

People know what the Wright brothers accomplished,
but they were not the first humans to take to the air.

Firsts in *Flight*

By Peter Grier

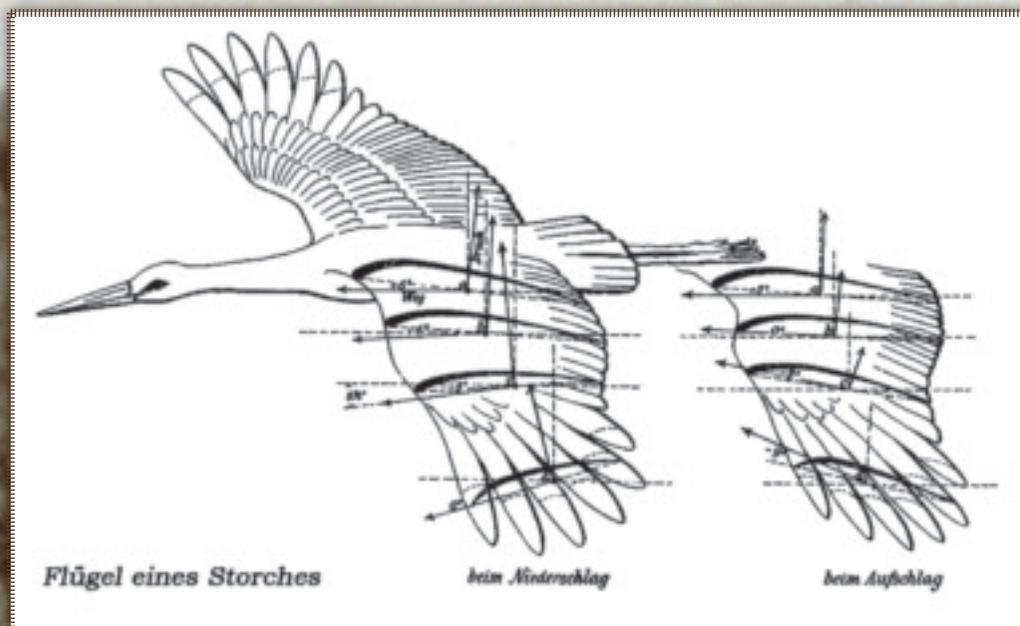


Illustration via Wikipedia

Thirteen years before the Wright brothers' pioneering flight at Kitty Hawk, N.C., a French inventor named Clément Ader climbed into a bat-like contraption at an isolated French estate and made aviation history of his own.

On Oct. 9, 1890, Ader opened the throttle on his steam-powered aircraft *Éole* and roared down a level 700-foot runway. As he recalled later, "I advanced at high speed, the jolting of the wheels on the ground stopped almost at once, and for a few seconds I was suspended in a state of indefinable joy."

He had achieved liftoff. With the end of his cleared space rapidly approaching Ader stopped the engine and sank back to the ground. Measurements showed the *Éole* was airborne for about 160 feet, at a height witnesses estimated at eight inches.

Ader was fortunate he had gone no higher. The *Éole* had no tail. Nor did it have workable flight controls, as perhaps befitted a contraption named after the god of the winds. The pilot's forward vision was blocked by the steam engine's condenser.

But for a brief moment he had done something no other person had ever accomplished.

"Although *Éole* was incapable of either sustained or controlled flight, this represented the first occasion on which a powered aircraft carrying a human made a takeoff from level ground," writes Smithsonian senior curator of aeronautics Tom D. Crouch in his book *Wings: A History of Aviation From Kites to the Space Age*.

Orville and Wilbur Wright invented and constructed the world's first successful heavier-than-air flying machine. Though their primacy was at times disputed by various claimants in the early years of the 20th century their place in history is secure today. The Wright brothers were technological geniuses who worked methodically to solve such problems as the proper camber and airfoil shape for wings. They grasped that the key to real flight was control of pitch, roll, and yaw. Their work revolutionized world transportation.

But they did not work in isolation, as they freely acknowledged.

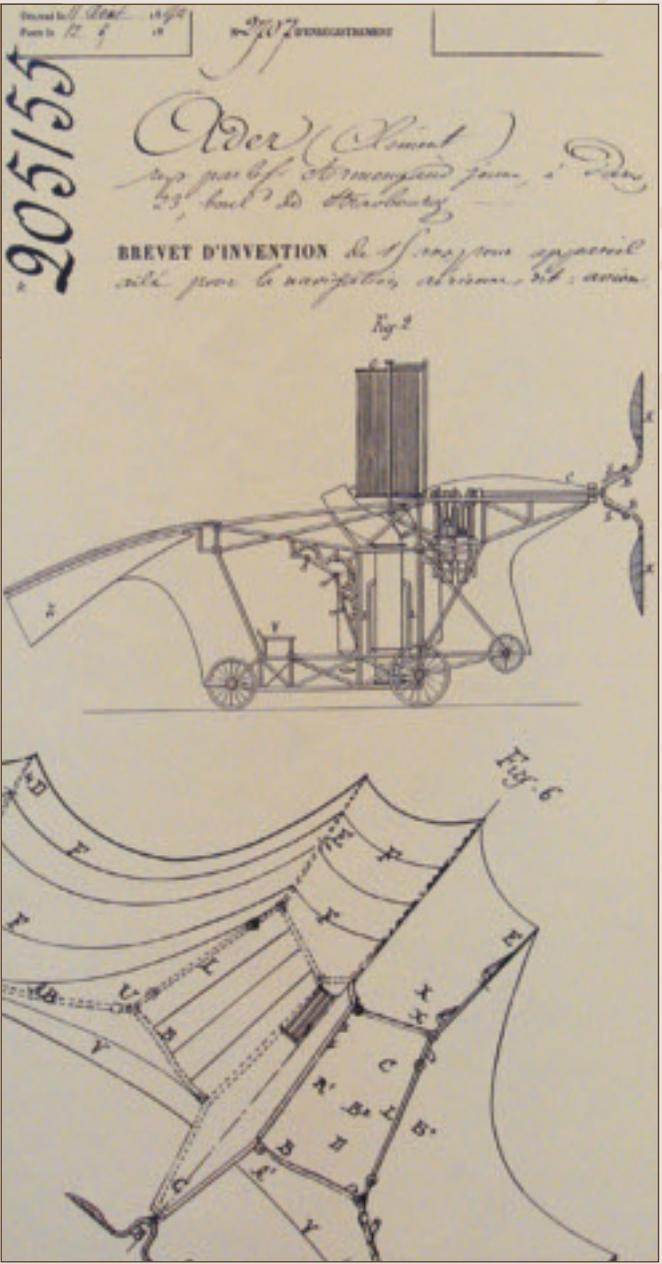
"They were well aware of all previous work, sought out information and advice,



Otto Lillenthal, aka the "birdman of Pomerania," was the first human to launch himself into the air, fly, and land safely. He conducted some 2,000 flying experiments in 16 gliders. Inset: Lillenthal's illustration of the flight of a stork.



Clément Ader (left) wasn't interested in gliders—he knew the value of powered flight. At right is the patent for one of Ader's flying machines. Pictured below is his Avion III. It was funded by the French Ministry of War. It crashed on takeoff.



relied (sometimes to their sorrow) on the work of others, and kept abreast of developments in America and abroad,” writes former Air Force historian Richard P. Hallion in his book *Taking Flight: Inventing the Aerial Age From Antiquity Through the First World War*.

At Kitty Hawk the Wright brothers made the first controlled, sustained, powered, human heavier-than-air flight. Change any of the words in that sentence and other claimants appear.

Clément Ader, for example, made what some historians regard as the first uncontrolled, unsustained, powered human heavier-than-air flight, though in his case “hop” might be a better word.

“There’s a whole series of notable flights, though a lot of the earliest ones are lost in time,” says Hallion.

Who made the first human flight of any kind? The answer to that is buried in legends. Many cultures have myths of bird-men who used wings of some sort to reach the heavens. Of these the familiar story of Daedalus and Icarus is today the best known.

The Flying Monk

The first significant attempts in recorded history were those undertaken with a scientific and technological focus. In other words, they were the work of people who looked at flight in an analytical manner and then tried to design flying equipment that might actually work.

Hallion points to one such in particular: Brother Eilmer, the “flying monk” of Malmesbury, England, who made a “very notable effort.”

Sometime near the beginning of the 11th century this young Benedictine monk donned a crude pair of cloth-covered wings, perhaps made from ash or willow, and leapt from the top of a tower at Malmesbury Abbey, a religious house in Wiltshire in England’s southwest.

Brother Eilmer had been inspired by the fable of Daedalus and had perhaps studied the jackdaws that rode air currents around the tower’s top.

He traveled a furlong, or about 600 feet, according to an account of the event by the eminent 12th-century historian and monk William of Malmesbury. This likely carried him over the city wall and into a small valley by the River Avon.

Then, buffeted by the wind and frightened by his boldness he fell, breaking both legs.

“He used to relate as the cause of his failure that he had forgotten to provide himself with a tail,” wrote William of Malmesbury.

Hallion theorizes that Brother Eilmer had a glide ratio of about four feet of forward progress to one foot of sink, given the reported distances involved. This means he had to have wings fairly far back on his body, lest the center of lift be too far forward.

Most likely, air pressure pushed his arms up into a crude dihedral, providing stability and preventing flapping, which would have likely resulted in his death.

Perhaps as he neared the ground, Brother Eilmer pulled his head up to avoid injury, causing a stall. His comment that a tail might have helped indicates he had some understanding of the aerodynamic forces involved and was learning from his experience.

Not that he ever tried again—the

broken legs left him lame for the rest of his life.

It’s impossible to prove that this was the first human flight. But the record indicates that at the least it was the first serious flight attempt in world history, according to Hallion.

“He is undertaking this with a substantial interest in how flight is actually prosecuted. That kind of sets a tone,” Hallion says.

Not every pioneer of pre-Wright flight used heavier-than-air methods patterned after birds. The late 18th century saw the birth of another way of ascending: ballooning.

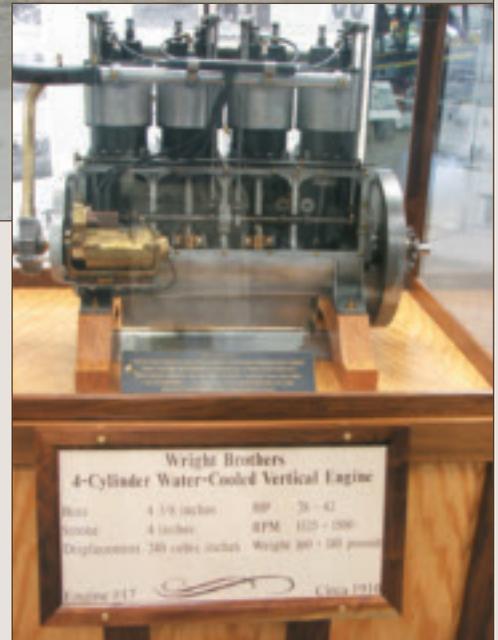
Two French papermakers, the brothers Jacques-Étienne and Joseph-Michel Montgolfier, were the first to demonstrate the lifting ability of balloons on a large scale. They had noticed ash rising in paper fires and at first thought it was smoke that was propelling the flakes

aloft. Eventually they discovered that hot air caused bags to rise.

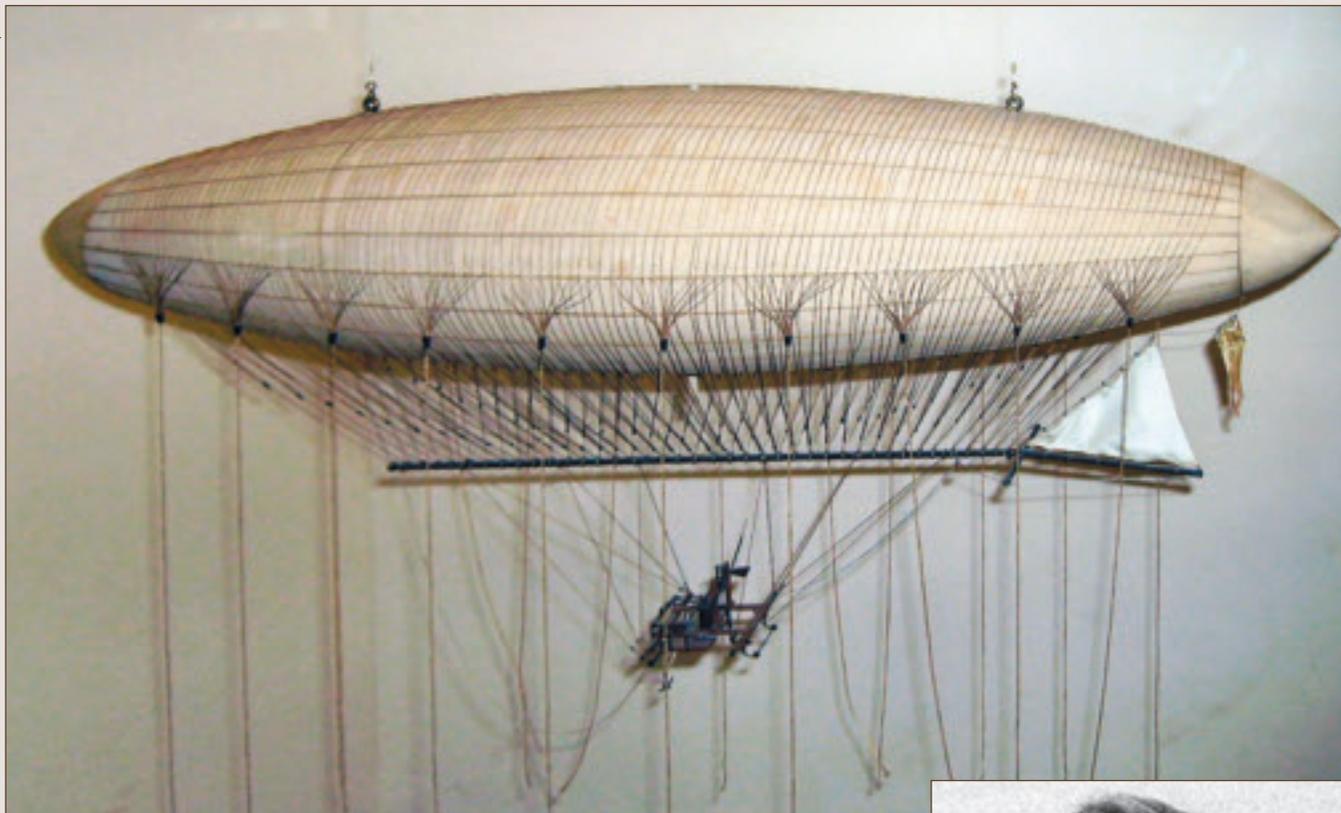
In June 1783, they sent up a 35-foot-diameter balloon in a public demonstration. Three months later they launched a duck, a sheep, and a rooster aloft at the palace at Versailles with the royal family in attendance. Then on Nov. 21 the brothers triumphed. A large Montgolfier hot air balloon rose untethered from the grounds of the chateau of the dauphin of France, carrying two men: the scientist Jean-François Pilâtre de Rozier and François Laurent, the marquis d’Arlandes.

The first successful flight of the Wright Flyer at Kitty Hawk, N.C., in 1903. Below, l-r: Wilbur Wright; Orville Wright; and a Wright four-cylinder water-cooled vertical engine, circa 1910, on display at the New England Air Museum, in Windsor Locks, Conn.

Library of Congress photos



Via Wikipedia



These intrepid travelers were “the first humans to make a free flight,” according to the Smithsonian’s Crouch. They doffed their hats and bowed to the throng below when they reached an altitude of 250 feet. Climbing to about 3,000 feet, they traveled for some 20 to 25 minutes over the environs of Paris. The flight ended with a gentle descent into an open field.

The Montgolfiers had faced competition in their race to make the first manned balloon ascension. The eminent scientist Jacques-Alexandre-César Charles was working on hydrogen-filled balloons at the same time the papermakers were experimenting with hot air.

Hydrogen promised superior lifting power and longer flights than hot air. But it was expensive and difficult to generate—one of the means of production Charles used was to fill an oak cask with iron filings and pour in sulphuric acid. In the end, the first manned flight in a hydrogen balloon followed the Montgolfiers by 10 days.

Up, Up and Away

As ballooning advanced through the end of the 18th century and the beginning of the 19th, its shortfalls became apparent. Balloon envelopes had to be huge to carry even small weights, for one thing. They went where the wind took them, for another. Control was a major problem. Balloons could fly out of a city, or into a city, depending on the

A model of Henri Giffard's 144-foot-long steam-powered airship (above). When his airship burst during a descent, Giffard (right) tried to raise funds to build a 2,000-foot version, but failed.

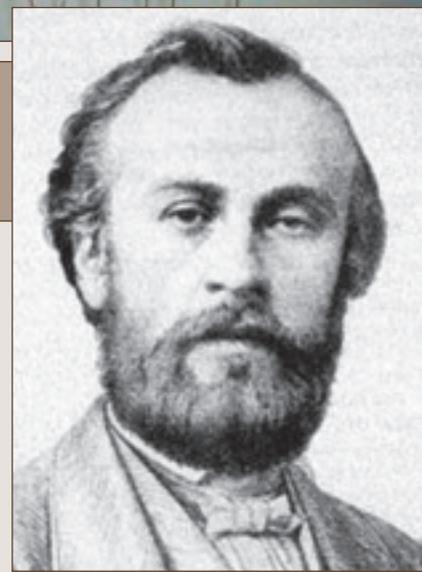
whims of nature. They could not reliably make round trips.

Enter Henri J. Giffard. A French railway draftsman and engineer, Giffard was highly interested in the possible use of steam propulsion for aerial navigation. In 1847, he proposed a steam-powered helicopter, but eventually turned his attention to the more practical target of an airship.

Eventually he designed a lightweight, coke-burning steam engine and boiler that produced about three horsepower, driving an 11-foot three-blade propeller at 110 revolutions per minute. He mounted this beneath a cigar-shaped gas bag of about 144 feet in length and added a triangular sail-like rudder at the back for directional control.

The result was “the first controlled powered balloon—a dirigible or airship,” writes British military and social historian R. G. Grant in his book *Flight: The Complete History*.

On Sept. 24, 1852, Giffard flew his airship from the Paris Hippodrome to the municipality of Élancourt, about 17 miles away. His underpowered craft cranked up to only about 5 mph, so it was helpless in the face of a headwind. But in still air



or in front of a breeze it could maneuver. Thus he arguably achieved the world’s first controlled, sustained, powered human lighter-than-air flight.

Eventually his airship burst during a descent, and he failed to raise funds for an enormous 2,000-foot-long version of the craft. Then his eyesight failed, rendering him miserable. In 1882 he committed suicide. He was only 57 years old.

One year after Giffard’s ground-breaking controlled flight, another aeronautic advance of equal or greater importance likely occurred a few hundred miles away across the English Channel.

George Cayley, a man some historians call the “Father of Aeronautics,” was the person behind it.



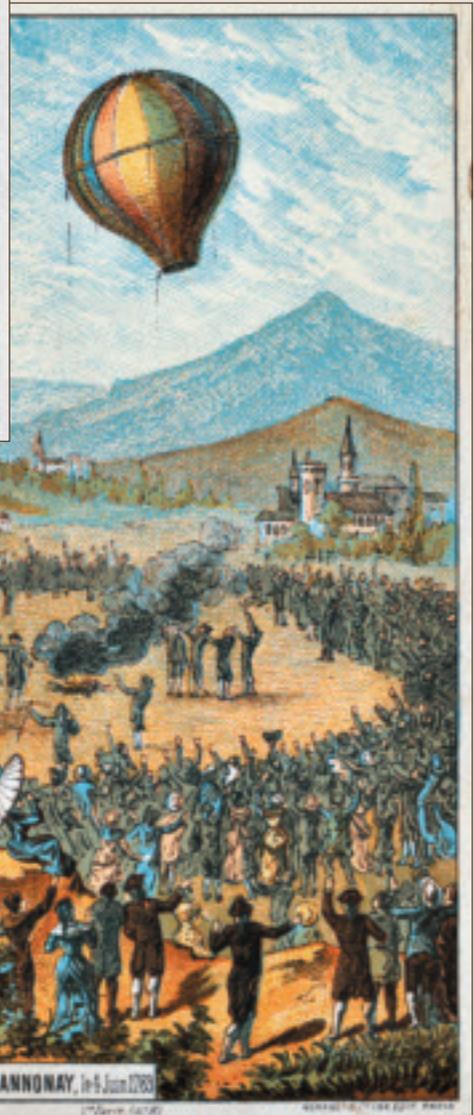
work indicated that angling wings upward at the center line, forming a dihedral, would provide some lateral stability.

In 1804 he designed and built what some call “the first real airplane in history.” This was a model glider—basically, a five-foot stick with a kite for a wing and a dart-like tail.

In 1809 Cayley constructed a larger model on the same form. A man who carried this “flying parachute” and ran downhill into a breeze would be pulled upward to the point where his feet could scarcely touch the ground.

During the middle decades of his life the enterprising Yorkshire baronet focused on politics and other mechanical

Left: A description and drawing, including engineering proportions, of the Montgolfier brothers' balloon. Note the brothers doffing their hats and waving to observers. Below, an artist's illustration of the event shows the amazed crowd's reaction.



Cayley, born in 1773, was a member of England’s rural gentry, a baronet with a country seat at Brompton Hall in Yorkshire. From an early age he took a keen interest in science and technology—and especially the possibility of flight. Overall he was a remarkable man, a poet who fought for the education of the lower classes and the abolition of slavery. Active in Whig politics, he eventually served as a member of Parliament for Scarborough.

His great contribution was to apply the research methods and tools of the scientific approach to the study of aerodynamic forces, and then use his findings to experiment with actual flying prototypes. He realized that the key to flight was the behavior of air itself.

“An uninterrupted ocean that comes to every man’s door ought not to be neglected as a source of human gratification and advantage,” Cayley said.

Using a whirling-arm device to test various shapes, Cayley ascertained that a cambered or curved surface produced greater lift for a given angle of attack than a flat surface. He discovered that there was an area of lower pressure on the upper surface of a cambered wing in flight and an area of lower pressure underneath. His

enthusiasms. In the late 1840s he had another burst of aeronautical enthusiasm, and began building larger, more refined gliding models.

In 1849 he constructed a triplane aircraft with a rudder and elevator and a boat-like fuselage large enough to carry a small boy as it flew a few yards downhill.

Then in 1853 came his breakthrough. Cayley built what he called his “new flyer,” which may have been either a triplane or a monoplane and was large enough to carry a full-grown man. He convinced one of his retainers—likely a coachman—to be his pilot. Launched on the high side of a valley behind Brampton Hall, the flyer flew across the vale and came down with a crash about 500 yards away, according to an account by Cayley’s granddaughter.

The granddaughter’s testimony was given decades after the fact. If she is to be believed, the coachman struggled out of the wreckage and gave notice on the spot, saying, “I was hired to drive and not to fly.”

But contemporaneous accounts refer to the glider taking to the air. It was said to be the first recorded flight by an adult in an aircraft. It was uncontrolled, unsustained, and unpowered. But it was a successful human heavier-than-air event.

Orville Wright later credited Cayley for his work on the principles of aeronautics, saying in 1912 that “Sir George Cayley was a remarkable man.”

But Cayley was not the glider designer who most influenced the Wrights. That was Otto Lilienthal, the birdman of Pomerania, the German who was the first human to launch himself into the air, fly, and land safely.

“Lilienthal inspires the Wrights to fly,” says Hallion.

Born in 1848, Lilienthal was a trained engineer who ran a successful machine shop and factory in Berlin. Like many of the pioneers of aviation he was fascinated by flight from childhood. He conducted his own experiments in wing design with whirling-arm machines, intensively studied the aerodynamics of bird flight, and published his findings, but what he believed in above all was personal experimentation.

“To invent an airplane is nothing. To build one is something. To fly is everything,” he said.

Between 1890 and 1896 Lilienthal made 2,000 flights in some 16 different gliders of his own design. They were all hang gliders, monoplane wings of

fabric-covered wood with small tails that were controlled by the movement of the pilot’s body.

He became an international celebrity via dramatic newspaper accounts of his exploits and engravings of his derring-do in the air. Eventually he sold copies of his gliders to like-minded experimenters around the world.

Then on Aug. 9, 1896, Lilienthal flew straight off the top of a hill in the countryside some 60 miles outside Berlin. A gust caught his wing, his nose rose in the air, and the aircraft stalled. He fell 50 feet to the ground and died the next day with a broken back.

Military Interest

Wilbur Wright read a brief account of the tragedy to his brother as the latter lay on his bed, sick with typhoid, at home in Dayton, Ohio. Years later Wilbur stated that Lilienthal had been the first man to understand that balancing, or control, was the first great problem of human flight, not the last. The tail-first design of the Wrights’ own aircraft was due in part to their desire to avoid the stalling problem that had proved fatal to the German flier.

Gliding, by definition, only takes an aircraft so far. Early aviators could not take full advantage of advances in aeronautical science until they had reliable propulsion systems. That is where Clément Ader and other pioneers of power entered the picture.

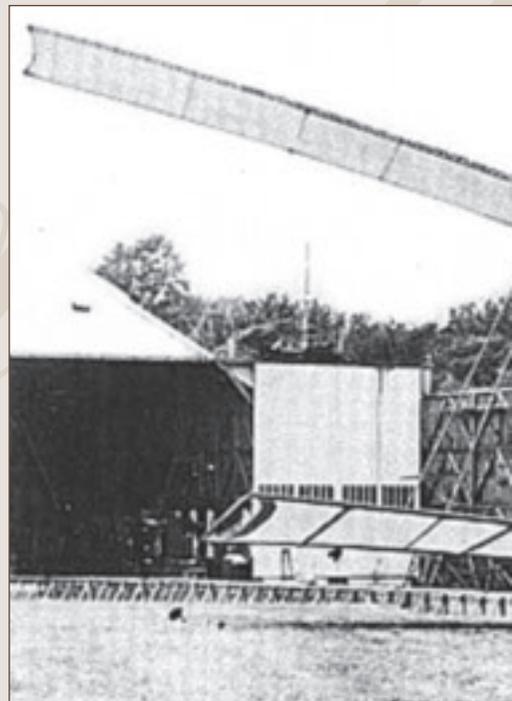
Born in 1841, Ader is a controversial figure in the history of aviation, “a mixed bag,” says Hallion.

An electrical and mechanical engineer, Ader first came to French public attention with his Theatrephone, a system of lines laid in Paris sewers that carried the sound of live performances to hotels and cafes. He studied birds by drugging them with chloroformed bait and then examining their wings while they remained unconscious.

Ader did not bother with gliding or models when he turned his full attention to aviation. He built his full-scale, steam monoplane *Éole* between 1882 and 1890.

The plane itself resembled a modern movie director’s idea of a 19th century aero craft. It was bat-shaped, with a streamlined fairing and four-blade propellers constructed to resemble bird feathers. Aside from aesthetics, its most notable aspect may have been its four-cylinder engine, which produced 20 horsepower despite weighing only about 200 pounds.

Éole’s power-to-weight ratio likely was a reason it hopped into the air on



Via Wikipedia

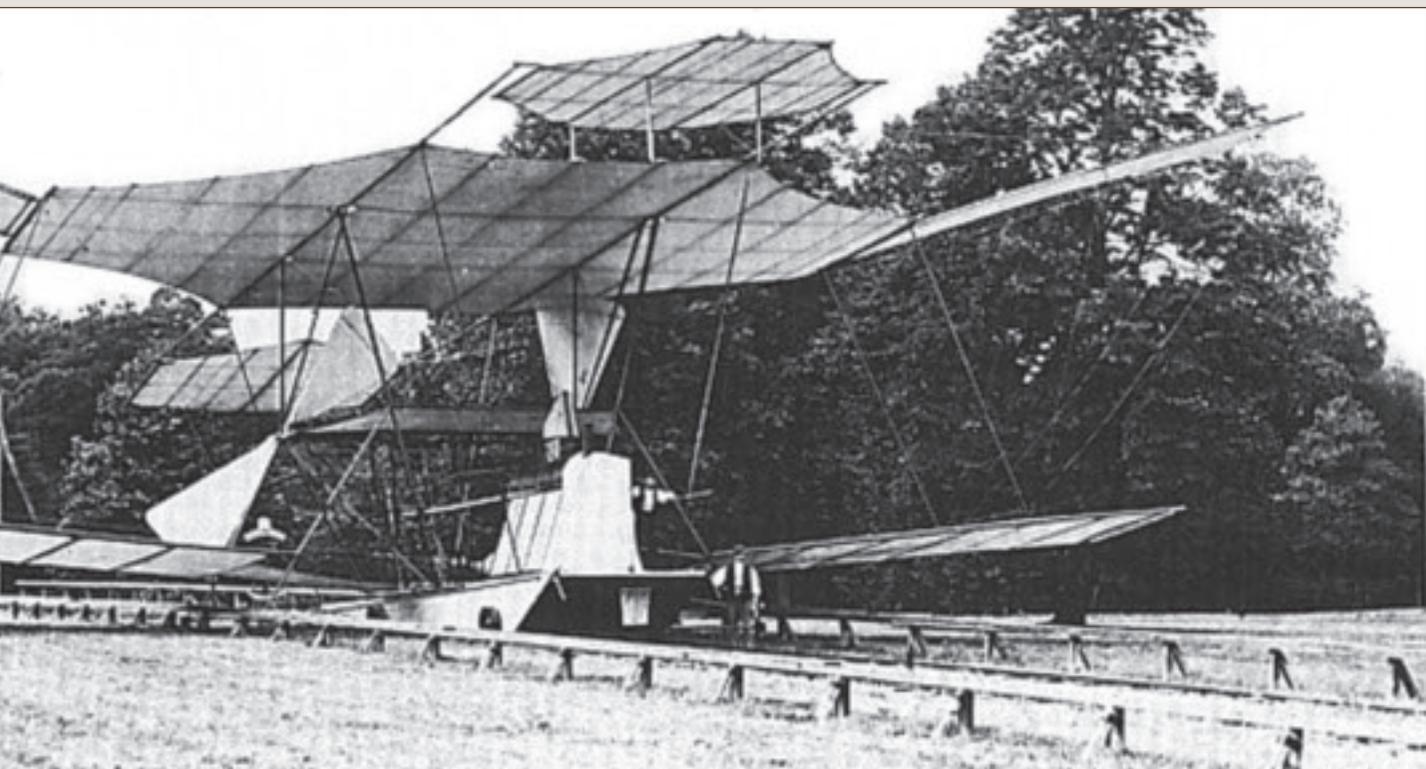


Oct. 9, 1890, for the first powered takeoff in history. But was Ader truly flying? That’s a matter of interpretation.

“You can build anything to ricochet around, but is it actually aloft? Can you see the sky under it?” says Hallion. “By that standard, I don’t think so.”

Even so, Ader was encouraged by his success. So was the French Ministry of War, which offered him money—eventually, more than 650,000 francs—to build a new and larger model. Over the course of seven years Ader produced a larger, twin-engine version of the *Éole* named *Avion III*.

In 1897, trials of this aircraft at a military camp were a disaster. The tail



Hiram Maxim (l), inventor of the Maxim machine gun, had a chance to beat the Wrights into the air with powered, controlled flight, but when his flying machine cranked up to 40 mph on its first flight, he cut power to avoid damaging the aircraft and never flew it again. The Wright brothers won the race.

wheel lifted off the ground but nothing else. Winds blew the craft off its test track, resulting in heavy damage.

The French military lost interest. Then in 1906, after the Wrights' success, Ader claimed that Avion III had flown 984 feet in 1897. Furthermore, he said the Éole had flown a second time, in 1891.

A few years later the military released its report on the Avion, revealing that the aircraft hadn't achieved liftoff. Virtually all historians today discount Ader's claim of further Éole flights as well.

Hiram S. Maxim, not Clément Ader, might have been the inventor with the best chance to beat the Wrights to the air in full-powered flight. A native of Maine, Maxim conceived the notion of a rapid-fire weapon that would use the recoil from one bullet to load the next. He moved to England in the 1880s after the British War Office expressed strong interest in his design.

The success of the Maxim gun made him a wealthy man and hero of Victorian England. But he was also strongly interested in flight and devoted a portion of his munitions fortune to

the construction of a large test machine for aeronautical research.

He completed the contraption in 1893. It was a huge biplane with 4,000 square feet of lifting surface and two 180-horsepower steam engines, each powering a 17-foot propeller. It ran on a circular track on his rented estate with upper guard rails that prevented it from lifting more than two feet into the air.

On July 31, 1894, Maxim fired up his steam engines to their maximum pressure and let his rig run. It moved so quickly that its crew, which included Maxim, was thrown off balance. After about 600 feet it lifted off its support rails, and its restraining supports began to buckle and fracture. At the time it was making perhaps 40 mph.

"There's one moment when he's really airborne in that thing," says Hallion. "He should have gone to full power and just said, 'Let's have at it.' If he had done that he would have been credited with the first flight."

Instead Maxim cut power to prevent further damage. His rig settled down. It never flew again, due to high cost, among other factors.

Maxim was a wealthy man but he had already spent pounds sterling worth about \$2 million in today's money in his flight research. His gun business was suffering, in part because of his inattention to the firm. Then in 1896 his brother Hudson, who felt Hiram had capitalized on work he had done, instigated bigamy charges against

Maxim in the US. The famous inventor was eventually cleared of the charges but in the meantime was distracted from his other interests. In the end his gun company was sold and his flight research ended.

The Wrights were the first to put all these accumulating advances together. They combined the aeronautical knowledge of the science-oriented pioneers with the technical knowledge of the engineers and the daring of the gliders.

Most of all, they were airmen. Maxim and Ader were what Hallion refers to as "chauffeurs," people who thought that piloting an aircraft would not be much different than driving a vehicle.

But the Wrights themselves were far from flawless. Their canard design was unstable and difficult to fly. They stuck with it too long as aviators in other nations, particularly France, produced more practical platforms.

"They knew how to build the first airplane. They did not know how to build the second airplane," says Hallion.

Despite the fact that the Wright brothers undeniably changed the world by launching aviation as we know it today, eventually they, too, were surpassed as the aerial age began. ■

Peter Grier, a Washington, D.C., editor for the Christian Science Monitor, is a longtime contributor to Air Force Magazine. His most recent articles, "Cyber-Patriot Heats Up" and "Not Clowning Around," appeared in June.