

The Contribution of the Wright Brothers in Airplane Development: An Investigative Report

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ABSTRACT

On 17 December 1903, Wilbur and Orville Wright entered the record books when their heavier-than-air flying machine became the first capable of manned, powered, sustained, and controlled flight. However, the Wrights did not invent the airplane. This is a general misconception. A closer examination of aviation history reveals that the accomplishment of the Wright brothers was the final step in a work that started much earlier than them. A review of the literature demonstrates that some historians may have disregarded certain unpopular characteristics in the Wrights' behaviors, namely their legal battles with the rest of the aviation world to attain wealth and recognition.

Introduction

By the 1900s, inventors and manufacturers from several industrialized nations were racing to be the first to achieve powered flight. What had been fantast was now becoming reality. On 17 December 1903, Wilbur and Orville Wright achieved this remarkable feat. The Wrights went a step further than their competitors by achieving the first manned, controlled, heavier-than-air powered flight. The feat, accomplished over a century ago, has been chronicled and celebrated by aviation enthusiasts, and rightly so.

In this investigative report, it will be substantiated that the Wrights should indeed receive praise for their achievement, but what has been touted as a distinct act of mechanical ingenuity is partially the result of tests on aerodynamic forms and function by others outside the United States. It is posited in this report that the Wrights cannot receive full credit for the invention of the airplane. A closer look at the history just before 1903, reveals that they were only the final step in a work that started with earlier pioneers such as George Cayley, Otto Lilienthal, and Octave Chanute, to name a few.

Significant Aviation Pioneers Before the Wrights

Sir George Cayley. In 1853, Sir George Cayley, a British engineer and reportedly the *Father of Aviation* (Rumerman, 2003), designed a full-scale glider that carried the very first person aloft. On 5 July 1853, his loyal coachman was the first man to fly an aircraft with a modern wing (Rodriguez, 2000). Cayley achieved this remarkable act by discovering the four forces of flight and then utilized

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that discovery by perfecting the efficiency of the cambered airfoil to produce lift (Noronha, 2012). He made unparalleled progress to flight by publishing a book on his research called *On Aerial Navigation*.

On Aerial Navigation, a collection of three articles published in the *Journal of Natural Philosophy, Chemistry, and the Arts*, in 1809 and 1810, were perhaps the most important papers of the time on airplane design and function, which paved the way for further development of Cayley's ideas over the next century (Noronha, 2012). Cayley articulated that lift, propulsion and control were the three essential elements for successful flight. And he correctly predicted that sustained flight would not occur until a lightweight engine was developed to provide adequate thrust and lift; an event that would not take place until 1903. Even Wilbur was quick to acknowledge Cayley while addressing the Royal Aero Club in 1909: "About 100 years ago an Englishman, Sir George Cayley, carried the science of flying to a point which it had never reached before and which it scarcely reached again during the last century" (Ackroyd, 2011, p. 130).

Lilienthal and Chanute. Gliders were the precursors to the airplane and in this realm the greatest contributors were Otto Lilienthal, a German, and Octave Chanute, from Chicago. Lilienthal's efforts marked the beginning of the experimental period of active research on heavier-than-air flight. He personally developed 18 different models of his gliders over a span of five years (Rodriguez, 2000). Two of Chanute's greatest contributions were conceptual rather than tangible: the idea that the goal of aircraft design was stability, the idea of altering wing shape as a control method, and the rejection of weight shifting (2000). All of these were fundamental in the race for heavier-than-air flight.

Chanute's academic acumen is undeniable. By gathering and documenting data regarding accomplishments in aeronautics, Chanute became one of the best known aviation scholars. His 1894 book, *Progress in Flying Machines*, heavily influenced the works of others including the Wrights (Rodriguez, 2000). During his later years, Chanute worked closely with the Wright brothers and served as an advisor in many occasions.

Wright Brothers' Contributions

By 1899, the Wright brothers would have acquainted themselves with the works of many aviation pioneers including the above-mentioned figures. When Otto Lilienthal perished in one of his gliding flights, the Wright brothers were able to recognize his fatal error and concluded that the amount of lift produced depended directly upon the amount of forward speed of the glider. Lilienthal died as a result of injuries sustained when his glider aerodynamically stalled and crashed (Whelan, 2000). Unfortunately, Lilienthal perished because of insufficient testing of his airfoils and miscalculations of their aerodynamic efficiency (2000).

The Wright Brothers knew they were on the verge of something special. Through analysis and testing, the Wrights were able to find answers to the objective of airplane control, which had remained a mystery in the minds of the big thinkers of the century before. Perhaps the reason for their success was partly due to their perspective when devising a mechanical apparatus. Being bicyclists, the Wrights instinctively felt that a flying machine was more like a bicycle, and would need to be flown with constant adjustments of balance (Grant, 2002). And this may be the first indication

where operational objectives were combined with engineering objectives from the start of the building process: a feature which is used to a great degree today, when building a new airframe.

One of the biggest obstacles they were able to overcome was the production of a propeller. Propellers were already in use, but only as a means to propel a ship through the water. The Wrights understood that the form of a propeller was similar to a wing, and that its ability to generate lift could be translated into thrust if made to operate in an axis perpendicular to the airplane's wing. It is fair to give credit to the Wrights for harnessing the use of the propeller in aeronautics (Whelan, 2000).

The next problem solved was to create an engine to turn the propeller, and the Wright-Taylor engine became the engine of choice. This engine would prove the genius of Charlie Taylor and the Wrights once more. They had constructed from scratch a propulsion system that successfully performed its designed function for a total of 101 seconds (Whelan, 2000). Octave Chanute was quick to recognize how close the Wright brothers were to achieving the impossible when weeks before the feat, on 23 November 1903 he said: "I believe the new machine of the Wrights to be the most promising attempt of flight that has been made" (Grant, 2002, p. 28).

If there are more lessons to learn from this pair of remarkable individuals, it would be in the form of persistence and teamwork. Orville once said: "We could not understand that there was anything about a bird that could not be built on a larger scale" (Grant, 2002, p. 24). Wilbur added: "From the time we were little children, my brother Orville and myself lived together, played together, worked together, and...thought together" (2002, p. 23).

Wilbur and Orville changed the world on the morning of December 17, 1903. They were able to capitalize on Cayley's discovery of aerodynamic forces, glean wisdom from the work of Lilienthal and Chanute on wing form and efficiency, but it was their own discovery of how to propel and control the powered aircraft that truly put the Wrights in the history books, while solving the problems of control and propulsion. As Orville Wright said, "it was only a flight of 12 seconds, and it was an uncertain, wavy, creeping sort of flight...but it was a real flight at last and not a glide" (Grant, 2002, p. 26).

The Patent Wars

As happens when someone invents something or when someone breaks a record, there are those who believe they should also be credited. On December 17, 1903 fantasy met reality. Wilbur and Orville Wright flew into the history books (World Wide Entertainment, 2010) and achieved the very first heavier-than-air powered flight. However, after the fanfare and applause for the Wrights' success, the brothers would spend considerable time fighting others over their patent. At first, the Wrights would remain guarded about their success, looking for legal protection for their accomplishments before formally disseminating their procedures for successful flight (Hayes, 2012).

The patent the Brothers were granted in 1906 covered the method of varying wing angle to control an aircraft and they fought many court battles with aviators who incorporated this into their aircraft designs without paying royalties (World Wide Entertainment, 2010). The patent included the discovery of wing-warping, a revolutionary idea that allowed the airplane to be controlled along the

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three axes of flight. The Wrights were able to acquire a patent with such a comprehensive reading regarding the wing-warping technique that even if someone used a different system to achieve lateral control, he or she was still likely beholden to the terms of the patent and would have to pay a substantial fee to the Wrights (Hayes, 2012).

Of all the patent wars none would be fiercer than the one with Glenn Curtiss. Glenn H. Curtiss was one of the founding fathers of American aviation (Grant, 2002). Born in New York, Curtiss - like the Wrights - was a bicyclist who became fascinated by the flying machine. In 1907, Alexander Graham Bell invited him to become part of the Aerial Experiment Association (AEA). According to the Wrights, the AEA would use information of the patent to manufacture more than a few aircraft designed by Curtiss. Glenn Curtiss would become successful in designing airplanes controlled by ailerons, instead of the wing-warping technology used by the Wright brothers.

Even though the AEA disbanded, Glenn Curtiss continued producing aircraft of great efficacy. He sold one of these to the Aeronautical Society of New York in the summer of 1909 (Brady, 2000). The incident immediately triggered a lawsuit from the Wright brothers. This legal battle raged against anyone who used their wing-warping technology, or anything similar to this discovery, in aircraft used for sale or exhibitions. These lawsuit actions completely stalled the aviation industry around the world. Wilbur and Orville attacked outsiders such as Paulhan from France and Graham-White from England. Each of them had stopped flying exhibitions in their respective country because of the Wright patent violation (Brady, 2000). Tony Doherty, son of Curtiss's assistant, Ellwood Doherty, stated: "In Hammondsport, the old-timers used to say that if you jumped up in the air and flapped your arms you'd be infringing on the Wrights' patent" (Shulman, 2002, p. 41).

On 15 December 1909, Judge John R. Hazel decided in favor of the Wrights and applied a wide interpretation to their claims. He ruled that ailerons were the equivalent of wing-warping and that dissimilarities in the structure had no bearing in the case (Brady, 2000). Even though Curtiss was encouraged and advised by Octave Chanute (Shulman, 2002), the 1913 appeal still favored the Wright brothers. The court battles drained the emotional and economic resources of both parties. When Wilbur died of typhoid fever in 1912, Orville blamed Curtiss' stubborn refusal to back down, claiming that Wilbur had lost his health over concern for the patent litigation (Rumerman, 2003).

Being sidetracked by legal entanglements, the Wrights nearly stopped their work to improve their designs. They spent much of their energy on legal action against their competitors in Europe and the United States for infringement of their patent (Grant, 2002). Curtiss would continue to find ways to combat the claims made by the Brothers. Henry Ford's lawyer encouraged Glenn Curtiss to reconstruct Samuel Langley's Aerodrome in an attempt to persuade the courts that Curtiss' plane was based on Langley's design, not the Wrights' (Rumerman, 2003). This action was backed by the Smithsonian Institution, to try to prove that Samuel Langley should be credited with creating the first viable flyable machine (2002). Although this attempt was unsuccessful, Ford's lawyer was able to persuade the court to temporarily stay the old verdict, and the legal battles started again (Rumerman, 2003). Orville's battles were now also with the Smithsonian Institute. In a clear act of fury, Orville sent the original Wright Flyer to England where it remained until the end of World War II, when the Smithsonian finally agreed to admit the Wright brothers were the first to fly.

The patent wars continued until the beginning of World War I. They settled when the United States government articulated that the airplanes were needed for air combat and production was being halted due to these litigations. Still, the negative consequences of the Wright lawsuit had affected American aviation enormously. The Wright brothers themselves became more interested in protecting the legacy of their contributions and less in advancing the art and science of flight. Those who were interested in these ventures found themselves stopped by the lawsuit.

The litany of litigations injured the sense of collaboration and common effort needed to make technical advances even as it took away time from the parties involved to develop superior aircraft and discouraged businesses from undertaking contracts, knowing they would most likely meet a lawsuit (Hayes, 2012). Though the Wrights also had similar patents in European countries, it was much easier for those manufacturers to bypass the consequences of infringement; the lawsuits took much longer to resolve in foreign courts and as such, the patents had a chance of expiring before reaching a settlement. The American manufacturers were at a steep disadvantage in regards to the Wright patent when compared to the Europeans, who were enjoying more aviation growth in this era (2012).

Finally, the image of the Wright brothers was tarnished. Their actions compared negatively to people like Chanute, Cayley, and other aeronautical knowledge disseminators who worked to extend the science of aviation openly. Henry Ford said, "Patents should be there to protect the inventor, not to hold back progress" (Shulman, 2002, p. 212).

Conclusion

Even though the Wrights' work was founded on the efforts of aviation inventors and engineers before them, the Brothers were legally right to patent their work. However, their decision to make their achievement the subject of a many lawsuits and stall aviation progress rather than contribute to its continued growth was an unfortunate, but maybe not preventable blunder. Wilbur and Orville changed the world on the morning of December 17, 1903 and that is a certainty. The Wrights' battles fought to protect their patent are not the subject most remembered in the telling of the tale. And perhaps, what was not possible to forget in the first two decades of the 20th century, is now quite forgettable.

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