

How a Gas Balloon Works

The gas balloons used in the Gordon Bennett and America's Challenge gas balloon races are in some ways similar to, and in others very different from, the hot air balloons spectators see during most of the Albuquerque International Balloon Fiesta.

Like hot air balloons, gas balloons have an envelope, or gas cell, to hold the lifting gas that keeps the balloon aloft. The balloon also has a basket or gondola which holds the passengers and everything they need to navigate and survive for two or three days aloft. The basket is most frequently made of wicker, but some use lightweight materials such as aluminum, or even an aluminum frame with fabric panels, in an effort to save weight. Lighter weight equipment can be an advantage when trying to achieve long distance and duration flights.

Gas balloons get their lift from a gas like hydrogen or helium which is lighter than ambient air in its natural, unheated state. Gas balloon envelopes are made of heavy, non-porous materials to keep the loss of gas to a minimum, since the balloon cannot be refueled in flight. The gas is pumped into the balloon through the appendix at the bottom of the envelope. During flight, the appendix generally remains open, so any excess gas will vent off and the balloon won't burst in flight.

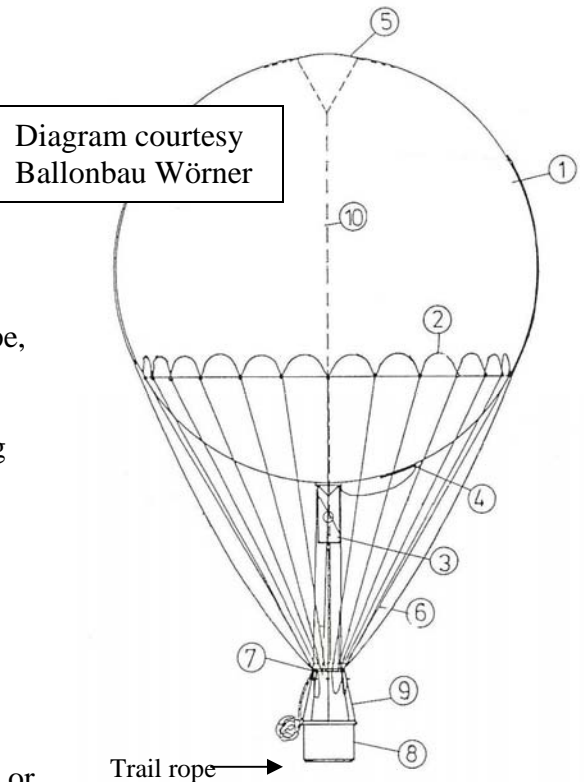
The balloon is attached to a circular load ring via a series of ropes or cords, or on some models load tapes that are similar to those



Installing a mechanical valve at the top of a gas balloon envelope.

found on hot-air balloons. The envelope and load ring are attached to the basket by a series of ropes and toggles.

At the top of the envelope is a valve used to release gas from the balloon: small amounts for maneuvering to lose altitude, or large amounts to deflate the balloon at the end of the flight. (Some gas balloons also have separate deflation ports that are opened at the end of the flight to deflate the balloon more quickly.) Some valves are very similar to the parachute tops found in a hot air balloon and are held in place by the



1. Envelope
2. Load belt
3. Appendix
4. Emergency opening line
5. Parachute
6. Envelope ropes
7. Load ring
8. Basket
9. Basket ropes
10. Parachute ropes

upward pressure of the gas in the envelope. Others are spring-loaded mechanical valves. Both are pulled open via a rope or line that extends into the basket.

The gas in the balloon expands when heated, so during the day, when the balloon is flying in the sun, the balloon gains altitude. However, when the sun goes down the gas cools and contracts, and the balloon loses altitude. Since a gas balloon has no onboard means, such as a burner, to heat the gas in flight, the pilot must compensate for the loss of lift by getting rid of weight out of the basket. To facilitate this, the balloon carries weight, or “ballast,” specifically for this purpose. The most common form of gas balloon ballast is sand, carried on the side of the basket in bags. Some pilots also carry jugs of water – water is fairly heavy, after all – that can be used as ballast and can be used as drinking water during the flight. But actually anything that has weight can be used as ballast. In critical situations such as storms where pilots have to get rid of weight in a hurry, anything in the basket can be used as ballast – equipment, clothes, food. When Blanchard and Jeffries made the first crossing of the English Channel by gas balloon in the late 1700’s, they literally landed in their underwear.



Austrian pilots Gerald Stürzlinger and Johann Fűrstner prepare to launch in the 2005 Gordon Bennett, as safety officer Matt Guthrie (left) takes “hands off.” Note the toggles attaching the envelope and basket to the load ring, the rain skirt tied around the load ring, and the orange sandbags tied to the side of the basket.

The gas balloons used in the Gordon Bennett and America’s Challenge are less than half the size of most of the hot-air balloons in the Balloon Fiesta. However, they are very expensive to fly because of the cost of gas. A “helium fill” for a gas balloon of this size costs upwards of \$4,000; hydrogen, somewhat less. Gas balloons in long distance races must also carry transponders, radios, night lighting, and other instrumentation so they can keep in contact with air traffic controllers and maneuver through controlled airspace (last year, for example, most of the balloons went right over Dallas and Ft. Worth). The balloons also carry GPS-based trackers that transmit position data to the race Command Center. This data is linked to the Balloon Fiesta Web site so spectators can track the progress of the race. It is also recorded and downloaded at the end of the race for scoring purposes.

Finally, the balloons must carry everything the pilots need for their safety and comfort for a flight that can last 60 hours or more. The balloon can’t exactly stop at the local 7-11 for snack and bathroom breaks. Most balloons have a “rain skirt” attached to the load ring that the pilots can lower over the basket in the event of rain or to help keep the air in the basket warmer at night. Pilots also carry food (though most say they don’t tend to eat much while aloft), water, layered clothing including heavy jackets and parkas, a small stove, reading material for those

rare moments when they aren't busy, maps and logbooks, and – you were waiting for this, weren't you? – a porta-pottie or some equivalent.



Japanese pilots Sabu Ichiyoshi and Maco Oiwa in flight: notice sandbags around basket and appendix at the bottom of the balloon.

Like hot air balloons, gas balloons take advantage of winds blowing in different directions and at different speeds at different altitudes to take them where they want to go. However, because gas flights often cover hundreds or even thousands of miles, pilots have to be able to get detailed weather information in flight. Often, this is a matter of safety as well as navigation, as the pilots have to be able to avoid dangerous storms. Pilots get weather data through aviation flight service stations, and many employ meteorologists familiar with gas balloons who provide advice about weather and race strategy.

When it is time to land, the pilot deploys a “trail rope” – a long, heavy rope that “trails” on the ground. The rope acts as a form of retractable ballast and also helps to slow the balloon on landing.

Gas ballooning in a race like the Gordon Bennett or America's Challenge is an endeavor for the skilled and adventurous – it is not for sissies. Sitting aloft in a balloon for two or three days is not for everyone and can be, as the saying goes, hours of relative boredom punctuated by moments of sheer terror. That said, gas balloonists tell of wonderful days and evenings aloft, cruising in silence (no burner noise!) except for the sounds wafting upward from earth. They see America in a way few people can – from a slow-moving platform suspended over the landscape. It is a truly unique and special experience undertaken by a unique and special breed of balloonist.



Gas balloons await launch at the 2006 America's Challenge