# Warp speed: birth of an aileron

*Air Facts Journal*

*Phil Scott*

**W**hen we first looked in on our superheroes, the Amazing Wright Brothers, the eldest had made an observation that would ultimately send aeronautical technology flying away at warp speed. Wilbur had noticed that buzzards, when flying around the skies above his hometown of Dayton, Ohio, would occasionally have their lateral balance upset by uncooperative wind currents.

***An unlikely hero***

Okay, so that was no great moment in observational history. But he saw the buzzards do something that no one, not even the eagle-eyed Leonardo da Vinci, had seen a bird do before: Instead of shifting its weight to right itself, as every bird-watching, would-be aeronaut assumed their winged subjects did, the buzzards flexed one wingtip up and the opposite down. “[The] bird becomes an animated windmill and instantly begins to turn, a line from its head to its tail being the axis,” Wilbur wrote.

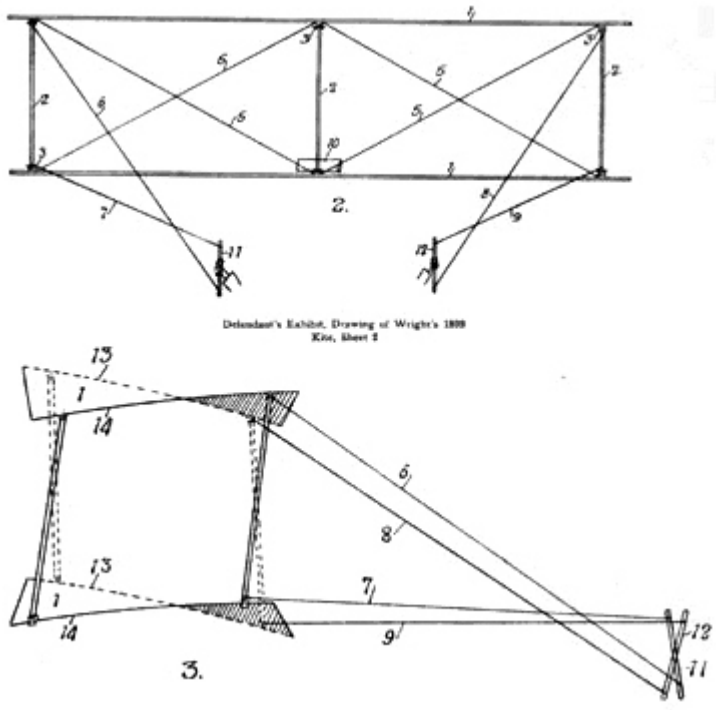
Could there be a more unlikely, less romantic bird to bestow the gift of flight upon humanity? Only the penguin or dodo, perhaps. But in recording observations, the truth is the truth, and so the problem that now presented itself to Wilbur and his younger brother Orville

was this: Taking the action that God created over a few million years' time (or maybe as little as 6,000 years) with an abundance of tiny muscles and sinew, lightweight feathers, and a framework of hollow bones at His disposal, and translating it into the kind of stuff you would find lying around any turn-of-the-20th-century lumber yard in middle America.

The Wrights' first thought was to equip the glider with a device with intermeshing gears, which, when activated, would present the requisite equal-and-opposite twisting motion that birds used to keep themselves level. They quickly discarded the concept on the grounds that it would be too heavy.

Then, as the story goes, Wilbur was in the Wright Bicycle Shop with a customer who had just purchased an inner tube. While the customer chatted on about the finer points of some now-forgotten aspect of bicycling, Wilbur absentmindedly tore the ends off the rectangular box that the tube had come in, and began flexing it. That's when it hit him. After he got rid of the customer, he rushed home to Orville and showed him the box. Like a biplane glider, it consisted of two lateral, flat rectangular planes. But the lack of internal cross-bracing allowed the ends of the box to twist in opposite directions—an action that they could duplicate with little more than some strategically placed control cables.

The system worked on a kite they built soon after, so they continued to refine it in the following years. After spending some time in the air, they realized that not only could they re-right their glider when it tipped laterally from gusts, but because the lower wing created drag, they could also use it to turn the machine with greater coordination than the obvious control surface. Yes, an airplane doesn't turn by rudder alone. The brothers were of course practical businessmen, so they didn't give their system of lateral control some fancy-schmancy marketing name like Turnon or Wing-Ex. No, they called it wingwarping.




***The Wrights attempted to patent their wingwarping discovery, but were initially rejected.***

The Wrights attempted to patent their wingwarping discovery, but were initially rejected. Being practical businessmen, the Wrights realized that wingwarping (and not an engine) was a unique feature that would make the successor to their glider become the first machine capable of powered, controlled flight. To keep those who would follow from making money off their brains and labor (and not least to rake in royalties for themselves), they sought patent protection for their system of control surfaces at the same time they started to build their first powered Flyer.

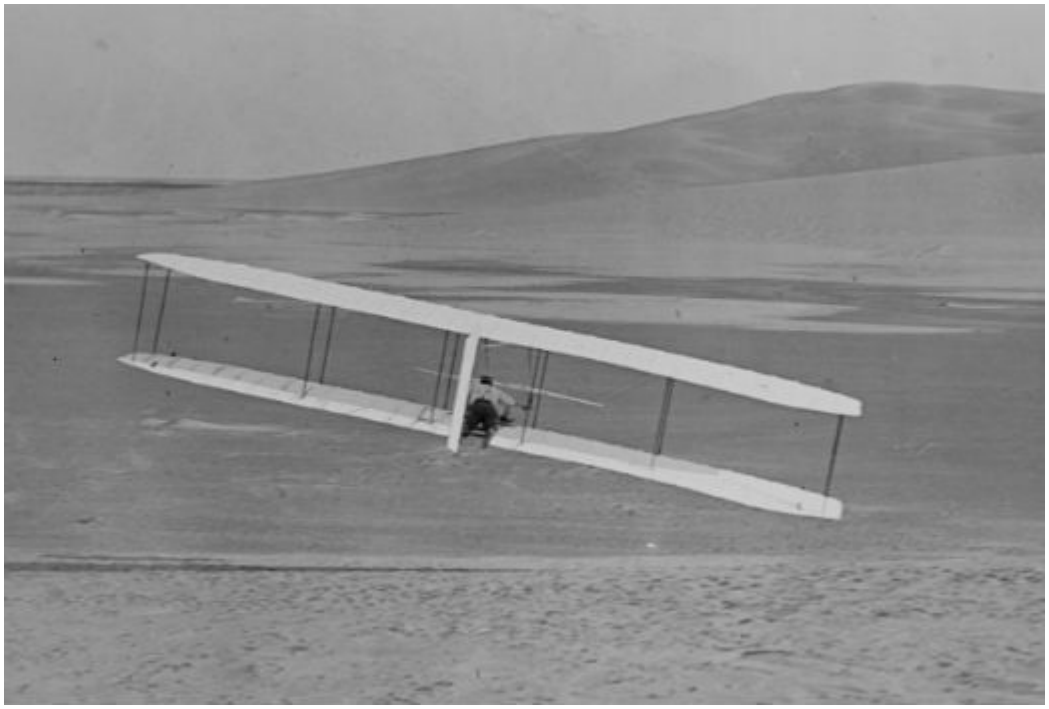
The U.S. Patent Office rejected their application out-of-hand. In those days flying machines were considered on a par with perpetual-motion devices, and the office routinely rejected inventors' plans for both on the grounds that they were just plain, old impossible schemes. Not until 1906, three years after having flown, did the Government, being the ponderous bureaucracy that it was (and still is), present the brothers with patent protection.

By that time other parties were taking to the air. In France the Voisin brothers built a huge, powered kitelike machine for their client, Henri Farman. It lacked anything resembling control surfaces on its wings, so it could only perform skidding turns and fly during the calmest conditions. Back in the U.S. (Upstate New York, to be precise), a fast-moving bunch that called itself the AEA—short for Aerial Experiment Association—leapt into the air in early 1908. The AEA's machine was similar to Farman's, but its career ended quickly when a gust rolled the machine over on its side in mid-air and it came crashing down to the ground.

"[It] was deemed advisable to get some positive method of controlling the lateral stability," reported the AEA Bulletin, whose circulation consisted of the five AEA members. According to later court testimony, the person who came up with that line was no less than Alexander Graham Bell. His solution wasn't nearly as clever or elegant as the Wrights' wingwarping system. "The tips at the extremities of the wings were hinged about their fore edges," the Bulletin bulletined, "and by a system of steering gear, the angles of incidence could be varied by the operator."

Still, it turned out to be a great idea, and in a couple of months (July 4, 1908), a successor machine called June Bug was awarded a trophy by Scientific American Magazine for performing the first public flight of more than 1 kilometer (if you ignored the dozens of much longer flights the Wrights had made from a cow pasture outside of Dayton, Ohio, and in front of anyone who cared to show up and watch).

Oddly enough, the aforementioned brothers didn't take too kindly to those hinged surfaces on the June Bug. Holding a watertight, broadly worded patent that encompassed such eventualities as control surfaces such as the AEA's, they wrote a letter to June Bug pilot Glenn Curtiss that they would sue if he kept on flying and making money from it. Curtiss promised to cease and desist, but the offers to fly that rolled in had so many zeroes following the dollar sign that he decided to take his chances with the litigious Wrights.



***Flying was the easy part, controlling an airplane in a turn was a real challenge.***

Not long after, Farman sailed from France to the U.S. While in New York he met the AEA's members and took a look at their latest airplane. Pointing to the pivoting control surfaces mounted on the wingtips, he uttered a word that in his native language meant small wing. "Aileron," he said.

Not only did the word stick, but so did the concept of a separate, hinged control surface. In a Voisin-like airplane he built for himself, Farman attached the ailerons to rectangular slots cut in the lower wing's trailing edge, which performed spectacularly. Soon he and nearly everyone else who flew did so with ailerons. For their part the Wrights made good on their promise to sue anyone anywhere who flew with anything remotely resembling wingwarping. In every instance they won. Unfortunately for them, their control system did not.

Wingwarping requires a certain degree of flexibility from the wing, which tends to limit an airplane's top speed to 70 knots or so. Ailerons allowed for solidly built wings, which subsequently allowed airplanes to reach greater and greater speeds. Unwilling to appear wrong before the courts, the Wrights never did adopt ailerons, so their airplanes shifted rapidly to technology's trailing edge. And wingwarping, the world-shaking invention that brought them superstar status—and not incidentally allowed mankind to truly fly for the first time in history—became a feature found solely on museum relics.