

Did the Wright brothers really get their idea of wing-warping from the birds?

The Critical Twist

BY BRUCE D. CALLANDER

WHAT did they know, and when did they know it?

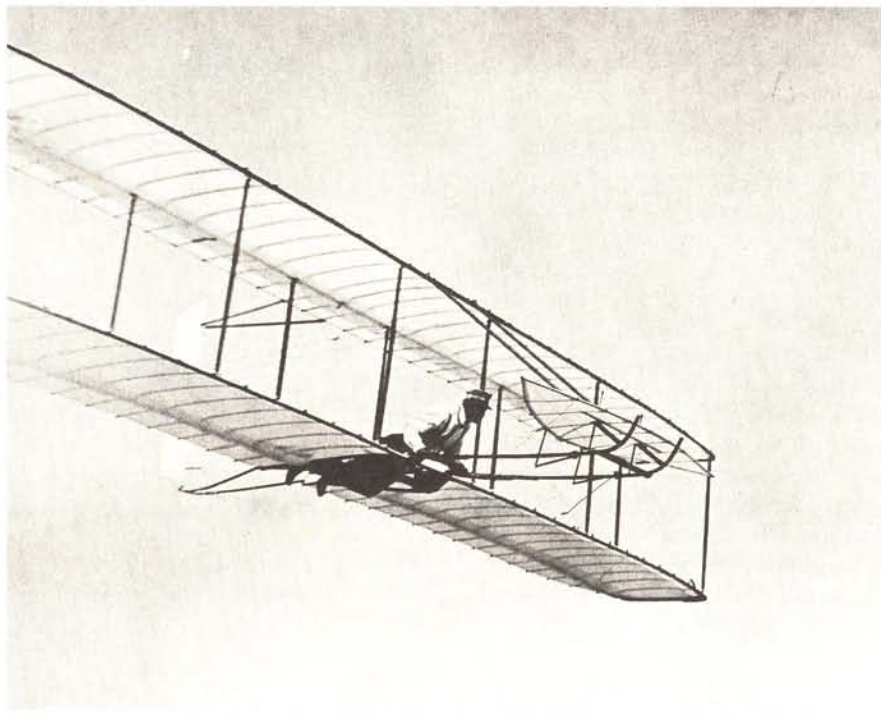
Long before Watergate made this question trendy, it was being asked of the two Ohio brothers now acclaimed as the fathers of aviation. The burden of answering it may have hastened the death of one. It dogged the other for life.

The issue arose in 1909. The venue was a patent suit. The defendant, plane-builder Glenn Curtiss, had been hauled into court by Orville and Wilbur Wright, the Ohioans who six years earlier had invented the airplane.

Or had they?

Curtiss provided cause for doubt. He charged that the "secret" of the Wrights' invention was, in fact, nothing more than a basic aeronautic principle. Worse, he alleged that it had been discovered years before the Wrights embarked on serious aviation careers.

It was a sensational charge, one that did not die there. The claim haunted the brothers through a long series of lawsuits waged at home and abroad. Time and again, they were pressed to prove their paternity of the idea at the core of their

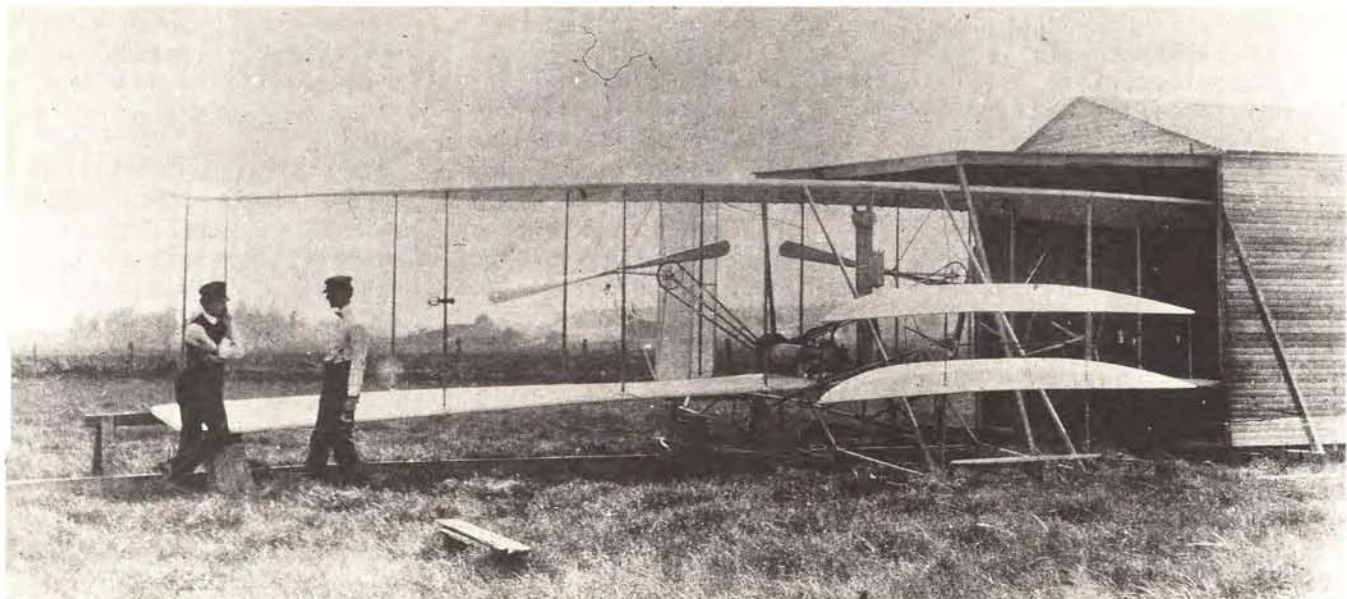


Wilbur flight-tests the 1902 Wright glider. Control of fixed-wing aircraft was reliable only in calm air; neither auto-type steering nor body-weight shifting—the two approaches most favored by flight experimenters—could compensate for the effects of wind shifts on such aircraft. Early Wright gliders continued to sideslip, despite wing-warping, until the addition of a movable rudder.

invention—an idea that they called "wing-warping."

Wing-warping was a novel flight-control system. It entailed twisting the ends of wings in opposite directions at the same time. With it, the Wrights' flyer managed to retain balance in air, execute turns on command, and thus stage, in 1903, the first powered flight.

Not long afterward, the Wrights received patents on wing-warping. However, Curtiss soon began using the technique in his own airplanes, employing different mechanical means. The Wrights sued, crying patent violation. Curtiss responded that, while the brothers could patent their specific mechanical means of applying the wing-warping princi-



This photo of the Wrights' second powered flyer, the Wright Flyer II, taken at Simm Station on Huffman Prairie (now part of Wright-Patterson AFB) in Ohio, clearly shows the twist in its wings. The wing-warp and rudder controls were still connected, which caused serious control problems that would not be solved until 1905.

ple, they could not patent the principle itself, particularly since they hadn't discovered it.

With the Wrights maintaining that they had made the discovery, and Curtiss insisting they had not, resolution of the matter turned on the question of when, where, and how the Wrights first hit on the basic idea of wing-warping.

From the Birds

The simplest answer provided by the Wrights was that they had learned about it from the birds. Wilbur Wright advanced this claim as early as the spring of 1900, long before the lawsuit, in his first letter to Octave Chanute, a French-born glider enthusiast.

Wilbur wrote: "My observation of the flight of buzzards leads me to believe that they regain their lateral balance, when partly overturned by a gust of wind, by a torsion of the tips of the wings. If the rear edge of the right wing tip is twisted upward and the left downward the bird becomes an animated windmill and instantly begins to turn, a line from its head to its tail being the axis."

Wilbur added that he planned to build an apparatus that would add this torsion principle to a double-deck glider, one similar to the type Chanute had used. Wilbur said that he already had tested the idea on a kite and was sufficiently encouraged to lay plans for a trial using a full-size machine.

Even earlier, in an 1899 letter that Wilbur wrote to the Smithsonian Institution seeking information about flight, he had mentioned his habit of observing birds.

Did the Wright brothers really get their idea of wing-warping from the birds? Perhaps. Years later, however, Orville would discount the value of such observations. He stated that he could think of nothing original the brothers had learned in this way.

"Learning the secret of flight from birds is a good deal like learning the secret of magic from a magician," he explained. "After you know the trick and know what to look for, you see things that you did not notice when you did not know exactly what to look for."

For some, this raises the question of whether the Wrights learned "the trick" from others. In his 1899 Smithsonian letter, Wilbur mentioned reading a work by Etienne Jules Marey that described the action of birds' wings. Similar descriptions of the flight of birds are found in pamphlets provided by the Smithsonian and in books that it suggested to the Wrights.

Understanding the birds' secret of control was one thing. Finding a practical means of applying that secret to a man-carrying flyer, however, was quite another. On this key issue, the Wrights again claimed that they had worked out a solution independently.

From their reading, the Wrights said, they had learned that experimenters pursued one of two tracks. One group tried to build stable machines that could be steered like autos. The other tried to compensate for wind changes by shifting a pilot's body weight in flight. The "drivers" found that their machines could remain balanced only in calm air. Their rivals found that "body English" alone was insufficient for airborne control.

The Wrights decided to build a hybrid—an unstable machine equipped with mechanical means of control. The answer was a system to duplicate the birds' twisting of their wingtips.

An Accidental Solution

After a false start, Wilbur hit on a solution by accident. A customer had come to the Wrights' bicycle shop to buy an inner tube. Wilbur pulled one from a pasteboard box. While the two chatted, Wilbur idly twisted the box in his hands. Suddenly, he realized he was producing the kind of torsion he wanted.

In 1898, the Wrights tried out the concept in the double-decker kite Wilbur described to Chanute the following year. The kite proved the principle. Over the next three years, they built a series of gliders using the same wing-warping system. When the gliders tended to slew and sideslip, the Wrights added fixed rear fins. When that failed to work,

they converted the fixed fins into a movable rudder connected to the wing-warping control.

In 1903, they built a flyable powered machine. Yet it and two subsequent machines continued to display control problems. It was not until 1905 that the Wrights separated warping and rudder controls so each could move independently. Thus was born a machine with the basic ingredients of a modern plane.

Satisfied that they had perfected a practical craft, the Wrights stopped flying for more than two and a half years.

During part of the time, they waited for approval of their patent. They had applied in March 1903, nine months before their historic first flight. In May 1906, it was granted. Soon, the brothers were seeking customers; by the summer of 1908, the Wrights were flying once more.

By then, however, they did not have the air to themselves. Their success had rekindled enthusiasm among experimenters. The rival machines varied in design, but the successful ones shared a common feature: some means of changing the trailing edges of the wings so they would work in opposite directions.

Aileron Controversy

The first such machine to arouse the Wrights' concern was made by Curtiss. A motorcyclist and engine builder, Curtiss had joined the Aerial Experiment Association. In January 1908, the Wrights gave AEA information about their control system on the understanding that it would be used for experimental work, not for production of commercial machines.

The association built three planes. The last, known as the *June Bug*, was designed by Curtiss. The Wrights were miffed when Curtiss used it to win a trophy from *Scientific American* Magazine for the first officially recorded American flight of more than a kilometer. The Wrights themselves had covered greater distances, at least since 1905, but no official observers had been present.

Soon, Orville was warning Curtiss that the *June Bug's* use of movable wing surfaces was covered by the Wrights' patents. He invited Curtiss to seek a license. Curtiss

ignored the warning and, in 1909, formed a company with Augustus Herring to produce machines for sale. Their first was the *Gold Bug*, sold to the Aeronautic Society of New York. They built a second, the *Golden Flyer*, for Curtiss to fly in the Gordon Bennett trophy race in Reims, France. On the eve of the race, the Wrights filed formal patent suits against the Herring-Curtiss Co., Glenn Curtiss, and the Aeronautic Society of New York.

None of Curtiss's machines used the Wrights' wing-warping system. Instead, they had small, movable surfaces mounted between the ends of the upper and lower wings. As one of these ailerons was raised, that on the opposite side automatically lowered. The effect of ailerons was the same as that of wing-warping.

Curtiss did not claim to have invented ailerons. What's more, the experimenter who did invent them conceded that he had been inspired by the Wrights' success with wing-warping. Ironically, the man at the heart of the aileron business was none other than the Wright's old friend and mentor, Octave Chanute.

Chanute Talks

Since Wilbur's first letter to Chanute, he and his brother had kept in touch with the older man. Chanute encouraged them to share their results with other experimenters. At first, the Wrights did so. As they neared success, however, they grew more guarded about the information they disclosed.

It was one thing for the Wrights to keep their mouths shut, but restraining the voluble Chanute was quite another matter. In April 1903, months before the Wrights' first flight, Chanute gave a brief description of their wing-warping idea in a speech before France's Aero Club.

The talk was covered by aviation journals, and the next year, French experimenter Robert Esnault-Pelterie attempted to copy the Wright glider. Deciding that twisting the wings would weaken its structure, he designed a system in which the wings would remain rigid and smaller, separate surfaces would move. He called them "horizontal rudders," but they soon became known as ailerons (from the French word for wing, *aile*).

Esnault-Pelterie's machine didn't work well, but others picked up on the idea of ailerons in their own aircraft. Among these inventors was Curtiss.

When the Wrights sued Curtiss, Chanute vowed to remain neutral, but he fed the Wrights' opposition its best arguments. In an August 1909 letter to *Aeronautics* Magazine, Chanute claimed that the Wrights' suit would not only antagonize many, but might also "disclose some prior patents which will invalidate their more important claims." Later, Chanute wrote the editor again, giving specifics. He claimed that, after first making contact with the Wrights, he provided them with a copy of an 1897 patent granted Louis-Pierre Mouillard for a system that "clearly covers the warping of wings."

Chanute had carried on a lengthy correspondence with the French inventor, giving him encouragement and financial support. When Mouillard had little success with his control system and showed no interest in seeking a patent, Chanute himself applied for a US patent on it in Mouillard's name and his own. It was granted in 1897, a few months before Mouillard died.

Chanute said that he had told the Wrights they were free to use Mouillard's system because Mouillard was dead and his heirs had made no claim to it. Years later, Orville said that he did not remember Chanute's offer and that, in any event, the Wrights had not been interested, having already developed their own wing-warping controls.

By October 1909, Chanute was talking not only to the press but to the rival legal camp, suggesting other impediments to the Wrights' claims. In a formal legal statement on the origins of wing-warping, he wrote: "The bare idea of warping and twisting the wings is old, but there are several ways of accomplishing it." He named others besides Mouillard who had described the principle or actually developed systems for using it.

The Last Straw

The New York *World* quoted Chanute in a series of articles questioning the Wrights' claim. The paper suggested that they had gotten most of their ideas from Chanute himself.

For the Wrights, that was the last straw. Wilbur fired off a scorching letter to Chanute, reminding him that Chanute had assured them as early as 1901 that their system was an original.

In his reply, Chanute conceded that the Wrights' system was original, but added that "it does not follow that it covers the general principle of warping or twisting wings; the proposals for doing this being ancient."

Chanute said that he thought he had called the Wrights' attention to Mouillard's system. "If the courts will decide that the purpose and results were entirely different and that you were the first to conceive the twisting of the wings," he said, "so much the better for you, but my judgment is that you will be restricted to the particular method by which you do it."

Chanute added, "I am afraid, my friend, that your usually sound judgment has been warped by the desire for great wealth."

suggestions can hope to link their names with the honor of its discovery."

Chanute aired a long-festering grievance. He said that he resented the impression the Wrights had given that he had thrust himself on them and had been of no real help in their work.

Wilbur's answer was equally bitter. If Chanute resented being given too little credit for his contribution, he said, then the brothers resented his giving the impression that they were no more than his pupils.

"As to inordinate desire for wealth," Wilbur concluded, "you are the only person acquainted with us who has ever made such an accusation. We believed that the physical and financial risks which we took, and the value of the service to the world, justified sufficient compensation to enable us to live modestly with enough surplus income to permit the devotion of our future time to scientific experimenting instead of business."

A Partial Victory

By then, a New York circuit court had ruled that the Mouillard system, which turned down one wing-tip at a time, was meant only to turn the airplane. If Mouillard had tried to use it to maintain balance, the court said, it would have disturbed the equilibrium rather than restored it. In any case, the court said, it did not bear on the Wrights' claim.

The victory was partial. It did not involve the case against Curtiss, but rather an injunction against Louis Paulhan, a French flyer whom the Wrights had accused of infringing their patents by bringing European machines into the US for exhibitions. Within a year, however, the Wrights had won favorable rulings in French courts and were beginning to work out royalty arrangements with European plane makers. "The French decision," Orville wrote to a friend, "virtually clinches our case in the American courts."

His prediction was premature. The Curtiss case dragged on. In



Lt. Harold Geiger in a Curtiss Pusher S. C. #8 airplane at San Diego, Calif., in 1913. Curtiss planes made use of wing-warping but employed independent ailerons for control. The Wrights' patent suits against Glenn Curtiss dragged on for eight years, outlasting their ownership of the Wright Co. and its patents and outlasting Wilbur himself.

This last barb doubtless was calculated to draw blood. The Wrights' greatest booster was accusing them of greed. In his first letter to Chanute, Wilbur had said, "I make no secret of my plans for the reason that I believe no financial profit will accrue to the inventor of the first flying machine, and that only those willing to give as well as to receive

The rift lasted for months. Finally, Wilbur wrote a conciliatory note suggesting they mend their friendship and work out a statement describing Chanute's contribution. Chanute said that he too was eager to resume good relations. They never worked out the statement, however, and Chanute died that November at seventy-eight.

1910, the Wrights offered to end it if Curtiss would take out a license under their patents and settle for past infringements. Curtiss demurred, and the Wrights dropped the offer. By late 1911, they had won injunctions against Curtiss, but no final judgment.

Meanwhile, the Wrights suffered a setback in the German courts.



In an attempt to discredit the Wrights' claim by proving that Samuel Langley's aircraft could actually have flown in 1903, Curtiss rebuilt Langley's "aerodrome"—with improvements. Here, Langley's original is fished from the Potomac River after an unsuccessful attempt. In both of its 1903 flight tests, its wings collapsed.

German law held that disclosure of an invention before application for a patent invalidates the patent. Again, it was Chanute who had created the problem. When the court learned of his description of the Wrights' wing-warping to the French Aero Club, it ruled that it was enough to compromise their claim. German patents had not been sought until March 1904.

Back in the US, Curtiss appealed the injunction and, by posting a bond, was able to continue to build planes. By May 1912, Wilbur was seriously ill with typhoid fever. The long legal ordeal weighed heavily on him. In a letter to a friend, he complained that competitors already were selling machines at prices below those the Wrights were asking. If the case dragged on much longer, he said, others would find new ways of evading their claims, even in the event of a favorable judgment. Wilbur died a few weeks later. Orville was convinced that the ordeal of the long court battles had helped to kill him.

Orville continued the patent fight alone and, for a time, seemed to be winning. In January 1914, a federal appeals court in New York rendered judgment in the Curtiss case, upholding the Wright patents. But, with his business threatened, Curtiss tried to skirt the court order by

modifying his control system so that each aileron could be worked independently. Orville brought another suit, and the whole process began anew.

Restoring Langley's Machine

Curtiss now looked for a new way to discredit the Wrights' claim. A possibility, he decided, would be to prove that Samuel Langley's "aerodrome," which did not use wing-warping, could fly. That machine was designed by Langley while he was Secretary to the Smithsonian Institution. It had been tested twice, a few weeks before the Wrights' successful flight of 1903. Both times, its wings collapsed before it was airborne. Langley, ridiculed for his failure, died a few years later. He had been able to fly successful steam-driven models as early as 1896, however, and supporters still believed that his full-sized aerodrome would have worked.

Curtiss approached the Smithsonian with the idea of restoring the Langley machine and attempting a flight. The Institution, eager to redeem Langley's reputation, agreed.

Curtiss took the machine to his factory at Hammondsport, N. Y., and not only restored it but rebuilt it. He strengthened the wings, changed their curvature, added a new control system, and substituted a Curtiss engine for Langley's original. The aerodrome collapsed again on its first trial, but Curtiss continued to change it until he was able to coax it into the air for a few short flights.

Without disclosing the craft's modifications, the Smithsonian announced that Langley's machine had flown. The aerodrome was returned to its original condition and displayed at the museum with a sign describing it as "the first man-carrying aeroplane in the history of the world capable of sustained free flight." That made Orville so angry that he sent the original Wright flyer to a British museum, where it remained for years. He agreed to bring it back only after the Smithsonian removed the sign and admitted how much the aerodrome had been altered to make it fly.

Whether the aerodrome hoax would have worked for or against Curtiss in court remains moot. Orville's new suit against Curtiss never came to a judgment. In 1915, he sold the Wright Co. and patents to New York capitalists. The new company continued the suit, but Curtiss managed to delay until 1917, when a cross-licensing agreement eased all patent restrictions to speed wartime production.

The Wrights had not made a fortune, but Orville did have enough to live modestly and devote his time to experimenting. He became embroiled in other suits, most claiming that someone else had flown first or had developed a control system that predated the Wrights'. None succeeded.

Even today, however, writers plow the old ground, seeking proof that the Wrights really weren't first. The Wrights may have borrowed more than they liked to admit and may have given Chanute and others less credit than they deserved. The fact remains that they were the first to put it all together and fly. ■

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