



# A BRIEF HISTORY OF FLIGHT

## BACKGROUND INFORMATION FOR EDUCATORS

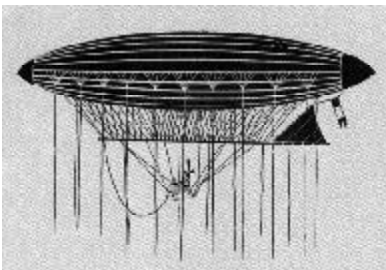
The idea of flight has fascinated people since the dawn of history. From the Greek legend of Daedalus and Icarus to space station Mir, people have been discussing, analyzing, attempting and achieving flight. Though technology has advanced dramatically, the dream of progress still remains.

While perhaps more famous for his artworks, Leonardo da Vinci was the first to make a scientific study of flight mechanics. In the late 15th century, he made sketches of a flying machine called an ornithopter, which had wings that would flap when the "pilot" moved his arms and legs. The basic principle was to enable a man to fly like a bird. Da Vinci never actually built an ornithopter, but if he had, it would not have worked: humans simply do not have the strength to lift their weight by flapping a pair of strapped-on wings.

The first successful flying machines were hot-air balloons built by the French Montgolfier brothers beginning in 1782. Their balloons flew when a fire was used to heat the air inside them. A duck, a sheep and a rooster were the first passengers, but in November of 1783, two men floated over Paris for 25 minutes and became the first humans to experience free flight.



*Montgolfier balloon*



*Giffard dirigible*

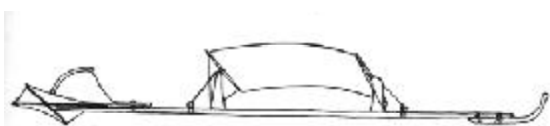
Although balloons put people in the air, they allowed little directional control; the development of airships, or dirigibles, addressed this problem. The first successful dirigible, built in 1852 by Henri Giffard, was shaped like a cigar and used hydrogen to create lift. It had a steam engine that turned a propeller and used rudders to control its direction. The LaFrance airship, built in 1884 by Charles Renard and A.C. Krebs, was the first airship that could be steered in any direction regardless of the wind.

Count Ferdinand von Zeppelin of Germany perfected the rigid dirigible at the turn of the 20th century. During World War I, Zeppelins and other airships dropped bombs over London. Both before and after the war, they enjoyed success as commercial passenger carriers. The *Hindenburg*, the largest and most famous Zeppelin, exploded on May 6, 1937, while trying to land in New Jersey. Thirty-six of the ninety-seven people on board died in the accident, and this catastrophe marked the end of the dirigible as a commercial mode of transport.



*Graf Zeppelin, 1928*

As Giffard, Zeppelin, and their counterparts experimented with airships, other men concentrated on winged aircraft. Sir George Cayley, often called the father of modern aerodynamics, discovered the principles of flight that govern the operation of aircraft. He applied his research to a series of gliders he designed

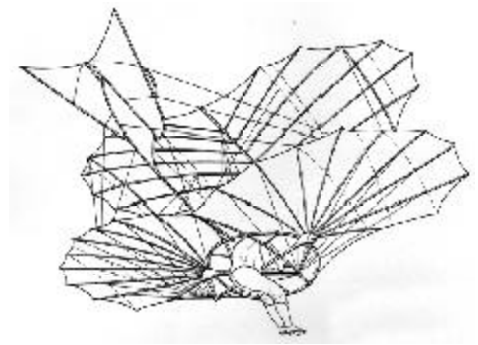


*Cayley glider*

during the first half of the 19th century. In 1853 Cayley's coachman became the first man to fly in a heavier-than-air machine, albeit primarily as a passenger—the glider had few provisions for directional control. In addition to his groundbreaking discoveries in aerodynamics, Cayley also contributed significantly to the

advancement of aviation by writing and publishing extensively on his research.

Otto Lilienthal, a German, built gliders with a rigid framework that gave their fabric-covered wings a curved upper surface. This enabled them to develop lift more effectively than Cayley's all-fabric wings, which relied on air pressure to create their curvature. In 1891 he began a series of more than 2,500 successful glider flights that proved the value of this innovation. By shifting his body weight, Lilienthal was also able to achieve a degree of directional control. It was insufficient, however, to compensate for sharp gusts of wind such as the one that caused his glider to stall and sent him plummeting to his death in 1896.

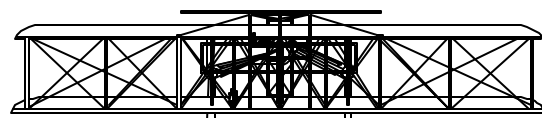


*Lilienthal glider*

Although many experimenters around the world studied and improved on Cayley's and Lilienthal's work as the 19th century drew to a close, most were unable to overcome the two main obstacles to creating what would be called an "airplane"—a suitable source of power and an effective means of directional control.

Orville and Wilbur Wright, with their famous flights at Kitty Hawk, North Carolina, were the first to

solve these problems. The Wright brothers had long been interested in flight and began experimenting with gliders in 1900. They improved the design of the wing to allow more directional control through a process known as warping. The brothers had noticed that when birds flew, they twisted the back edge of one wing upward and the

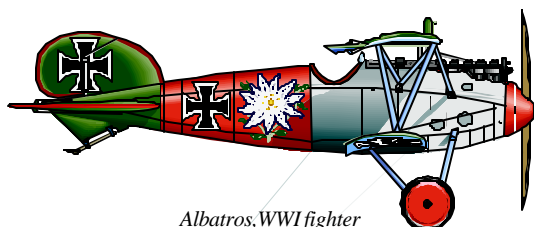


*Wright Flyer, 1903*

back edge of the other wing downward to change their direction. The Wrights incorporated this feature into their glider design by attaching cords to the wing tips so that they could be warped. In 1902 they flew a glider with this feature successfully at Kitty Hawk, a location they had chosen for their experiments due to its favorable winds. This glider also had an elevator and a rudder to control up-and-down and side-to-side motion, respectively.

A year later, the Wrights returned to Kitty Hawk with their newest machine, the Flyer. It had the same basic design as their 1902 glider, with the addition of an engine and propellers. On December 17, 1903, the Wright brothers made the first controlled, manned, powered, heavier-than-air flights in history. The first of these flights lasted 12 seconds and traveled 120 feet. The impact of their success, however, was not felt until 1908, when the Wrights demonstrated their achievements in the U.S. and France.

The next year, 1909, was a significant year in aviation history. Louis Bleriot flew his monoplane across the English Channel from France to England, becoming the first person to fly an airplane across a body of water or from one country to another. Also in France, Elise Deroche, also known as "La Baronne de La Roche," became the first licensed woman pilot. In that same year, the first U.S. Army airplane was built



*Albatros, WWI fighter*

by the Wright brothers. Two years later Glenn Curtiss, the father of naval aviation, flew his first successful seaplane in San Diego.

World War I spurred great advances in aviation use and technology. At the beginning of the war, airplanes were used primarily for observation. With the addition of machine guns,

however, airplanes became effective weapons of war. Design innovations also made planes larger, faster, and capable of carrying bombs.

In May 1918, the U.S. became the first country to offer regularly scheduled, year-round airmail service. The first route ran between Washington, D.C., and New York City. After the war ended in November 1918, the Post Office used many surplus Army aircraft and a smaller number of new planes to expand airmail service across the country.

In 1927, Charles Lindbergh won a \$25,000 prize, offered in 1919 by hotel owner Raymond Orteig, for accomplishing the first non-stop flight from New York to Paris. Lindbergh left New York on May 20, 1927, in his San Diego-built plane the *Spirit of St. Louis* and landed in Paris 33 hours and 30 minutes later. His solo flight made him a hero overnight and inspired aviation enthusiasts around the world.

Another famous pilot of the inter-war period, Amelia Earhart, also reached legendary status. In 1932, Earhart became the first woman pilot to cross the Atlantic alone. Most people remember her, however, because of her disappearance in 1937. Earhart and her navigator set out from Miami intending to fly around the world, but they were last heard from over the Pacific Ocean. Many theories for their disappearance exist, but all searches either then or since have failed to find any evidence of the airplane or its crew.

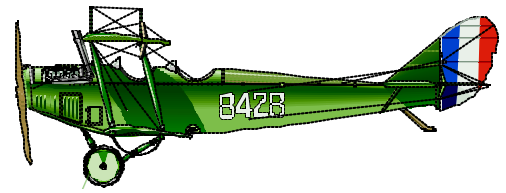
Around the time of Earhart's last flight, a man named Igor Sikorsky was working to improve another type of aircraft, the helicopter. Documents relating to the theory and design of helicopters date as far back as the fourth century, and in addition to his ornithopter, da Vinci had sketched a helicopter-like "helical air screw." In 1907, a helicopter achieved flight at about 5 feet, but it was practically uncontrollable. Sikorsky and his aircraft company perfected the single-main-rotor helicopter in the late 1930s, and the following decades brought significant improvements in

performance and reliability. Helicopters are now widely used for military, emergency-rescue, and commercial purposes.

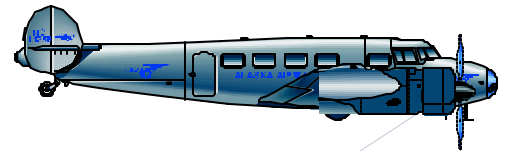
Airplanes played an important role in World War II. During this period, aviation technology again saw many advances, the most significant being the development of jet aircraft. Experiments with jet propulsion had been conducted as early as 1910, but war demands accelerated the progress being made in this area. German engineers were the first to produce an operational jet fighter, the Messerschmitt 262.

Although Great Britain and the U.S. also developed jets during the war, they did not see combat; the first jet-to-jet aerial engagement did not occur until the Korean War (1950).

It was longer still before jets were used in commercial aviation. Great Britain's de Havilland Company developed the Comet jetliner in 1952, but withdrew them from service after two disastrous crashes. The



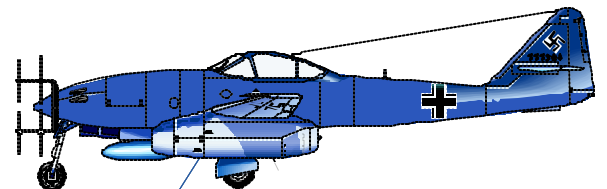
*Curtiss Jenny, 1918 mail plane*



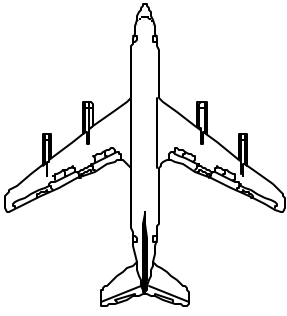
*Lockheed Electra similar to Earhart's 1937 model*



*Sikorsky's VS-300, 1939*



*Messerschmitt 262*

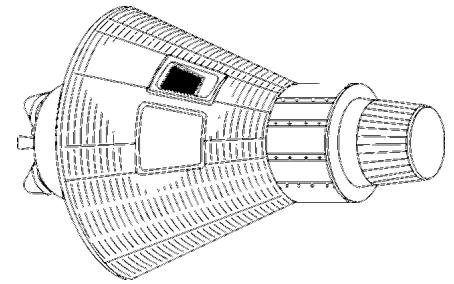


Boeing 707

problems were solved and Comets returned to transatlantic jet service in 1958, about the same time as America's Boeing 707.

Space flight had been a human dream for centuries, but in the years following World War II that dream became a reality. The Cold War between the United States and the Soviet Union motivated each to devote tremendous resources to the space race. The Soviets led with the launch of their *Sputnik* satellite on October 4, 1957, and Soviet Cosmonaut Yuri Gagarin became the first man in space on April 12, 1961.

The United States was not far behind. Projects Mercury, Gemini, and Apollo put Americans into space, into orbit, and on the moon during the 1960s. The first American in space, Alan Shepard, flew a 15-minute sub-orbital mission in a Mercury capsule on May 5, 1961. In February 1962, John Glenn was the first American to orbit the earth. In 1965, the Gemini program, with its two-man space craft, began a series of missions to perfect the skills needed to reach the moon.

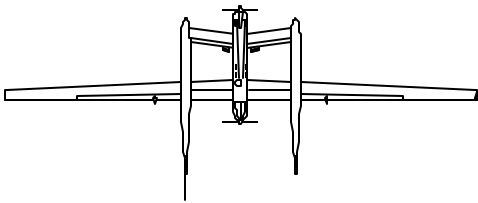


Gemini capsule

The Apollo program received a serious setback when three astronauts perished from a fire in their command module during ground testing in January 1967. In July of 1969, however, the Apollo 11 mission fulfilled President Kennedy's 1961 goal of landing on the moon before the close of the decade when Neil Armstrong, followed shortly by Buzz Aldrin, stepped onto the lunar surface.

During the 1970s, the National Aeronautics and Space Administration (NASA) began developing the Space Transportation System, or Space Shuttle. The first STS mission launched on April 12, 1981. After two days in orbit, Commander John Young and Pilot Robert Crippen safely landed the shuttle *Columbia*. Although grounded for two and a half years after the tragic loss of *Challenger* and its crew in 1986, the Space Shuttle will continue as America's primary space vehicle into the 21st century.

Since the end of the Cold War, the U.S., the former Soviet Union and other countries have been working together to advance space exploration, with the primary goal of establishing an international space station. Progress in aviation continues as well. In 1986, Dick Rutan and Jeanna Yeager became the first people to fly non-stop around the world without refueling in their sophisticated aircraft, *Voyager*. These examples demonstrate how aerospace technology continues to progress as the 21st century approaches.



Rutan Voyager

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