

Balloon Basics ... Ballooning 101

How do balloons fly?

Balloons operate through the basic principles of buoyancy and heat transfer. Buoyancy is a basic principal of physics that say a body is buoyed up (lifted up) by the difference in its weight and that of the medium it displaces. With ships or submarines the medium displaced is water with Hot Air balloon the medium displaced is cool air. The differential comes from the fact that hot air at a given pressure weighs less than cool air; thus Hot air rises, and carries the balloon along with it. As the air inside the balloon cools, it descends. To make the balloon fly, an inflator fan fills it with air, which is then heated to give the balloon lift.

Can you steer a balloon?

Winds determine a balloon's direction. Balloonists can steer a balloon, to a limited extent, by adjusting the balloon's altitude to make use of different wind speeds and directions.



How long does a balloon flight last?

The actual flight time averages about an hour. The entire ballooning experience, including pre-flight preparation, flight and post-flight celebration, may take two to three hours.

How long could a hot-air Balloon stay in the air?

Flight duration is determined predominantly by three variables. The proportional load in the basket (number of people relative to fully-loaded capacity), air temperature, and the amount of fuel carried. Balloons that fly in the summer with fully loaded baskets can typically fly about one and a half hours. Conversely, a lightly loaded balloon flying in the winter may be able to fly six to eight hours on the same fuel volume. The reason winter flying is more efficient is that cold air is more dense, and a given temperature differential between the air in the balloon and the outside air produces more lift. The reason passenger loading impacts efficiency is that the more people you have in the basket, the hotter you have to heat the air in the balloon in order to fly. Maintaining this temperature differential requires more fuel.

What fuel do balloons use?

Sport hot air balloons carry 20 to 45 gallons of propane in stainless steel fuel tanks.

Why Propane?

Propane is generally readily available. It is liquid in its stored state (which results in dense energy storage) and it does not require a fuel pump or pressurization under most circumstances and its Moderate vapor pressure allows storage in reasonably lightweight tanks.

- Gasoline would require onboard pressurization or a huge fuel pump (too complicated)
- Acetylene has too high a vapor pressure and would require heavy cylinders to contain the fuel (tanks too heavy)
- Butane has too low a vapor pressure and would have to be pressurized. Butane, though not ideal fuel, is used in ballooning in some countries where propane is not commercially available.
- Compressed natural gas would need very large and heavy tanks it can't practically be stored in its liquid state for transportation in a balloon.

How much heat do burners produce?

Each burner canister in a State of the Art Balloon System is capable of producing in excess of 18 million BTU of heat per hour. This is the equivalent of 600 average gas grills and many balloons have two burners. You can literally feel the punch of hot air as it hits the top of the envelope particularly if the basket is not fully loaded.

How much fabric is in a balloon?

The amount of fabric in a balloon is obviously dependant on the size of the balloon a typical four passenger balloon has over two thousand square yards of fabric.

How come balloons have different fabric configurations that come down to the balloon Basket?

The fabric that extends from where the support cables attach to the balloon down to the baskets is called a skirt. Although the configurations vary from balloon to balloon, the basic purpose is the same. The skirt minimizes the effects of minor wind sheer on the flame of the burners. Balloons that are frequently used for tethering or that can be turned with rotation vents often have non-symmetric skirts called scoops or dippers. These channel air into the balloon to maintain pressure in moderate wind conditions.

What is the narrow seatbelt material that is at most if the seams vertically and in some of the horizontal seams of a Hot Air Balloon?

This webbing is the strength of the balloon. Although fabric alone could be used to make a balloon, the design factor would be very low and balloons might be threatened by occasional high stresses that balloons are exposed to. With the webbing the balloon is more than ten times stronger.

Why do balloons fly in the early morning and late evening?

Winds are generally most favorable the first hours after sunrise and the last hours before sunset. The sun's uneven heating of the earth's surface causes strong, variable winds. In the morning, it takes a few hours for the sun to heat the earth's surface enough to generate the thermal activity that creates wind. In the evening, the sun's intensity has diminished enough to reduce winds to acceptable flight levels. Ideal winds are 3 to 6 mph.

Why do some flights get canceled?

Ballooning is the most weather-restricted form of aviation. Typically, there must be no thunderstorms in a 100-mile radius, winds must be under 10 mph, and must be predicted to stay below 10 mph throughout the remainder of the flight, and there must be no precipitation in the vicinity. Additionally, wind direction, available launch and landing sites, fog, or low ceilings can be reasons for balloon flight cancellation.

How high do balloons fly?

Balloons typically fly from treetop level all the way up to several thousand feet, depending on what the pilot is trying to accomplish. The world record in a stock hot air balloon is over 32,000 feet!

What makes the idea landing field?

First and foremost, is welcoming land owners, willing to allow a balloon to land. If it is a mowed field in close proximity to a road, this is ideal. A landing balloonist must also consider the proximity of power lines, creeks or ponds, livestock, and crops.

Who can be a balloonist?

Balloon pilots come from all walks of life. Anyone with the desire to learn to fly a balloon can become a pilot. Balloon pilots who have met minimum flight competency can solo at age 14. There is no mandated minimum age that a student must be to begin flight training. (They be able to read and understand the English language) Children may fly under the direction of a Commercial pilot who is by definition a certified flight Instructor.

Do you need a pilot's license?

Yes. There are two levels of balloon pilot ratings. The first is a private pilot. The pilot must have at least 10 hours of flight time in free balloons, which must include six flights under the supervision of an instructor. The private pilot must pass a written test, oral test and flight check prior to being

issued a private pilot's license. The second rating is a commercial pilot. The commercial pilot must have at least 35 hours of flight time, of which at least 20 must be in balloons (the remaining 15 hours may be in other aircraft). The commercial pilot must pass an additional written, oral and flight check prior to being issued a commercial pilot's license. The holder of a commercial pilot's license may operate a balloon for hire and may give flight instruction. (For additional requirements on both ratings, please consult FAA Regulation Part 61 for details.)

How can I be involved without buying a balloon or becoming a pilot?

Many people start in ballooning as a crew person. In most areas, you can join a local club such as The Genesee Valley Balloon Association or The North East Ohio Balloon Pilots Association that organize races and community functions. You can also join the Balloon Federation of America, which is the national sanctioning body for the National Championships and is dedicated to promotion of the sport. In addition, you can check the local yellow pages for balloonists in your area and offer your services. Or, the next time you see a balloon flying in your area, follow it and offer to help when it lands.

What equipment is required for balloons?

Balloons include several parts: the envelope (the fabric portion of the balloon), the basket, burners and fuel systems. The material for balloon envelopes is made of ripstop nylon or ripstop polyester with tough, silicone or urethane coatings for heat and air retention. Most baskets are made of wicker, which is strong, yet flexible and is aesthetically pleasing. Burners can come in either single, dual, or triple.

How much does a balloon cost?

Like cars and boats, new balloons can vary in size and amenities. You can start with a smaller sport model for around \$14,000. These balloons typically carry a pilot and one additional person. The larger balloons that can carry two or ten passengers in addition to the pilot will range between \$15,000 and \$50,000. There are many good used balloons on the market that vary in price due to size, age and flight hours.

Besides a Balloon what else do you need to go Flying?

- A "chase vehicle" is required to transport all but the tiniest balloons, Balloons travel with the wind and can cover considerable distance depending on wind speed and flight duration.
- A gas powered fan is required to cold inflate the envelope.
- Toy balloons and a helium tank are required unless you always fly with other pilots who have them. Pibals (pilot balloons) are critical for pre-flight studying the winds aloft.
- A quality hand held compass to read Pibals is important. If you really want to be accurate a stopwatch, and an inclinometer, will allow you to determine the exact wind speed, and direction, at specific altitudes.
- Helmets are a good idea and are required equipment for some manufactures
- Gloves to minimize the transfer of skin oils during envelope handling and to prevent rope burn from handling lines are a good idea. Pilot gloves that have long cuffs and offer protection from open flame and raw liquid propane frost burns are smarter still.
- A Tie down line that has a simple reliable release under considerable tension, yet can restrain a balloon with the equivalent of over 5000 square feet of sail area, is a must.
- It's a good idea to have an aviation Radio particularly if you fly in the vicinity of an airport. Some airspace is only accessible with a radio.
- Ground communication between balloon and chase, including radios and cell phones are suggested both from a safety prospective and a "where are you" prospective.
- Some Balloonist invest in tether systems, which allow a balloon to be flown up and down while tied to the ground. The maximum height and wind tolerance of these systems vary considerably. As does the associated price.
- If a pilot desires to fly in the winter, special equipment (tank heaters or nitrogen fuel pressurization) is required to insure adequate fuel pressure.

- Depending on where you fly a two wheel cart in the chase vehicle might be the difference between having willing crew, and crew who need to wash their hair when it's flyable.
- One other accessory that is nearly universally hated by crew but is sometimes a necessary evil is a tarp to lay out the envelope on. Dusty, damp, muddy or snowy landing fields can really take there toll on balloon fabric. Protecting the fabric sometimes requires a tarp on the ground under the envelope.
- Crew preference also may dictate having an envelope "squeezer" to milk the air out of the envelope after flying. There are any number of other contrivances to help minimize labor and keep things orderly.