

1. That the lifting power of a large machine, held stationary in a wind at a small distance from the earth, is much less than the Lilienthal table and our own laboratory experiments would lead us to expect. When the machine is moved through the air, as in gliding, the discrepancy seems much less marked.
2. That the ratio of drift to lift in well-shaped surfaces is less at angles of incidence of five degrees to 12 degrees than at an angle of three degrees.
3. That in arched surfaces the centre of pressure at 90 degrees is near the centre of the surface, but moves slowly forward as the angle becomes less, till a critical angle varying with the shape and depth of the curve is reached, after which it moves rapidly toward the rear till the angle of no lift is found.
4. That with similar conditions large surfaces may be controlled with not much greater difficulty than small ones, if the control is effected by manipulation of the surfaces themselves, rather than by a movement of the body of the operator.
5. That the head resistances of the framing can be brought to a point much below that usually estimated as necessary.
6. That tails, both vertical and horizontal, may with safety be eliminated in gliding and other flying experiments.
7. That a horizontal position of the operator's body may be assumed without excessive danger, and thus the head resistance reduced to about one-fifth that of the upright position.
8. That a pair of superposed, or tandem, surfaces has less lift in proportion to drift than either surface separately, even after making allowance for weight and head resistance of the connections.

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#### APPENDIX C.

*Letter read by Mr. Frank Lahm before the Aviation Committee of the Aero Club de France, December 29th, 1905.*

Mansfield, Ohio,  
December 6th, 1905.

MY DEAR LAHM,

December 1st I was at Chicago, stopping at the Grand Pacific Hotel, and after a tedious day's work, had retired early. Just as I was about falling asleep my room telephone rang, and on inquiry learned that a telegram would be sent me, and soon it was delivered to me. It was a puzzle: "Verify what Wright Brothers claim, necessary go Dayton, prompt response cable." I studied it carefully, and as the matter seemed very important, concluded to ask Wright Brothers to explain, for surely they should understand. So I telegraphed them, retired to the sleep of the just, and awaited the reply to come the next morning, and, when received, it threw no light on the subject. In desperation I telegraphed again: "Do you know Frank Lahm, of Paris?" Answer came back: "Yes, Lahm, the French aeronaut."

All this time there was dimly conscious in my mind that I knew somewhere—somehow of Wright Brothers. As soon as I saw the word "aeronaut" it came to my mind that they must be the ones who some years ago experimented with a "flying machine" in the Carolinas, and I promptly notified them I would be in Dayton the next morning and would they meet me. At seven o'clock the next morning I was there. I inquired, after a time, whether there was such a firm in the city, but no one could give me any information. There was none in the directory, and no one seemed to know anything about a "flying machine."

I then went to the telegraph office, since I knew my messages had been delivered, and finally discovered the boy who had delivered the telegrams, and through him their street address. Going back to the hotel, I found Mr. Orville Wright, the younger of the brothers, awaiting me, and about as much puzzled as I had been over what the cable message and my telegrams meant. In a few minutes we both grasped just what was wanted, and Mr. Wright promptly told

me he would do all he could to satisfy you and me that all he reported as accomplished was the truth, and nothing but the truth. His very appearance, though, would disarm any suspicions to the contrary. A young man, of about 30, apparently, slight of build, and with a face more of a poet than an inventor or promoter. In contour, head and face resemble Edgar Allen Poe. Very modest in alluding to the marvels they have accomplished—looking more to the renown and glory that will surely come to them as the solvers of the problem of mechanical flight than any possible pecuniary reward.

He told me that the place they tried their experiments was eight miles away, and we promptly sought a trolley car, and in less than an hour reached the spot. A great field of about 90 acres, flat and level, what we call meadowland, covered with coarse grass, and hummocky. Off in the distance, nearly half a mile away, was a small structure in which was housed the aeroplane during the time of their experimenting. The field was otherwise bare except three trees far to the right, and which marked in a way the limits of their circling flights.

During the preceding hour Mr. Wright had briefly outlined what they had accomplished in the season of 1905, and which closed abruptly on October 5th, for reasons to be stated later. During that time they had made some 50 flights, and the first trials had been of varying success, though with changes and improvements they were conscious that every week showed an important gain. By the middle of September they had completed the machine practically as it was when they closed the season. The frame was made of larch wood—from tip to tip of the wings the dimension was 40 feet. The gasoline motor, a special construction, made by them—much the same, though, as the motor on the Pope-Toledo automobile—was of from 12 to 15 horse-power. The motor weighed 240lbs. The frame was covered with ordinary muslin of good quality. No attempt was made to lighten the machine; they simply built it strong enough to stand the shocks. The structure stood on skids or runners, like a sleigh. These held the frame high enough from the ground in alighting to protect the blades of the propeller. Complete with motor, the machine weighed 925lbs.

The operator lies face downward in a horizontal position and as close to the frame as possible. Contrary to what would be expected, it is a fact that a weight hanging below the centre of gravity, like a pendulum, causes the aeroplane to capsize; hence all weight is concentrated as near as possible in a common plane—much as a bird flies, drawing its feet close to its body. No rudder is used. What may be called a tail extends to the rear, but is used only to change the direction up or down. The guiding of the machine, cutting figure eights, or swinging with lightning speed in great circles is accomplished otherwise.

About October 1st they had finally got their motor in such shape as to ensure good, long flights. Previous to that time flights of 10, 11, and 12 miles had been made. On October 3rd 16 miles had been made; October 4th, 21 miles; and October 5th, the record was 24½ miles, and the flight only ceased because the supply of gasoline gave out. In this flight the older brother operated the machine. They take "turn about" in this part of the work. Mr. Wright weighs 145lbs., and an additional weight of iron, 50lbs. was lashed to the prow. The great birdlike-machine rushed round the circle 29 times, and the time was 38 minutes. At times the speed, with the favouring wind, was fully a mile a minute. No wonder that some of the more mercurial spectators grew wild with excitement as it rushed by, for you must remember that all the time the machine was not over 60 feet from the earth, the average height, just clearing the tree-tops, being held. Only in turning the more abrupt corners, so to speak, was the height increased.

Mr. Wright tells me he has flown a distance of four miles and held the machine so near the earth that the greatest height was not to exceed 10 feet. This would show absolute control in a vertical plane. For obvious reasons, they kept their experiments as secret as possible. The cars on the electric line ran every 30 minutes, and so as not to attract attention, they have timed their flights between the runs, and have been very successful in avoiding observation. The

farmers living near by are the only ones who have had the opportunities of watching the experiments, and after two years of such experiments, had lost what little interest they had in them.

Mr. D. Beard lives across the Springfield road from the experimental field, and to him Mr. Wright took me first. I found him an intelligent man of about 60. He told me of the work which had gone on under the eye for so long a time, and assured me absolutely there was no question as to the flights. He had often observed them, and particularly knew of the series ending October 5th of this year. We next called on Farmer Stauffer, living half a mile farther up the road. He was a typical American farmer, with jolly face and voluble. He rents the farm which includes the field where the flights were made. On October 5th he was cutting corn in the next field east, and which is higher ground. When he noticed the aeroplane had started on its flight he remarked to his helper: "Well, the boys are at it again," and kept on cutting corn, at the same time keeping an eye on the great white form rushing about its course. "I just kept on shocking corn," he continued, "until I got down to the fence, and the darned thing was still going round. I thought it never would stop." I asked him how long he thought the flight continued, and he replied it seemed to him it was in the air for half an hour.

After this interview we returned to the city. We called on Mr. Foust, druggist, a friend of Mr. Wright. On invitation, Mr. Foust was present at the trial of October 5th, and described to me fully the operation of the machine. He timed the duration of the flight, and counted the number of times it circled the field. Mr. Foust is a young and enthusiastic man, and, though cautioned by the brothers not to divulge what he had seen, he could not restrain himself, and talked about it so effectively that the next day the field was invaded by a crowd of sightseers. The fences were lined by Kodak fiends, and reluctantly the Wright Brothers were forced to discontinue their work. They took apart their flyer and brought it back to the city. The practical work of 1905 was ended.

I next called at the pleasant home of these discoverers of the "only new thing under the sun." They live very quietly with their father, who is a clergyman. The elder brother, Wilbur, I found even quieter and less demonstrative than the younger. He looked the scholar and recluse. Neither is married. As Mr. Wright expressed it, they had not the means to support "a wife and a flying machine too."

Twelve years ago they engaged in manufacturing bicycles, but gradually went out of the business as the craze subsided. Even as boys they were of an inventive turn of mind, one of their achievements being a printing press, which, on account of its great novelty, attracted much attention. And, too, at a very early age they commenced to study the problem of mechanical flight. They have made a special study of the laws governing the flight of birds, and have compiled tables of great value relating to wind resistance as applied to aeroplanes. In this they have discovered many errors in the deductions and laws laid down by those now esteemed authorities. In these matters they have found that Lilienthal was far ahead of those who followed.

They have given much thought and time to scientifically construct the best form of motor—as to the pitch of the wings, size—and it appears to me that they know far more than others in this peculiar field. My visit was made on Sunday, and for that reason I did not see all the parties who witnessed or knew the work accomplished. I enclose you letter just received from them, which gives further references.

They told me of their correspondence with Captain Ferber, who I understand is a member of your Aero Club, and laughed at his assertion that there "was not a man in all France who believed they had done what they claimed."

(Signed) HENRY M. WEAVER.