

# THE EXPERIMENTS OF 1899: WILBUR AND ORVILLE WRIGHT FLY A KITE

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The names of the places where Wilbur and Orville Wright made history are familiar to people everywhere who know and cherish the story of the invention of the airplane. The brothers tested their first kite/glider at Kitty Hawk, North Carolina in 1900, then shifted their seasonal camp four miles south to the Kill Devils Hills, where they flew from 1901 to 1903. They perfected their invention at Huffman Prairie, eight miles east of Dayton, in 1904 and 1905, and opened their flying field there in 1910.

Wilbur astonished the world with his first public flights from the race course at Hunaudieres, France, in the high summer of 1908, while Orville demonstrated the airplane to the Army trials at Ft. Myer, Virginia in 1908 and 1909. Wilbur taught the first three U.S. Army airmen to fly in 1909 at College Park, Maryland. And there are other familiar places, from Gardiner's Island in New York Harbor, where Wilbur took off for his flight around the Statue of Liberty in 1909, to a field near Montgomery, Alabama, where Orville made the first night flights and began to instruct the young men who would fly as members of the Wright exhibition team.

Ironically, the precise spot where Wilbur tested their first experimental aircraft is unknown to all but the most knowledgeable students of Wright lore. Many of the circumstances surrounding that first Wright flight test remain hazy. Over a century after the Wright brothers began their period of active experimentation with the flights of their wing-warping kite of



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1899, the time has come to clarify the record of those initial experiments.

In February 1912, when Wilbur Wright was asked how he became involved in the flying machine problem, he responded that a local news article announcing "...the death of Lilienthal... [August 10, 1896] brought the subject to our attention and led us to make some inquiry for books relating to flight."

"But the only serious books we found were by Prof. [Etienne Jules] Marey and these related to the mechanism of bird-flight rather than human flight. As our interest at that time was mere curiosity as to what had been done, we did not pursue the subject further when we failed to find books relating to human flight."<sup>1</sup>

Orville Wright recalled that their early interest was a bit more serious than that. "From the date of the death of Lilienthal," he remarked, "we were so interested [in aeronautics] that we discussed matters in this line almost daily."<sup>2</sup> As Wilbur explained, their smoldering interest in flight finally burst into flame in June 1899. It was "...while reading a book on Ornithology that we became interested in studying the appearance and habits of birds, but it soon occurred to us that the really interesting thing about birds was their power of flight."<sup>3</sup>

"Our own growing belief that men might nevertheless learn to fly was based on the idea that while thousands of creatures of the most dissimilar bodily structures, such as insects, fishes, reptiles, birds and mammals, were every day flying through the air at pleasure, it was reasonable to suppose that men might also fly. Of course, there might be, and doubtless would be, many serious difficulties to be overcome, but we thought that by learning what these difficulties were and finding methods of overcoming them, the

problems of human flight might be solved, and we thought that probably the cheapest and best way to take up the subject would be to acquaint ourselves with the troubles which others had met in attempting to solve the problem."

On May 30, 1899, Wilbur Wright wrote a letter to the Smithsonian Institution. "I am an enthusiast," he explained, "but not a crank in the sense that I have some pet theories as to the proper construction of a flying machine." Noting that he was "...about to begin a systematic study of the subject in preparation for practical work to which I expect to devote what time I can spare from my regular business," he requested "such papers as the Smithsonian Institution has published on this subject, and if possible a list of other works in print in the English language."<sup>4</sup>

Assistant Secretary of the Smithsonian Richard Rathbun replied just three days later. It was a testament both to the speed of the U.S. Postal Service in the closing years of the old century, and to the Smithsonian's emphasis on rapid response to public inquiries, even by officials at the highest levels of the Institution. Moreover, the response was full and satisfying. Rathbun provided the Wrights with free copies of four Smithsonian reprints: translated extracts from Louis Mouillard's *Empire of the Air*; Otto Lilienthal, *The Problem of Flying and Practical Experiments in Soaring*; Samuel P. Langley, *The Story of Experiments in Mechanical Flight*; and E.C. Huffaker, *On Soaring Flight*. He also included a list of recommended publications on the subject, including S.P. Langley, *Experiments in Aerodynamics*; Octave Chanute's *Progress in Flying Machines*, and the 1895, 1896, and 1897 issues of *The Aeronautical Annual*.

Wilbur immediately replied, thanking

Rathbun for the pamphlets and enclosing a dollar for the Langley volume. An entry for the second week in June, 1899 in the ledger in which the Wrights kept a meticulous account of the receipts and expenditures of the bicycle shop includes an expenditure of \$5.50 "for books on flying." In addition to ordering the Langley book, the brothers must have taken Rathbun's advice and purchased the Chanute volume and the available issues of the *Aeronautical Annual*, as well.<sup>5</sup>

The spring of 1899 had been a busy time for the residents of No. 7 Hawthorne Street, Dayton, Ohio. The *pater familias*, seventy-one year old Bishop Milton Wright, as usual, spent a great deal of time on the road, visiting far flung congregations, calling on relatives in Ohio and Indiana, and attending church conferences. When at home, he made periodic visits to the dentist who was fitting him with a "vulcanized" upper plate; supervised the workmen who were refurbishing the kitchen and the "east room" of the house; and handled family business, including the sale of timber on an Indiana farm.

But there was always time for his grandchildren, especially his son Lorin's eldest boy and girl, Milton and Ivonette, who lived just around the corner on Horace Street. At young Milton's request, he took them on walks to their grandmother's grave in lovely Woodland Cemetery. On May 10, 1899, the three of them cheered from the upper story windows of a church office as Col. William F. "Buffalo Bill" Cody paraded his Wild West Show through the streets of Dayton. Grandfather and grandchildren alike were looking forward to fireworks on the Fourth of July.

It was a busy spring for twenty-four year old Katharine Wright, as well. Katie, as her father and friends knew her, was the only

college graduate in the family, Oberlin, class of '98. Recently "elected" a teacher of English and Latin on the regular faculty of Central High School, she spent the spring and summer preparing for and enjoying her high school reunion and entertaining visiting college friends. She and a group of friends hosted a supper for a visiting Oberlin professor on May 20. A college chum, Margaret "Mag" Goodwin, arrived for a visit after June 8. The two of them took a train for Oberlin, and their first college reunion, on June 15.

Orville would later recall that serious discussions of aeronautical issues were well underway "while Miss Goodwin ... was visiting in our home."<sup>6</sup> The first step was to assess the state of the aeronautical arts. "As to the state of the experimental knowledge at the time we began our experiments," Wilbur explained:

"...we reached the conclusion that the problem of constructing wings sufficiently strong to carry the weight of the machine itself, along with that of the motor and of the aviator and also of constructing sufficiently light motors were sufficiently worked out to present no serious difficulty; but that the problem of equilibrium had been the real stumbling block in all serious attempts to solve the problem of human flight, and that this problem of equilibrium in reality constituted the problem of flight itself."<sup>7</sup>

From the outset, as Wilbur explained, "we were actively studying the means of controlling [an] aerial apparatus in the air...."<sup>8</sup> Lilienthal, the great German gliding master had been killed when his craft went out of control, as had Percy Pilcher, an English experimenter. Determined to avoid that fate, the Wrights set out to devise an effective control system before they built their first flying machine. They immediately

recognized that the real problem related to control in the roll axis, raising or lowering either wingtip at will to maintain balance in the air. “[We] ...conceived the idea of adjusting right and left wings to respective difference angles of incidence,” Wilbur explained, “for the purpose of controlling lateral balance.”<sup>9</sup>

How was that to be achieved? Orville suggested “...mounting the wings ... upon axles extending laterally from the center of the machine with gears attached to the two wings meshing so that when the lever attached to either wing was pushed forward or backward the wings would face forward at different angles to each other.”<sup>10</sup> Wilbur, however, argued that the scheme was impractical because of the weight of such a mechanism and the difficulty of incorporating it into an adequate structure.

Harriet Silliman, another one of Katharine’s college friends, arrived for a visit on Thursday, July 20.<sup>11</sup> Wilbur was working late in the bicycle shop a day or so later, while Orville and Katie were off somewhere entertaining Miss Silliman.

“One evening while studying the movements of a little square paper tube which I was using for the purpose of noting the movements of one side which I conceived to represent the upper plane of a double deck structure and the opposite side which I conceived to represent the lower plane, I noticed that the upper plane could be moved bodily forward or backward with reference to the lower plane which would be useful in controlling the fore and aft equilibrium of the apparatus, or if the top plane were moved forward at one end and backward at the other the whole structure would be twisted so that the right ends of the plane would be pulled down at the rear while the left ends would be elevated. Thus

each plane would assume a screw form or helicoid and the right wing would have a greater angle than the left wing.”<sup>12</sup>

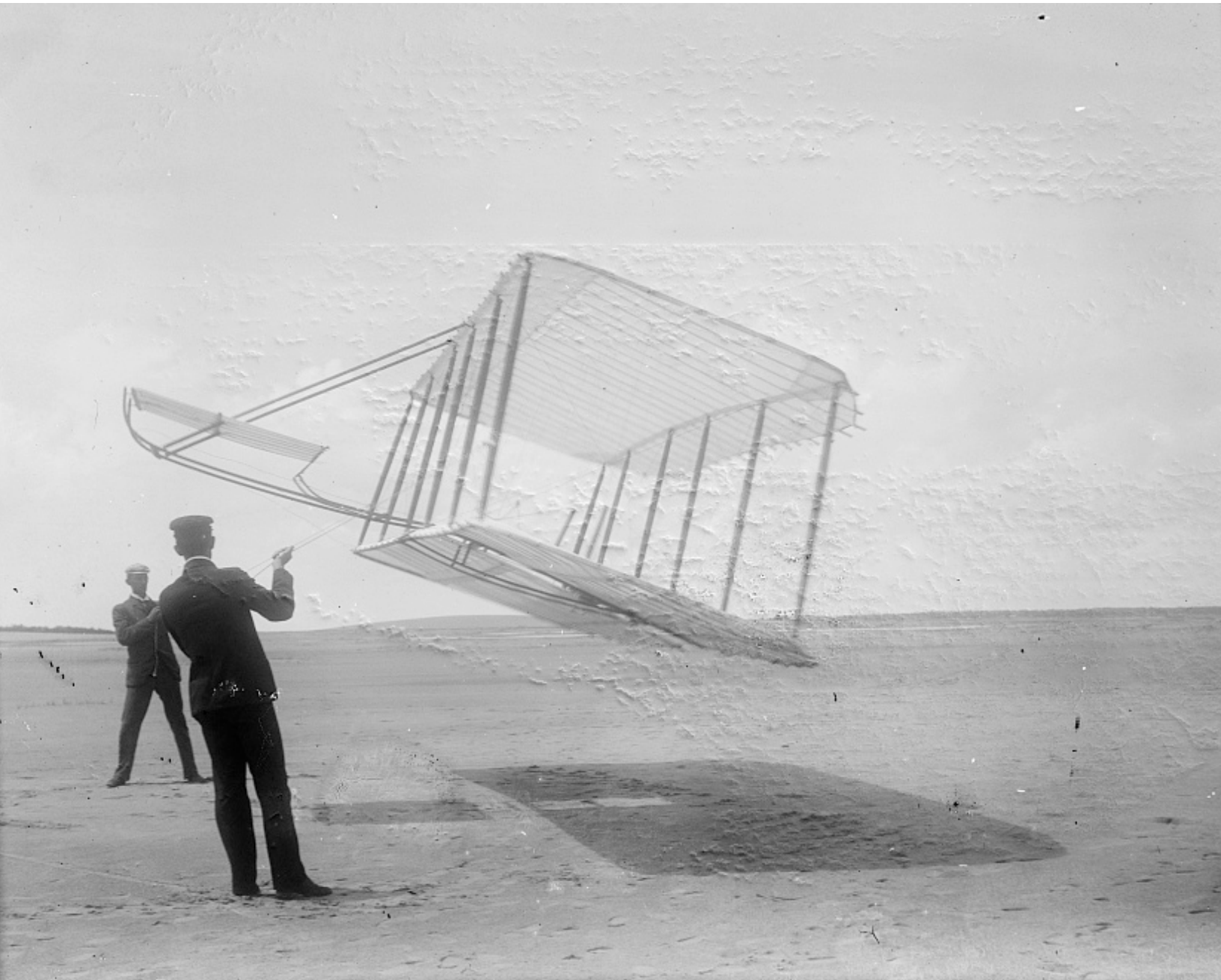
By twisting or “warping” the wing in that fashion, the operator would increase or decrease the angle of attack, and the amount of lift, on one side or the other, banking into a turn, or simply restoring lateral balance.

When Orville returned home with the ladies later that evening, Wilbur was waiting with the box. “By marking vertical and diagonal lines on the ... two vertical walls... [Wilbur] represented the upright posts and the diagonal truss wires of a superposed aeroplane.”<sup>13</sup> Wilbur carefully positioned his index fingers and thumbs on either end of the box and twisted. Orville recalled that they became “...very enthusiastic...”<sup>14</sup>

Wilbur then proceeded to build “...a little model made out of bamboo having lateral spars and upright standards connecting them, the whole being braced by truss threads.”<sup>15</sup> It was an even clearer demonstration of the warping principle, and indicated a means of incorporating the technique into an actual structure.

His next step was to design, build, and test their first real aircraft, a kite that would enable them to test their control system in the air. “The kite had two slightly curved planes,” Wilbur explained, “about thirteen inches from front to rear, and about five feet from tip to tip, one being placed above the other and connected to it by two rows of upright standards, one near the front edge and the other row near the back edge.” Wilbur attached the upright struts to the wings with flexible connections, “...so that the top plane could be thrown forward or backward with reference to the lower plane.”<sup>16</sup>

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Side view of glider flying as a kite near the ground, Wilbur at left and Orville at right, glider turned forward to right and tipped downward.

A single rod attached to the mid-point of the middle rear strut supported a rectangular, horizontal elevator. When the top surface of the kite moved forward or backward, the trailing edge of the elevator rose or fell to assist the kite in climbing or diving.

Orville knew that the classic box kite, introduced by the Australian Lawrence Hargrave in 1892, offered a light, strong aeronautical structure. Such kites were braced across the front and back with light wires forming a Pratt Truss, a classic American bridge truss, and across both ends. In 1896, the Chicago engineer Octave Chanute had sponsored successful flight tests of a hang glider based on that pattern. If the wire bracing on the ends was removed, it would enable the top surface to move to the front or rear of the lower wing, causing the kite to climb or dive. The wings could also be twisted for lateral control, like the box and the bamboo model, but could not move to the right or left.

Control lines leading to wooden sticks in the operator's hands could be connected to the top and bottom of the outside front struts on both the right and left sides. The lines on the right and left were crossed, so that the operator could tip the top of the two sticks in his hand forward to allow the top wing to move back, causing the kite to climb. Pointing the top of both sticks to the rear would cause a dive, and pointing the top of one stick forward and the other to the rear would cause the kite to bank in one direction or the other. It would be the first flying machine of any kind capable of maneuvering under the control of the pilot.

The structure of the 1899 Wright kite was built entirely of pine. The wings were covered with fabric and sealed with shellac.<sup>17</sup> An examination of the ledger book in which the Wrights recorded all of

their income and expenditures reveals a number of interesting purchases that might have been related to the kite, including several entries for ten cents worth of muslin, and Wilbur's purchase of a ten cent ball of string in the last week in July or the first in August. In any case, the book records that Wilbur reported a great many unspecified expenditures during late July, any of which might have been related to the kite.<sup>18</sup>

Wilbur later recalled that he was at work on the kite "within a few days" of having experimented with the cardboard box and the bamboo structure. "The actual work on the kite was done mostly by myself," although "...it embodied the results of numerous conversations between us."<sup>19</sup> While Orville was helping Katharine entertain their guest, Wilbur spent long hours at the bicycle shop, waiting on customers, performing repairs, and constructing his kite. "I was not able to be present when the structure was flown as a kite, but I operated the machine in ... our store before it was taken out to be flown," Orville recalled. "My brother held the kite in his hands while I warped the wings by means of the four cords."

Katharine, Harriet, Orville, and a group of other friends left for a camping trip at a spot near Dayton's Fairview Park during the first week in August, 1899. The party returned home on August 7, the first Monday of the month.<sup>20</sup> The tests of the kite, Wilbur recalled, were prior to the trip. Orville agreed with his brother, recalling that he had returned from the camping trip on Tuesday, August 8, and that Wilbur had visited him in camp on Sunday, August 6, at which point they discussed the kite tests that had been conducted prior to his departure. In the late summer of 1899 the Wrights did not have an assistant who could man the bicycle shop in their absence. Presumably, Orville did not witness the kite

tests because he had to mind the store.<sup>21</sup>

Wilbur reported that he flew the kite “a number of times about the end of July.”<sup>22</sup> He had given the question of where to fly it considerable thought, and selected an open area on the grounds of the Union Theological Seminary, at the corner of West First Street and Euclid Avenue in Dayton, Ohio. “This field is now part of the city,” Wilbur explained in a deposition offered just a month before his death. “But at that time [it was] a retired place where I thought no one would intrude.”<sup>23</sup>

Officials of the Church of the United Brethren in Christ opened the doors of the impressive three-story structure in 1878. Since that time, it had become a landmark on the western edge of Dayton. Eight years before, Katharine, then a high school student, had mentioned the place in an essay describing the sites encountered by passengers on a horse car traveling east along West Third Street. Having begun the journey at the Third Street car barns, and passed the already historic Miami City school, the tour guide directed the attention of her readers to the next noteworthy site along the route.

“To the left, about two squares distant, is another school, sometimes irreverently called “the preacher factory.” Its official name is Union Biblical Seminary. It stands in the center of a beautiful campus on high ground overlooking the valley of Wolf Creek, and is the first building to attract the eye of travelers entering the city by railroad from the west.”<sup>24</sup>

Wilbur remarked that he had flown the kite more than once. The fact that the drawings of the kite which he prepared for use during a deposition on the morning of March 30, 1912, show a short section of pipe tied to the center forward strut certainly indicates

that he had flown it enough to realize that it was tail heavy.

In spite of Wilbur’s desire for privacy, there were witnesses to the tests. Fred Fansher recalled that he had been flying kites with ten or twelve other boys in an empty lot adjacent to the Seminary at the corner of Summit and West First, when Wilbur Wright walked by carrying “...what looked to us like a peculiar sort of box kite.” Curious, the boys pulled their own kites down and followed Wilbur onto the Seminary grounds.<sup>25</sup>

John Myers remembered that Wilbur had asked him to hold the kite as far above his head as he could and to let it go when instructed. “There was quite a big wind that day,” he noted. “I recall that when he tilted the planes the kite came down very rapidly, darted in other words.... He made several attempts and then boxed it up and put it away.”<sup>26</sup>

John Reiniger had been there, as well. “At times it would have a tendency to come down.” He recalled, “which would be overcome by the manipulation of the sticks in Mr. Wright’s hands.” Once, he remembered, the kite had gotten completely out of control and swooped down to the ground.<sup>27</sup>

Of course, Wilbur gave Orville a detailed account of the tests. Several days later, John Reiniger and his brother Walter stopped by the bike shop and provided what we can safely assume to have been a spirited description of the proceedings. “According to Wilbur’s account of the tests,” Orville remarked, “the model worked very successfully.”

“It responded promptly to the warping of the surfaces, always lifting the wing that had the larger angle [of incidence].

Several times, according to Wilbur's account to me, when he shifted the upper surface backward by the manipulation of the sticks attached to flying cords, the nose of the machine turned downward as was intended; but in diving downward it created a slack in the flying cords, so that he was not able to control it further. The model made such a rapid dive to the ground that the small boys present fell on their faces to avoid being hit, not having time to run."<sup>28</sup>

During the course of a series of patent suits that began in 1909 and ran for over a decade, the origins and operation of the 1899 kite would repeatedly become a matter of some legal importance. It was, after all, the starting point of the Wright experiments. As a result, the brothers were forced to reconstruct events that had occurred more than a decade before, and which seemed much more important in hindsight than they had at the time. In general, their method of dating the small steps leading to the kite tests involved remembering the comings and goings of guests, the camping trip and other household events occurring at the same time.

There is one puzzling anomaly, however. The brothers relied on their father's meticulous diary to establish a basic timeline of events in the Wright household during the spring and summer of 1899. In his entry for July 7, Bishop Wright reports that his grandson Milton visited that evening, "to see the flying machine."<sup>29</sup> According to the chronology reconstructed by the brothers, however, there was no "flying machine" in early July. The incident with the paper box, which set everything in motion, did not occur until on or about July 20. Perhaps young Milton came to look at pictures of flying machines in the books and pamphlets that his uncles had recently

acquired.

In addition to reconstructing the weeks when they had taken their first steps toward the invention of the airplane, the Wrights had to locate witnesses who could testify to having seen the kite maneuvering in the air. Some of the boys were easy enough to find. John Reiniger was still living in Dayton, as were Fred Fansher, who was serving as Secretary of the Chamber of Commerce in 1912, and John Myers, who had become an electrician. The Wrights wrote letters to other men, now living as close as Cincinnati and as far away as Georgetown, Texas, whom they thought might have been among the ten or a dozen youngsters who had seen the kite fly thirteen years before.<sup>30</sup> Apparently, there were no responses.

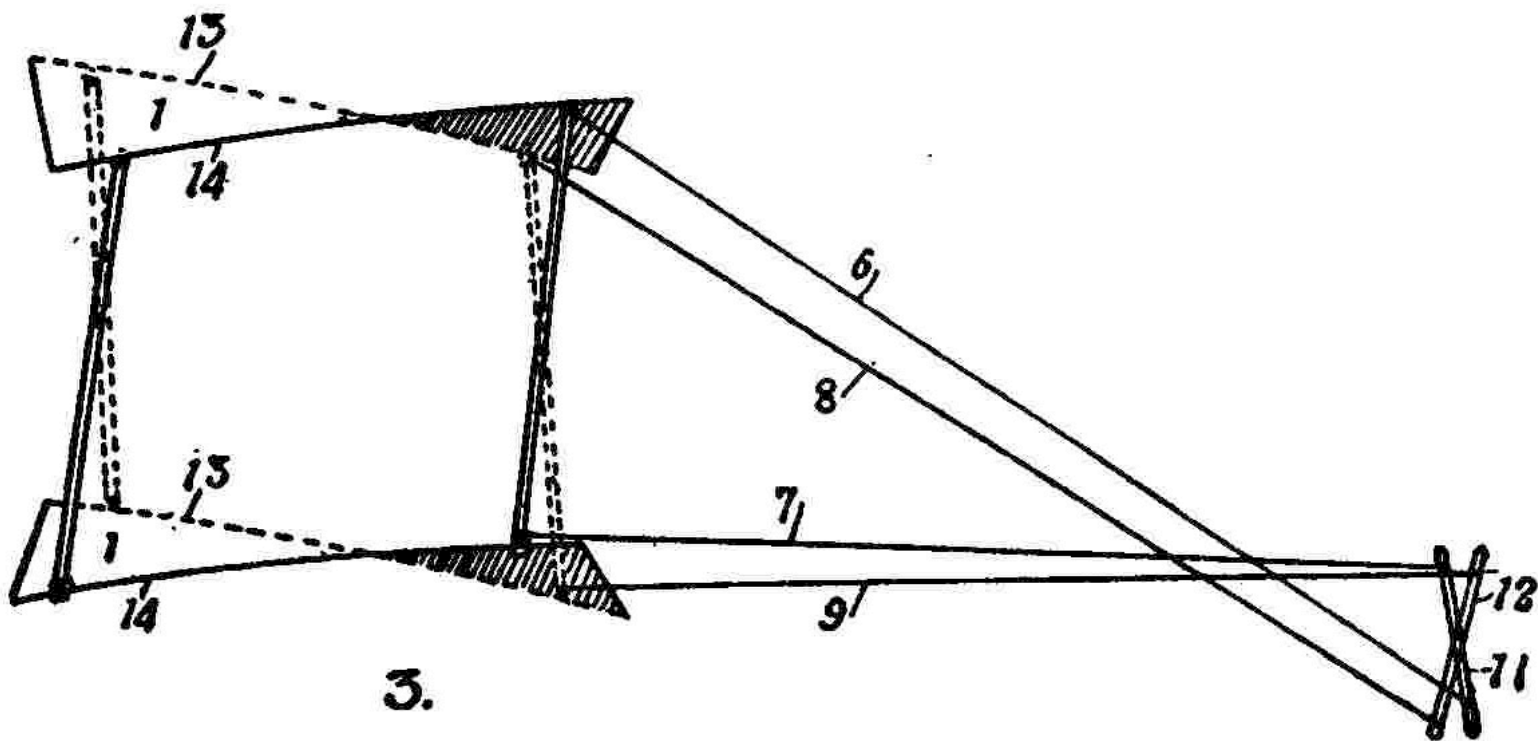
Opposing counsel in the various patent suits would also express curiosity with regard to the ultimate fate of the objects that had played such an important role in the initial involvement of the Wright brothers in aviation. "I do not think that we have parts of any of our kites or gliders before the motor aeroplanes [sic] of 1903," Wilbur explained.<sup>31</sup> While he did not actually remember, he presumed that the little bamboo model had been "thrown in the waste basket or wood box."<sup>32</sup>

"The kite remained about the store for three or four years," Wilbur recalled, "and was used at various times in making experiments with an automatic stabilizer." During one of those tests, probably in 1905, "...it was so badly broken that no attempt was made to rebuild it."<sup>33</sup> The 1899 kite had outlived its historic progeny, the 1900, 1901, and 1902 Wright gliders. Like them, however, it ultimately found its way into "the waste basket or wood box."

"Following these flights [of the 1899 kite],"

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Wilbur Wright's drawing of the 1899 kite with the surfaces warped. It is in the public domain, drawn from his testimony in the patent suit, as reproduced in McFarland, *The Papers of Wilbur and Orville Wright* (McGraw-Hill, 1953).

Wilbur recalled, “we decided to build a much larger kite sufficient to support a man, and we made a search for grounds in the vicinity of Dayton but found nothing that suited us.”<sup>34</sup> This time they would have to look a bit farther afield than the Union Theological Seminary. Just a year later, on Thursday, September 6, 1900, Wilbur Wright boarded a Big Four train at Dayton’s Union Station. He was bound for Elizabeth City, North Carolina, where he would hire a boat to carry him across Albermarle Sound to the little village of Kitty Hawk, on the Outer Banks of North Carolina. Safely packed away in the baggage car were the prefabricated makings of the 1900 kite/glider, the first full-scale Wright airplane. The freight charge was \$2.53, several times the cost of the small kite that had started it all.<sup>35</sup>

#### SIXTEEN YEARS LATER

I wrote this essay 16 years ago, in the spring of 1999, as a first step toward the Centennial of Powered Flight, which I assumed would be celebrated with great fanfare in 2003. The kite experiments of 1899, so often overlooked by historians, marked the serious entry of these two Dayton men into aeronautics, a field in which they would write their names large across the sky. The essay was an experiment in microhistory, an attempt to see just how much detail I could uncover about those few weeks in the summer of 1899. Re-reading it now, I found the need to do some re-writing, not to correct errors, but to clarify what occurred and to put those events in a bit more context.

I am more than pleased that my friends from the Drachen Foundation have chosen to offer the revised version to a new generation of readers in their online journal. I enjoyed re-visiting my own account of the story, and am grateful to have been able to make some improvements. My thanks to Ali Fujino and Scott Skinner for the invitation, and to editor Katie Davis who helped make it more presentable.

Tom Crouch  
Chantilly, Virginia  
October 6, 2015 ♦

## ENDNOTES

1. Wilbur Wright testimony, U.S. District Court, Western Division of New York. The Wright Company vs. Herring-Curtiss Co. and Glenn H. Curtiss. In Equity No. 400. Complainant's Record. Vol. 1, pg. 474.
2. Orville Wright deposition, The United States District Court, Southern District of Ohio, Western Division, Charles H. Lamson vs. The Wright Company, In Equity No. 6,611, pg. 78, Defendant's Copy, The Papers of Wilbur and Orville Wright, Manuscript Division, Library of Congress, box 63.
3. Wilbur Wright testimony, Wright Company vs. Herring-Curtiss Co. and Glenn H. Curtiss, Vol. 1, pg. 474.
4. W. Wright to the Smithsonian Institution, May 30, 1899, in McFarland, *PWOW.*, vol. 1, pg. 4-5.
5. Entry for June 15 (?), 1899, 1899 ledger book, Box 77, pg. 13, Papers of Wilbur and Orville Wright, Manuscript Division, Library of Congress.
6. Lamson vs. the Wright Company, pg. 78.
7. Wilbur Wright testimony, Wright Company vs. Herring-Curtiss Co. and Glenn H. Curtiss, Vol. 1, pg. 478.
8. Lamson vs. the Wright Company, pg. 14.
9. Lamson vs. the Wright Company, pg. 14.
10. *Ibid.*, 78.
11. Bishop Milton Wright, Diary, Paul Lawrence Dunbar Library, Wright State University.
12. Wilbur Wright, Lamson vs. Wright, pgs. 14-15.
13. Orville Wright, Lamson vs. Wright, pg. 79.
14. *Ibid.*
15. Wilbur Wright, Lamson vs. Wright, pg. 15.
16. Wilbur Wright, Lamson vs. Wright, pg. 16.
17. Wilbur Wright to Octave Chanute, August 10, 1900, in McFarland, *Papers*, vol. 1, pg. 22.
18. For the string see: 1899 ledger book, pg. 59, Wright Papers, Box 77.
19. Wilbur Wright, Lamson vs. Wright, pg. 17.
20. Orville Wright, testimony, U.S. District Court, Western Division of New York. The Wright Company vs. Herring-Curtiss Co. and Glenn H. Curtiss. In Equity No. 400. Complainant's Record. Vol. 1, pg. 807. "While Miss S. Was visiting us we spent a few days camping north of the city, that is, my sister, Miss S- and I camped with some friends.... We were camping about one week and we returned to Dayton, as I remember it, the first Monday of August 1899."
21. For Orville's recollections see, "Orville Wright on the Wright experiments of 1899," in Marvin W. McFarland, ed., *The Papers of Wilbur and Orville Wright* (New York: McGraw-Hill and Company, 1953), vol. 1, pg. 11.
22. Wilbur Wright, Lamson vs. Wright, pg. 16.
23. Wilbur Wright, Lamson vs. Wright, pg. 17.
24. Katharine Wright, "Rambles in Miami City," [*Central High School Times*, December 1891, pg. 7.
25. Deposition of Frederick W. Fansher, Dayton, Ohio, February 2, 1921, Regina Cleary Montgomery et al. vs. the United States, Court of Claims of the United States, No. 33852. Typed copy of the deposition in the John J. Montgomery biographical file, National Air and Space Museum. See also Fansher's earlier deposition, in Lamson vs. Wright, pg. 90.
26. Deposition of John K. Myers, Dayton, Ohio, February 2, 1921, Regina Cleary Montgomery et al. vs. the United States, Court of Claims of the United States, No. 33852. Typed copy of the deposition in the John J. Montgomery biographical file, National Air and Space Museum.
27. Deposition of John D. Reiniger, Lamson vs. Wright, pg. 95.
28. "Orville Wright on the Wright experiments of 1899," in McFarland, ed., *Papers*, vol. 1, pg. 11.
29. Bishop Milton Wright, Diary, July 7, 1899, Paul Lawrence Dunbar Library, Wright State University.
30. Wright brothers to Horace Hiscy, April 13, 1912; Wright brothers to Joseph Scholl, April 13, 1912; Wright brothers to Horace Drury, April 13, 1912, all in *The Papers of Wilbur and Orville Wright*, Manuscript Division, Library of Congress, box 63, materials relating to Lamson vs. Wright.
31. Wilbur Wright, Lamson vs. Wright, pg. 49.
32. *Ibid.*
33. *Ibid.*, pg. 17.
34. *Ibid.*
35. For freight charge see: 1900 ledger book, pg. 153, Wright Papers, Box 77.