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Hot Air Balloons

On the 19th September 1783 Pilatre De Rozier, a scientist, launched the first hot air balloon called 'Aerostat Reveillon'. The passengers were a sheep, a duck and a rooster and the balloon stayed in the air for a grand total of 15 minutes before crashing back to the ground.

The first manned attempt came about 2 months later on 21st November, with a balloon made by 2 French brothers, Joseph and Etienne Montgolfier. The balloon was launched from the centre of Paris and flew for a period of 20 minutes. The birth of hot air ballooning!!!

Just 2 years later in 1785 a French balloonist, Jean Pierre Blanchard, and his American co pilot, John Jefferies, became the first to fly across the English Channel. In these early days of ballooning, the English Channel was considered the first step to long distance ballooning so this was a large benchmark in ballooning history.

Unfortunately, this same year Pilatre de Rozier (the world's first balloonist) was killed in his

attempt at crossing the channel. His balloon exploded half an hour after takeoff due to the experimental design of using a hydrogen balloon and hot air balloon tied together.

Now a large jump in time, of over 100 years: In August of 1932 Swiss scientist Auguste Piccard was the first to achieve a manned flight to the Stratosphere. He reached a height of 52,498 feet, setting the new altitude record. Over the next couple of years, altitude records continued to be set and broken every couple of months - the race was on to see who would reach the highest point.

In 1935 a new altitude record was set and it remained at this level for the next 20 years. The balloon Explorer 2, a gas helium model reached an altitude of 72,395 feet (13.7 miles)! For the first time in history, it was proven that humans could survive in a pressurized chamber at extremely high altitudes. This flight set a milestone for aviation and helped pave the way for future space travel.

The Altitude record was set again in 1960 when Captain Joe Kittinger parachute jumped from a balloon that was at a height of 102,000 feet. The balloon broke the altitude record and Captain Kittinger, the high altitude parachute jump record. He broke the sound barrier with his body!

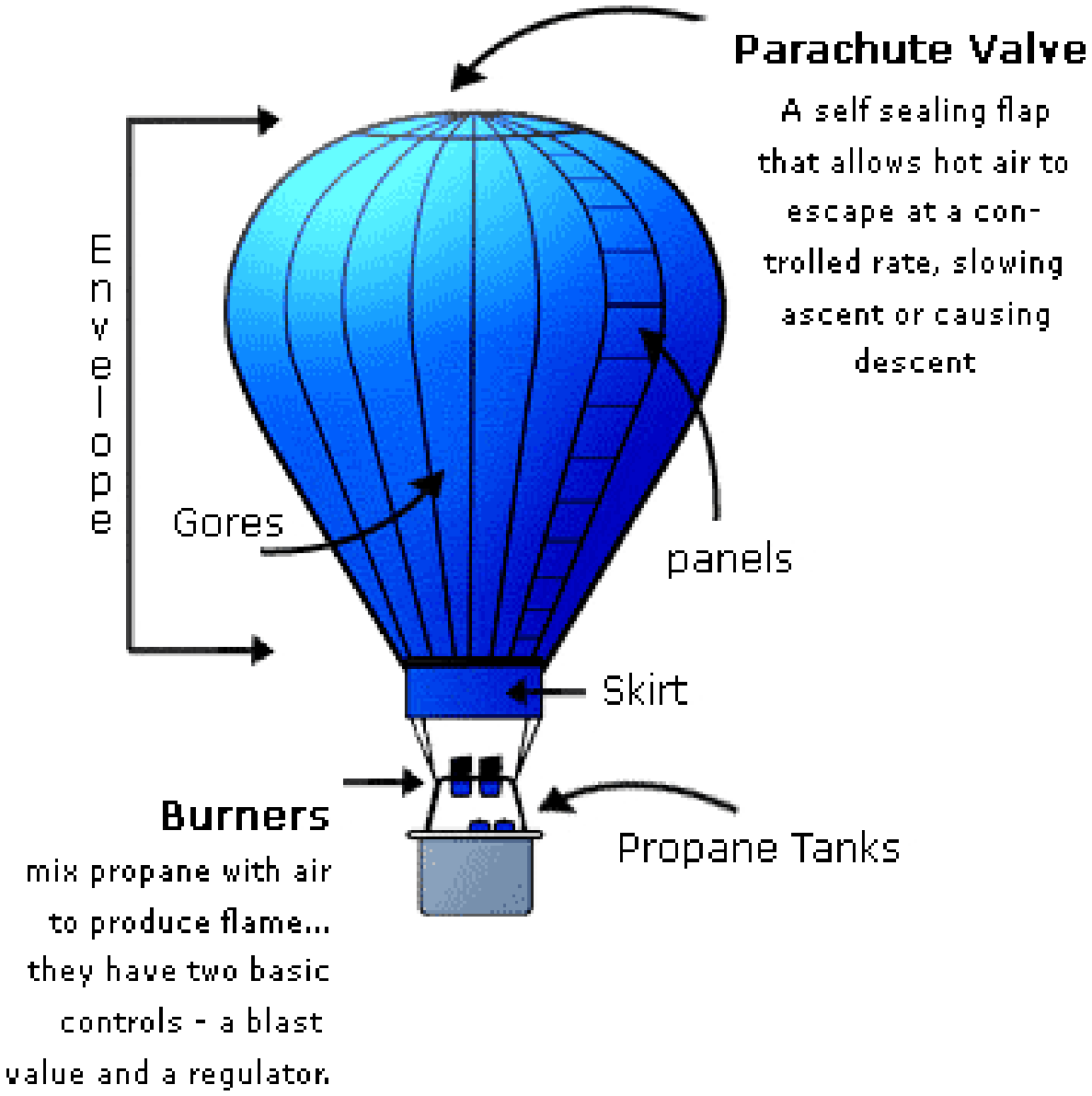
How the Balloon Works?

Hot air balloons are an ingenious application of basic scientific principles. Here we will show exactly how the balloon works, what makes it rise and fall and how a pilot is able to move it when it is in the air.

The basis of how the balloon works is that warmer air rises in cooler air. This is because hot air is lighter than cool air as it has less mass per unit of volume. Mass can be defined by the measure of how much matter something contains. The actual balloon (called an envelope) has to be very large as it takes such a large amount of heated air to lift it off the ground. For example, to lift about 450 kg worth of weight you would need almost 1840 cubic metre of heated air! To help keep the balloon in the air and rising, hot air needs to be propelled upwards into the envelope using the burner.

A hot air balloon is made up of 3 main parts:

1. **The Envelope**
   The actual fabric balloon which holds the air
2. **The Burner**
   The unit which propels the heat up inside the envelope
3. **The Basket**
   Where the passengers and pilot stand



The burner uses propane gas to heat up the air in the envelope to move the balloon off the ground and into the air. The pilot must keep firing the burner at regular intervals throughout the flight to ensure that the balloon continues to be stable. Naturally, the hot air will not escape from the hole at the very bottom of the envelope as firstly, hot air rises and secondly, the buoyancy keeps it moving up.

The controls for piloting a balloon are actually extremely simple.

1 - To move the balloon upwards - the pilot opens up the propane controller which lets the propane flow to the burner which in turn fires the flame up into the envelope. Works in much the same way as a gas grill, the more you open the valve, the bigger the flame to heat the air, the faster the balloon rises.

2 - To move the balloon downwards - the 'Parachute Valve' at the very top of the balloon is what is used to bring the balloon down towards the ground. It is essentially a circle of fabric cut out of the top of the envelope which is controlled by a long chord which runs down through the middle of the envelope to the basket. If the pilot wants to bring the balloon down he simply pulls on the chord which will open the valve, letting hot air escape, decreasing the inner air temperature. This

cooling of air causes the balloon to slow its ascent.

So essentially this takes care of the up and down movement, so how does the balloon move from place to place? Again the answer is very simple, the pilot can move horizontally by changing the vertical position of the balloon because the wind blows in different directions at different altitudes. If the pilot wants to move in a particular direction they simply ascend and descend to the appropriate level and ride with the wind.

Adapted from:
http://www.eballoon.org/balloon/how-it-works.html