- Balloons / Airships

TRANSPORT

HOW HOT-AIR BALLOONS FLY

Creating changes in air density is key to getting balloons off the ground and into the skies

WORDS SCOTT DUTFIELD

The science that enables hot-air balloons to soar through the skies comes down to one fundamental principle: heat rises. To turn this fact of physics into flight, hot-air balloons are equipped with powerful burners. When fired up, these heat the air molecules inside the huge canopy. The energy and distance between each of these molecules increases with the heat, causing the air within the balloon to expand. The result is a pocket of hot air that's less dense than the colder air surrounding the balloon.

The hot air within the balloon is then displaced by colder, denser air, causing the balloon to move upwards. This upward force is known as buoyancy. Much like how a submerged rubber duck in a bathtub will rise to the surface of the water, buoyancy lifts hot-air balloons through the air.

Theoretically, a hot-air balloon would continue to rise until it reached the 'surface' of Earth's atmosphere. However, so far the highest balloon ride in the sky has only taken passengers up to around 6,700 metres, which is just a fraction of the atmosphere's 60-mile thickness. For the balloon to descend, the pilot just needs to reduce the amount of heat and cool the air within the balloon, making it denser and causing it to sink through the atmosphere.



An illustration of the first hot-air balloon flight to carry humans

One of the challenges of flying around in a balloon is its dexterity in the air. Without propellers and wings, hot-air balloons are largely at the mercy of the wind to determine their direction. However, pilots can skilfully alter the altitude of the balloon to meet varying wind currents in the atmosphere to guide its direction.

In 2023, Virgin announced a collaboration with pioneering hot-air balloon creator Cameron Balloons to produce the world's first steerable hot-air balloon, called the B-Wing. Along with all the whimsy of a traditional hot-air balloon, the B-Wing includes a pair of practical wings that the pilot can use to actively steer the balloon. By using rotation vents, pilots will be able to orient the balloon in the air and even control whether the aircraft moves forwards or backwards.

SOLAR-POWERED BALLOONS

It might seem like a farfetched idea, but solar-powered hot-air balloons do indeed exist. The debut of this kind of balloon occurred in 2015 at the 37th Bristol International Balloon Fiesta, and was created by Cameron Balloons. To utilise the Sun's power, the almost 4,248-cubic-metre balloon was partly made from black material specially designed to absorb the heat from sunlight, to maintain the temperature of the hot air within. This occupied half of the balloon's overall form and was positioned towards the Sun. The half of the balloon facing away from the Sun was made using double-lined insulating silver material to reduce any heat loss during flight. The balloon wasn't entirely solar-powered; it was a hybrid aircraft, with a propane burner at its heart for takeoff and support.



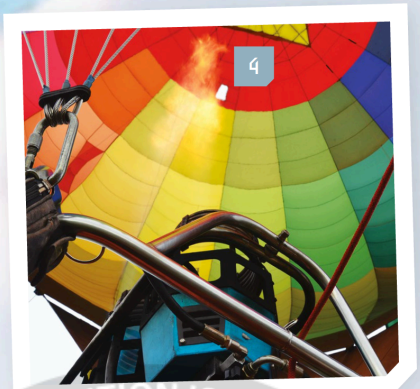
Cameron Balloons' debut of a solar-powered hot-air balloon

DID YOU KNOW? The world's largest hot-air balloon is 21,238 cubic metres and can carry up to 32 passengers

3 GORES
The tear-drop shape of a balloon is created by long panels called gores.

6 ENVELOPE
The body of the hot-air balloon, typically made out of thin nylon.

4 PARACHUTE VENT
In the event that a balloon needs to descend quickly, the pilot can pull a cord attached to a vent at the top of the balloon to allow cold air to flood inside.



2 SKIRT
The material closest to the flame is made from flame-resistant material, commonly a textile called Nomex.

1 BURNER
Heat is supplied by burning propane, which is stored as a compressed liquid in cylinders within the balloon's basket.

Did you know?
The hot-air balloon was invented in 1783



UP, UP AND AWAY

The components that lift hot-air balloons into the sky

5 BASKET
Passengers are carried in a lightweight basket. Balloons can typically support a weight limit of half a tonne.

5 FACTS RECORD-BREAKING BALLOONS

1 FASTEST FLIGHT AROUND THE GLOBE
This speedy hot-air balloon trip was made in 2016 by Russian adventurer Fedor Konyukhov, who travelled 20,829.2 miles from Northam, Australia, to Bonnie Rock, also in Australia, in 268 hours and 20 minutes.

2 FASTEST BALLOON
Not only was the Virgin Atlantic Flyer the first hot-air balloon to cross the Atlantic in 1987, it also set the speed limit for the fastest manned balloon, reaching speeds of up to 153 miles per hour.

3 FIRST NON-STOP ROUND-THE-WORLD TRIP
In 1999, Bertrand Piccard and Brian Jones became the first people to travel around the world in a hot-air balloon. The trip took 19 days, 21 hours and 55 minutes, taking the pair from Switzerland to North Africa.

4 TALLEST BALLOON
The world's tallest hot-air balloon was created in 2022 and stood just over 56 metres tall. It took the form of an enormous Coca-Cola bottle: the 'Giant of Refreshment'.

5 FIRST SOLO TRIP AROUND THE WORLD
The first solo balloonist to circumvent the globe in a hot-air balloon was Steve Fossett in 2002. After six attempts at the record, Fossett flew for 13 days over 22,100 miles to complete the record.

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