Lighter than Air

A Reading A–Z Level T Leveled Book
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Written by John Meyer

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Lighter than Air
Level T Leveled Book

Written by John Meyer
Illustrated by Paula Schricker

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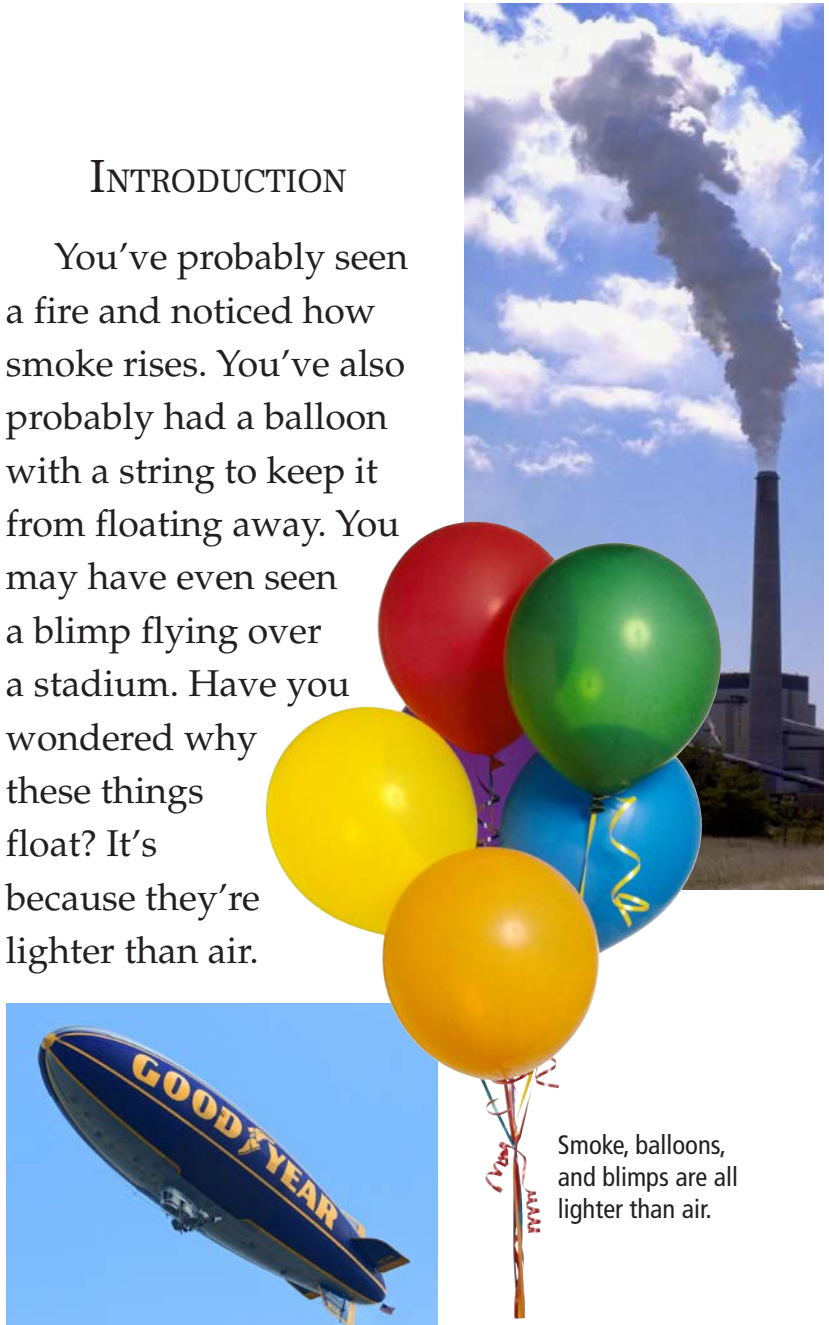
Introduction

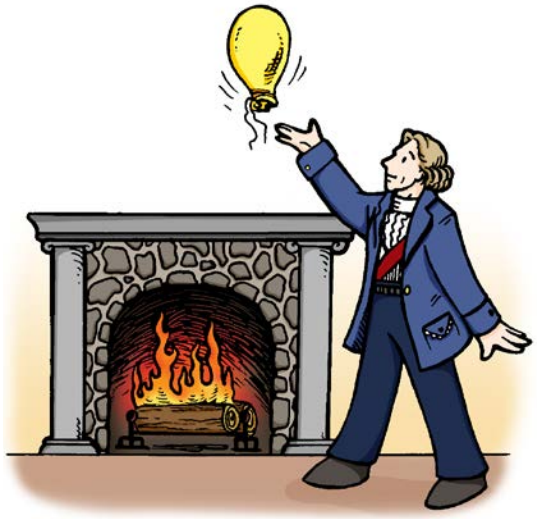
You've probably seen a fire and noticed how smoke rises. You've also probably had a balloon with a string to keep it from floating away. You may have even seen a blimp flying over a stadium. Have you wondered why these things float? It's because they're lighter than air.



Smoke, balloons, and blimps are all lighter than air.

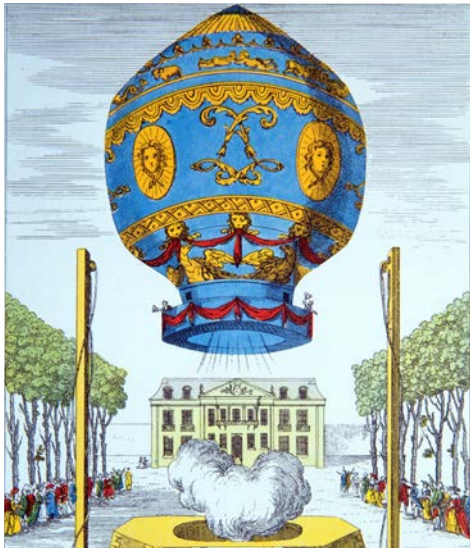
Early Days

More than two centuries ago, a man named Joseph Montgolfier (mon-GOLF-yay) was watching a fire in his fireplace. He began to wonder what made the smoke and sparks rise up the chimney. He decided the burning fire must create a **gas** of some kind. He called this gas "Montgolfier Gas." Then he tried an experiment. He made a bag out of silk and held the open bottom over a fire. Sure enough, when he let go, the bag began to rise into the air.



Montgolfier and the silk bag that gave him an idea

Later, Joseph and his brother made a bag of cloth and paper that was nearly 12 meters (40 ft) around. When they filled it with "Montgolfier Gas" from a large fire, it rose



A drawing of the Montgolfier balloon

over 1,800 meters (6,000 ft) in the air and traveled more than 1.6 kilometers (1 mi). In their next demonstration, they attached a basket to the bag and sent a duck, a rooster, and a sheep into the air. These were the very first aircraft passengers in history.

Soon after that, in 1783, two other Frenchmen became the first humans to fly in a balloon. Their flight lasted 25 minutes, and they landed more than eight kilometers (5 mi) from where they started. When some farmers saw the balloon come down in their field, they were so frightened that they attacked it with pitchforks and tore it to pieces.

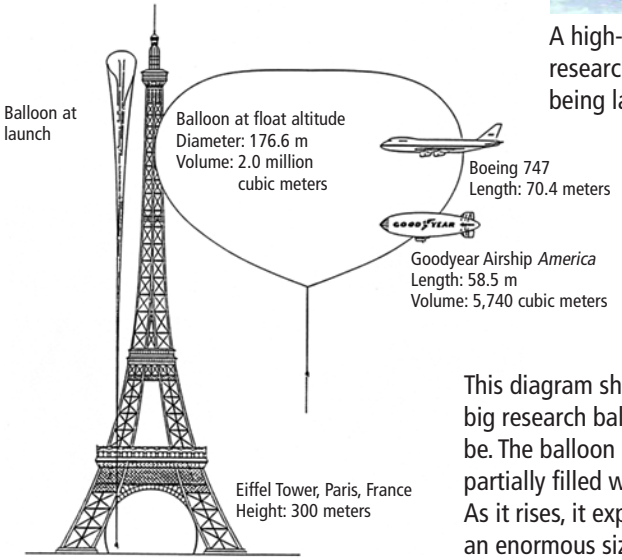
Kinds of Balloons

The "silk balloons" mentioned previously were the first hot air balloons. Today, hot air ballooning is a very popular sport all over the world. Today's balloons are much safer than the ones the Montgolfiers knew. They use propane gas-powered burners to heat the air, and the pilot can adjust the size of the burner's flame to make the balloon go up and down.

Balloons rise over New Mexico (left); A balloon pilot uses the propane burner to make the balloon rise (above).

Scientists also use gas-filled balloons to study the weather. Small balloons filled with gases such as helium or hydrogen that are lighter than air carry instruments used to study and predict the weather. Other balloons are much larger and are able to reach altitudes of 37 kilometers (23 mi) or more, almost to the edge of space. They carry equipment for studying the atmosphere and for observing objects in space.

A high-altitude research balloon being launched



This diagram shows how big research balloons can be. The balloon is only partially filled with helium. As it rises, it expands to an enormous size.

One of the last great challenges of ballooning has been to fly a balloon around the world. Many attempts have been made at this very difficult feat. Bad weather, fuel shortages, and technical problems forced an early end to all of the flights. Many distance and time records were set, but nobody had been able to circle the Earth. Finally, in 1999, Bertrand Piccard of Switzerland and Brian Jones of Britain did it.

The Breitling Orbiter, the first balloon to fly around the world

Steering

One drawback of balloon travel is that balloons can't be steered. They go wherever the wind takes them. Balloon pilots have control over altitude, and they can make the balloon go up and down to find winds blowing in different directions. But they are not able to steer the balloon in a particular direction. Almost as soon as balloons were invented, people started to think of ways to steer them, or make them **dirigible**. Today any lighter-than-air vehicle that can be steered is called a dirigible.

International Ballooning Contest, Aero Park, Chicago, July 4, 1908

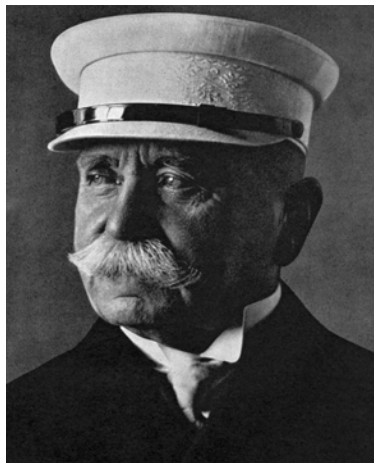
A drawing of Henri Giffard's dirigible, the first powered aircraft in history

In 1852, a Frenchman named Henri Giffard made the first powered flight in history when he flew his dirigible 27.4 kilometers (17 mi) and landed safely. His dirigible was powered by a steam engine of his own design. His engine produced three horsepower, about as much as a modern-day lawnmower. But his engine was too weak to fly the dirigible against the wind. Almost 40 years passed before the gasoline engine finally provided the power needed for a useful dirigible.

A Brief History of Airships

The Zeppelin

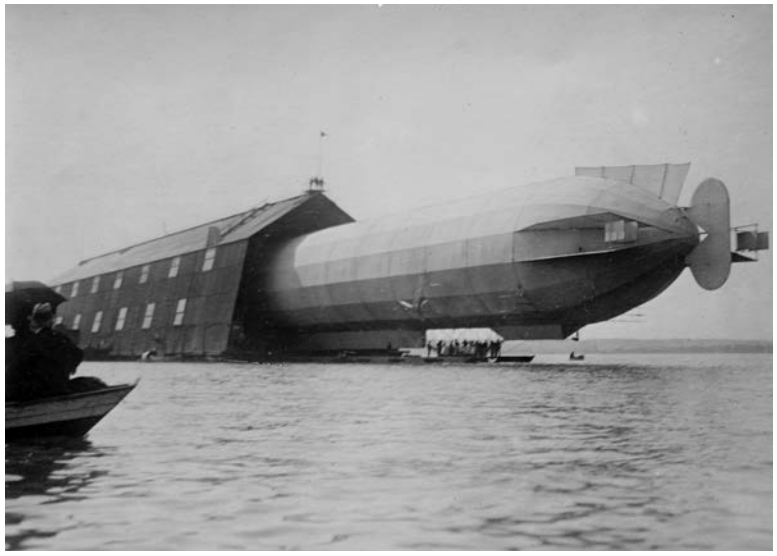
Perhaps the most important person in the history of lighter-than-air flight was Count Ferdinand Graf von Zeppelin. He had long dreamed of a way to navigate the skies the way ships navigate the water.



Count von Zeppelin

Von Zeppelin became convinced that an **airship** with a rigid framework could be made strong enough to be useful. The framework would be covered with fabric and would support the weight of the engines, fuel, passengers, and cargo. Inside the framework would be cells containing the lifting gas. He chose hydrogen because it is the lightest gas. It was also very explosive, so it had to be used very carefully. He named his invention the **zeppelin**. It was a huge dirigible, often known as a rigid airship.

Count von Zeppelin was a military officer who imagined using a fleet of military zeppelins as scouts and bombers. But he failed to interest the military in his invention. Instead he raised money from private donations and spent a large amount from his own fortune. In 1900, the Count flew his first airship, the *Lufftschiff Zeppelin 1*, or *LZ 1*. The *LZ 1* made only three flights before the Count ran out of money and had to dismantle it. Five years passed before he could raise money for another ship. Despite its short career, the *LZ 1* proved that the zeppelin could work.



Early zeppelins had hangars that floated on the surface of a lake. This is the *LZ 3.*

The First Airline

Nine years after the *LZ 1*, Count von Zeppelin still had not convinced the military that airships could be useful in war. He realized he would need another source of money if he wanted to build more zeppelins. So in 1909 he formed a company called DELAG to buy airships and carry passengers between German cities. The DELAG airships served delicious food and fine champagne while passengers sat in comfort, watching the countryside below. By 1914, DELAG had carried more than 34,000 passengers and flown roughly 160,000 kilometers (100,000 mi) without any problems.

The *LZ 10 Schwaben* was the first successful commercial zeppelin. In the summer of 1911, she made almost 100 flights.

The *LZ 127 Graf Zeppelin*

The Great Graf

In September of 1928, an enormous new airship was pulled from her hangar for the first time. The ship was named *Graf Zeppelin* in honor of the Count, who was still thought of as a national hero in Germany. Nobody had ever seen anything like the *Graf*. She was 236 meters (775 ft) long, longer than three 747 jetliners and almost as long as the *Titanic*. In 1927, an airplane had struggled to fly across the Atlantic. One year later, the *Graf Zeppelin* could carry 20 passengers across the

The *Graf Zeppelin* attracted crowds wherever she went.

ocean in luxury matched only by the finest ocean liners. The *Graf Zeppelin* caused a huge sensation wherever she went. In the 1920s, many people had never seen an airship or even an airplane. People were awestruck when they saw a silver ship the size of a skyscraper sail over their heads. They rushed out of their houses and gathered by the thousands wherever the *Graf* landed.

The *Graf Zeppelin* made regular passenger flights to and from Germany. In 1929, the *Graf* made a twelve-day voyage around the world. She also helped explore the Arctic and made

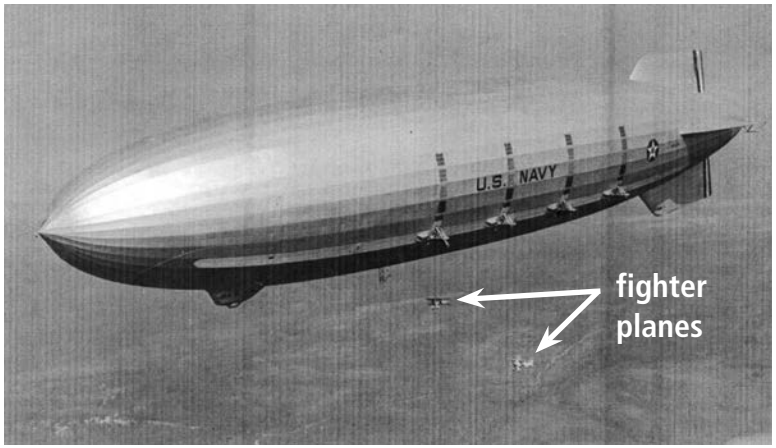
the first passenger flights between Europe and South America. The *Graf* flew until 1937. After that, she was made into a museum. But when World War II began, the Nazi government of Germany had her melted down to use the metal to make fighter planes.

The *Graf Zeppelin* landing at Lakehurst, New Jersey, after her flight around the world in 1929

A number of countries issued stamps featuring the *Graf Zeppelin.*

Flying Aircraft Carriers

People are used to the idea of airplanes taking off from and landing on ships called aircraft carriers. But in the 1930s, the U.S. Navy had two aircraft carriers that could fly. The *Akron* and *Macon* were designed to carry several small airplanes that could be launched and recovered in mid-air.



The USS *Macon* with two fighter planes visible underneath

Inside each airship was a hangar where the small planes were stored. A hook on the airplane's wing was attached to a trapeze, which lowered the airplane through an opening in the bottom of the airship. The airplane started its engine, unhooked, and flew off. When the airplane returned, the

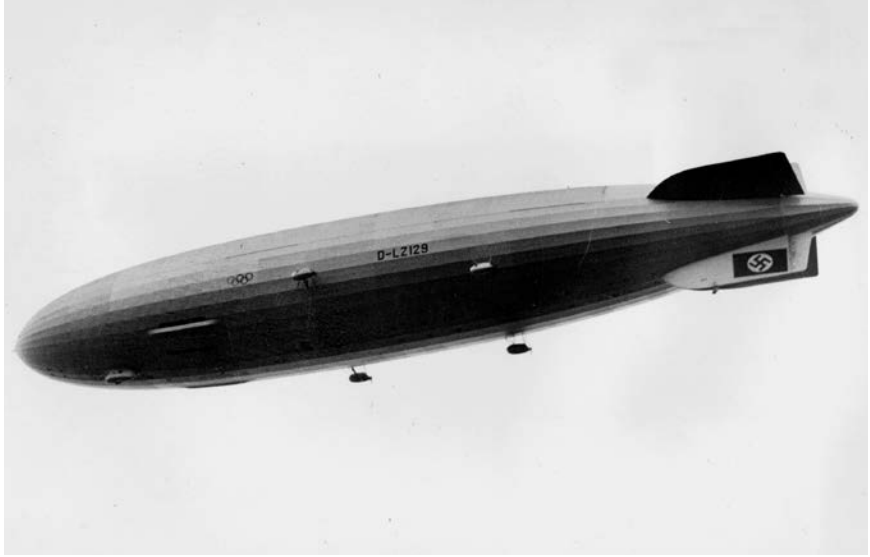
procedure was reversed. The pilots became so good at landing in the air that some of the airplanes had their wheels removed to save weight.

Unfortunately, both the *Akron* and *Macon* were lost in accidents caused by bad weather and human error. The Navy lost interest in big zeppelins but continued to fly smaller patrol blimps for many years.

The Hindenburg

The *Graf's* success and popularity inspired the Zeppelin Company to build an even bigger ship. This new ship was the *Hindenburg*. The *Hindenburg* was the most luxurious airship ever built. At 245 meters (803 ft) long, or nearly three football fields, she is still the largest flying machine ever. The *Hindenburg* began service in 1936, delighting her passengers and thrilling everyone who saw her.

Although she was designed to use helium, the *Hindenburg* was filled with hydrogen. At that time helium was very scarce, and



The *LZ 129 Hindenburg* flies overhead.

the United States was the only country with enough to fill even one airship. The U.S. refused to sell any helium for the *Hindenburg* because of the Nazi government that controlled Germany. Even though her crew was extremely careful about any flames or sparks, the *Hindenburg* burst into flames while landing in stormy weather at Lakehurst, New Jersey, in 1937. Of course, everyone blamed the hydrogen for the explosion. New evidence suggests that the cause was actually the fabric covering, which was also very flammable. No matter what the cause, the fiery crash was the end of passenger-carrying zeppelins.

Modern Airships

After World War II, most people lost interest in big airships. Crossing the ocean on an ocean liner was less expensive, and airplanes were getting bigger and faster. The fiery crash of the *Hindenburg* made people afraid to fly on zeppelins even if they were filled with helium. But people have never lost interest in lighter-than-air flight.

The Goodyear blimp *Spirit of Goodyear*

Probably the most famous airships of all are the Goodyear **blimps**. In the 1930s, Goodyear teamed up with the Zeppelin Company to build zeppelins and blimps for the U.S. Navy. Goodyear also made some blimps to use for advertising its products and hasn't stopped since. Goodyear blimps are seen by millions of people every year. Other companies, such as Fuji Film and Metropolitan Life, also use blimps to promote their products.

In Germany, where the zeppelin was invented, interest in new airships is very strong. The Zeppelin Company is once again building airships. Their new ship is the *Zeppelin NT* (New Technology). It is designed for many different uses, including patrol, exploration, advertising, and passenger travel. For the first time in almost 70 years, you can buy a ticket for an airship flight. The company that once flew the *Graf Zeppelin* now offers sightseeing trips over Germany.

The cockpit of a *Zeppelin NT*

The *Zeppelin NT* taking off

Other companies have started to build airships, as well. Lockheed Martin, for example, has the *Hybrid Airship.* This ship can be used to carry very heavy and bulky cargo. It will be able to pick up its load at the factory and drop it right where it's needed, especially places that do not have decent roads.

P-791 Hybrid Airship

The *P-791 Hybrid Airship* can lift more than 450 metric tons.

Conclusion

Once people realized that air could be made lighter by heating it and that there were gases lighter than air, they looked for ways to float objects in the air. First it was hot air balloons. Then came dirigibles that could be steered. These airships got bigger and better.

They became dependable, safe means to travel through the air. Dirigibles still fascinate and excite people 150 years after they were invented.

How Can Something Be Lighter than Air?

What the Montgolfier brothers didn't know is that there is no such thing as "Montgolfier Gas." The brothers were not aware of something called **density**. When air is heated by a fire, the air's **molecules** spread apart, making the air less dense. In effect, it becomes lighter than the air around it, and so it rises. If you've ever seen a piece of wood floating in the water, you've seen this happen. The wood floats because it is less dense than the water. A hot air balloon floats because the hot air is less dense than the air around it, and it lifts the balloon (and its passengers) up with it. Some other gases are also less dense than air. People soon discovered that they could also use hydrogen or helium to fill a balloon. Both of these gases are less dense (lighter) than air. Hydrogen can lift more than helium, but it is also very flammable.

Glossary

airship any self-propelled lighter-than-air aircraft with means to control the direction of flight (p. 12)

blimps airships that use internal gas pressure rather than a rigid framework to maintain their shapes (p. 21)

density how tightly packed together a material's molecules are. (p. 25)

dirigible able to be directed or steered; now refers to any steerable lighter-than-air aircraft (p. 10)

gas matter that can freely change shape and size (p. 5)

molecules the tiny particles that make up every substance (p. 25)

zeppelin an airship with a rigid internal framework and cells to contain the lifting gas (p. 12)