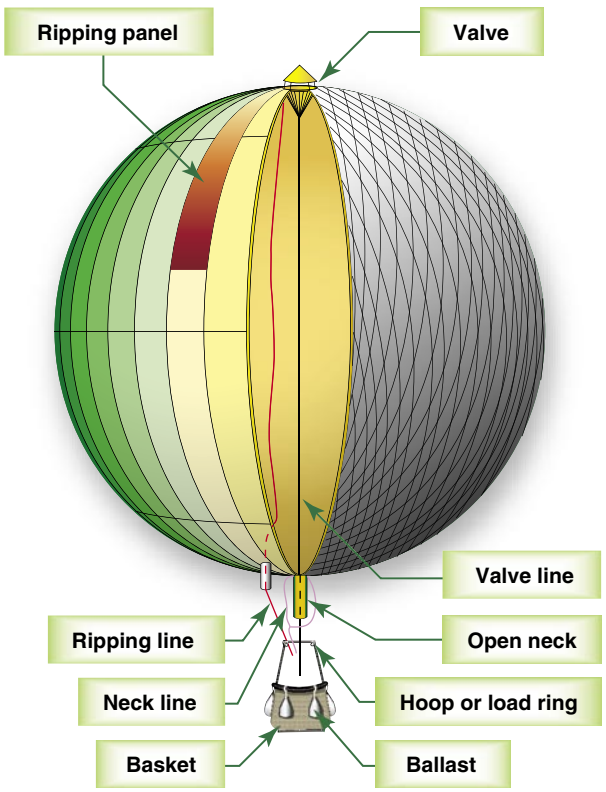

Figure 11-1. *Early style of gas balloon. Many of these terms still apply today.*

With the success of the demonstration flight, Charles next made a 25.5-foot diameter globe of rubberized silk. A net was fitted over the upper half of the balloon and tied to a loop around the middle of the bag. From this loop, a sort of car or boat was suspended. The bag was tied at the bottom to contain the gas. Dropping ballast caused the balloon to rise, and releasing gas through a valve at the top made it fall. On December 1, 1783, Professor Charles and Nicholas Robert made the first manned gas balloon flight. The first flight lasted for 1 hour and 45 minutes, rose to 1,800 feet, and covered more than 27 miles. On landing, Robert got out of the boat and Charles, now flying solo, ascended to almost 9,000 feet. The balloon had been flaccid on first landing, but filled out as it rose and gas was released to prevent it from bursting. Benjamin Franklin was present for this lift off and recognized the potential for balloons in military operations.

Other ascensions followed, mostly to gather scientific data. It was through these early experiments that the design/shape of gas balloons, lifting capacity, and weight of air were determined. One notable early flight was the crossing of the English Channel from Britain to France by Jean-Pierre Blanchard and Dr. John Jeffries on January 7, 1785. Their balloon was scarcely sufficient to carry them and they threw out their ballast, anchors, food, and clothing to complete the crossing.

In 1906, James Gordon Bennett needed news for his newspaper and having been successful in starting car and boat races, decided to initiate a gas balloon race. The first race was organized for Paris, France. Each country could send contestants to the race. This race, the Coupe Aéronautique de Gordon Bennett, is still held annually although there were years when no race occurred due to wars. Today, the race is the most prestigious gas race in the world. It is sanctioned by the Fédération Aéronautique Internationale (FAI). The country of the previous year's winner is entitled to host the race. In 2006, the 50th race was held flying out of Belgium (www.coupegordonbennett.org).

The Albuquerque International Balloon Fiesta (AIBF) started the America's Challenge Gas Balloon Race in 1995. It has been conducted yearly, with the exception of 1999 when AIBF instead hosted the Gordon Bennett Race. This has become a very prestigious and international race that offers pilots the opportunity for extremely long flights (www.balloonfiesta.com/Education/History/).

Balloon Systems

Gas balloons designs are generally classified as netted or quick fill.