

How We Made The First Flight



Celebrating 100 Years of Powered Flight

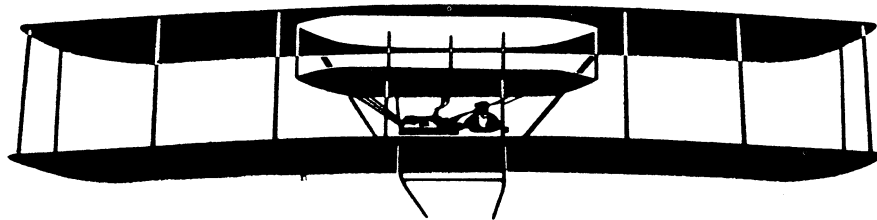
By Orville Wright

Introduction by: Dr. Paul E. Garber
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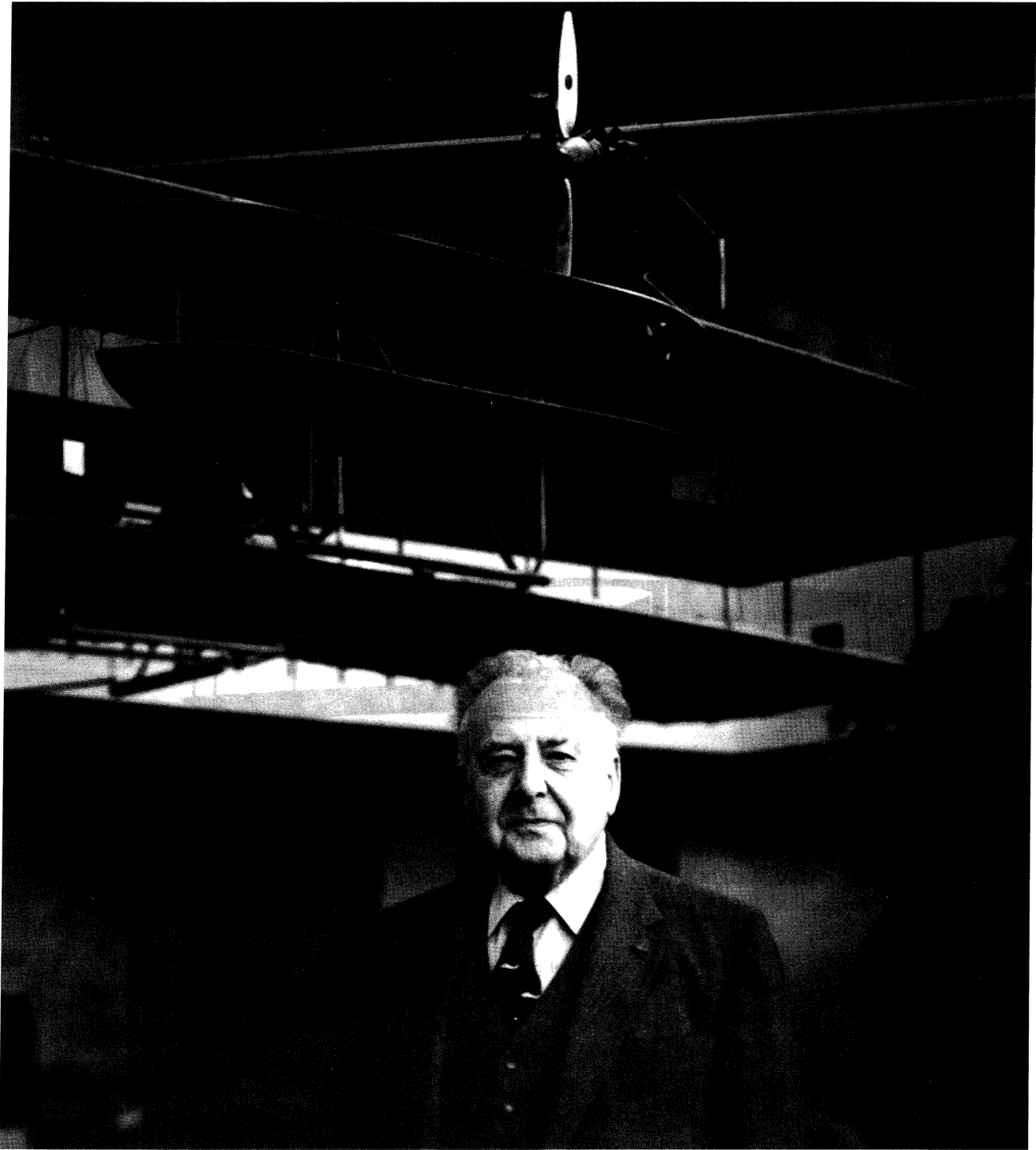
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This is Orville Wright's own account of the world's first powered, sustained and controlled flight.

Edited by Michael E. Wayda

“...I wish to avail myself of all that is already known and then if possible add my mite to help on the future worker who will attain final success...”



Dr. Garber and the 1903 Wright Flyer at the National Air and Space Museum in Washington, D.C.

Paul E. Garber is Historian Emeritus and Ramsey Fellow of the National Air and Space Museum in Washington, DC. A native of New Jersey, Dr. Garber attended schools in New Jersey, the District of Columbia, and the University of Maryland. He became interested in aviation in 1909, when he saw Orville Wright fly at Ft. Myer, Virginia. After working with the Air Mail Service, he joined the Smithsonian Institution in 1920. During the

Second World War, Dr. Garber served as a Commander in the U.S. Naval Reserve. He was appointed the first Curator of the NASM following his return from military service. Born in 1899, Dr. Garber retired upon reaching the mandatory retirement age of 70, and was awarded honorary status as Historian Emeritus and Ramsey Fellow. He is a member of The Early Birds of Aviation and the Air Mail Pioneers, and has received numerous awards and decorations, including the Gold Medal for Exceptional Service of the Smithsonian Institution.

Foreword

by Paul E. Garber

The Aviation Education staff in the Federal Aviation Administration has asked me to write a preface to their reprint of a very interesting account by the Wright brothers describing how they made the first powered and controlled flight, December 17, 1903. I am pleased to do so because as Historian Emeritus of the Smithsonian Institution, National Air and Space Museum, I have devoted many years in trying to learn more about the history of flight. Moreover, I admire the important place in our nation's aviation progress that is maintained by the Federal Aviation Administration.

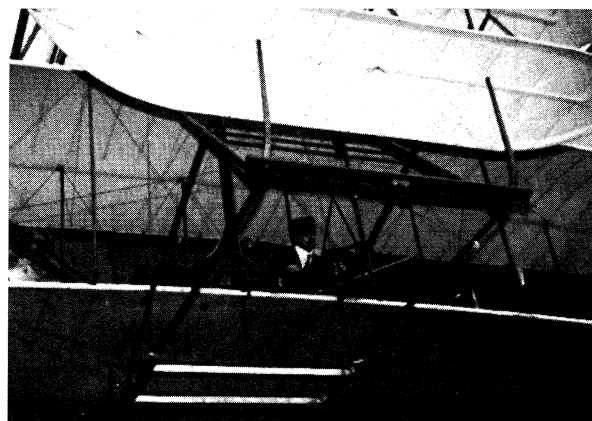
As I read this account by the Wright brothers, I thought of another excellent source of information about them. It is a two-volume record, "The Papers of Wilbur and Orville Wright" edited by Marvin McFarland of the Library of Congress and published in 1953 by the McGraw-Hill Book Company, New York. On pages 3 and 4 is an account by Orville Wright of the brothers' early interest in aviation. An excerpt is:

"In the spring of the year 1899, our interest in the subject was aroused through the reading of a book on ornithology. We could not understand that there was anything about a bird that would enable it to fly that could not be built on a larger scale and used by man. At this time our thought pertained more particularly to gliding flight and soaring. If the bird's wings would sustain it in the air without the use of any muscular effort we did not see why man could not be sustained by the same means. We knew that the Smithsonian Institution had been interested in some work on the problem of flight and, accordingly, on the 30th of May 1899, my brother Wilbur wrote a letter to the Smithsonian inquiring about publications on the subject."

The reason the Smithsonian had this interest was that the Secretary, Samuel P. Langley had been experimenting with kites and small unmanned airplanes for a decade prior to Wilbur's request. On May 6, 1896, Number 5 of his steam engine, two-propellered, 14-foot span, tandem-winged, unmanned model had made repeated flights of about 3000 feet, alighting gently on the surface of the Potomac River, ready to be dried and refueled for another flight. This had surpassed by ten times the best duration and distance flights by models of other experimenters. Langley had read of flight experiments by others and had prepared several accounts describing the models and their perfor-

mances. In response to Wilbur's letter, these were sent to him together with suggestions about other publications. Wilbur replied with sincere thanks and sent a dollar to purchase a copy of Langley's own description of his experiments. In a later statement, Wilbur accredited Langley's work as an encouragement for their own progress.

As I think back through my own interest in aviation and recall the date of Wilbur's letter to the Smithsonian, May 30, 1899, I think of my own birthdate of August 31, 1899 and I realize that my own life-start was coincident with the beginnings of practical progress in controlled and powered flight by mankind in heavier-than-air craft. When I was four years old, the Wright brothers did actually fly with control and power. When I was nine years old, I saw both Wilbur and Orville at Fort Myer, Virginia when Orville was accomplishing



one of the requirements for our Army's military airplane—that it fly for an hour with pilot and passenger. That airplane was the world's first to be used for military purposes. Ten years later, I soloed in a Curtiss JN4-D biplane (two winged), July 4, 1919.

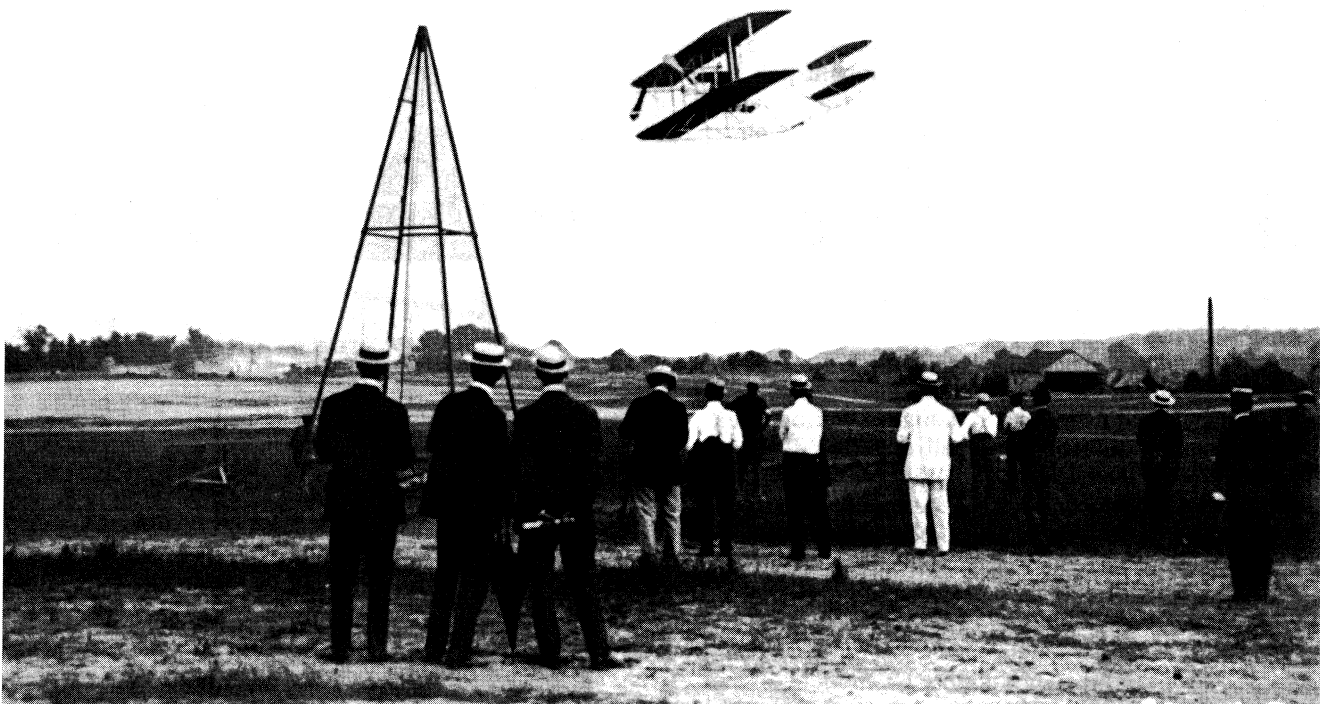
I had flown earlier in a homemade glider. Fifty years later, in 1969, I saw by television, two men, Neil Armstrong and "Buzz" Aldrin walking on the moon, and their safe return to earth.

Now, 17 years later, I am sitting in my office in a museum devoted to the history and progress of aircraft and spacecraft. This is the most popular museum in the world, by actual visitor count, more than ten million a year. I am still hale and hearty at age 87, thanking the good Lord that I am able to do a good day's work five days a week.

I have included a number of personal references so that you, the reader, whether you are a student,

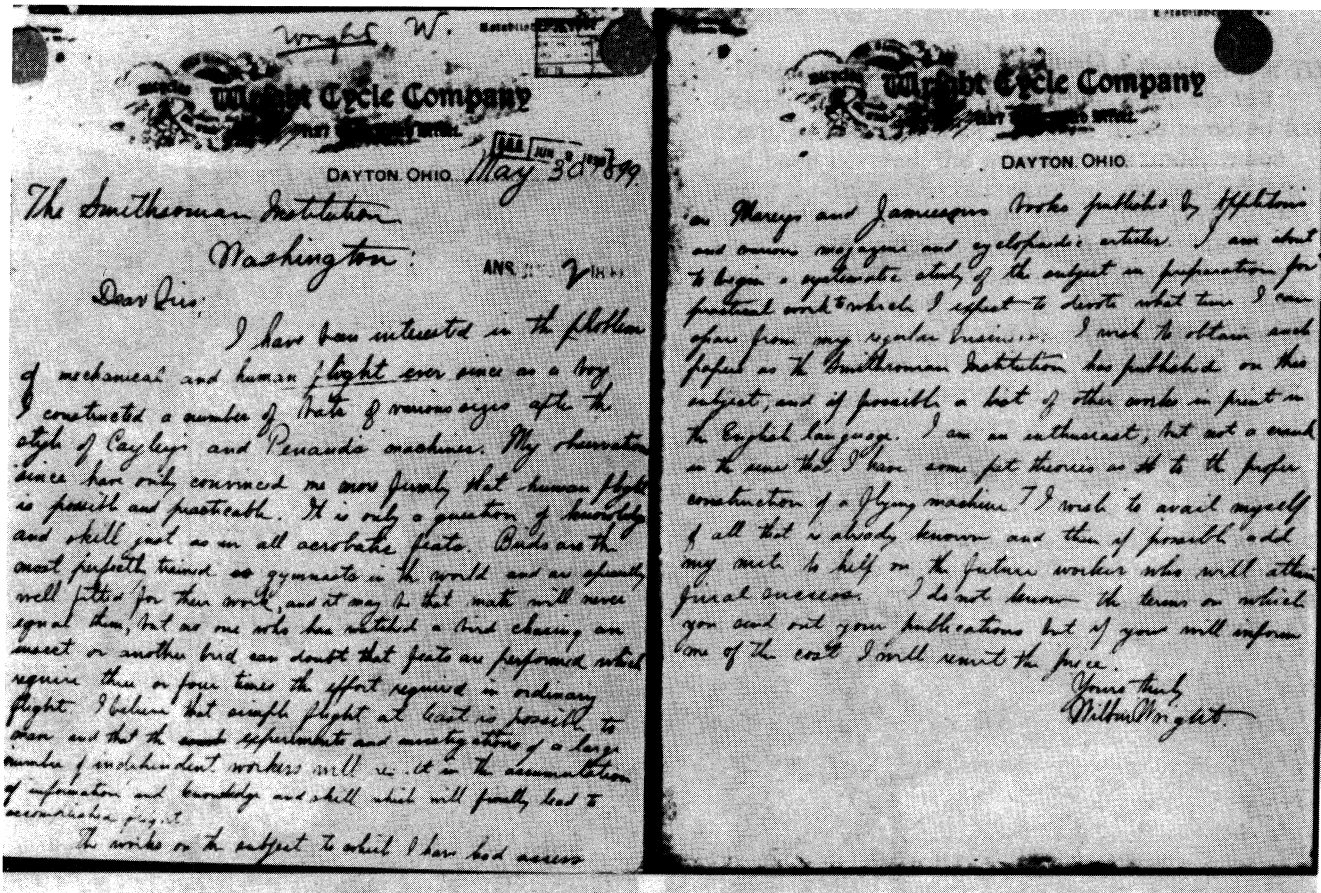
pilot, aeronautical engineer or in any other profession can sit back, as I do, and thank the many pioneers of aeronautics and astronautics for the marvelous progress accomplished in the movement of mankind and his possessions on this earth and beyond. Tomorrow, I'll be flying in a commercial airliner from Washington to San Antonio—a flight of only a few hours. I'll be lecturing to a group about famous aircraft. As I take my seat in the airplane, I'll look about at the other passengers. They'll be reading, or chatting, or snoozing. For myself, I will have entered that airplane with a reverence and gratitude only somewhat less than that with which I enter church because I am thanking the Bountiful Lord for His gifts of mind and hands and eyes and all that mankind is, whereby we have learned to fly to the outermost parts of America, and the world, and forth into space. All this and more to come within the span of a lifetime.

Washington, D.C. December 1986



Wilbur Wright flying at Ft. Myer, Virginia. The aircraft is commonly known as the Signal Corps Flyer. July 1909.

Wilbur Wright's Letter to the Smithsonian Institution



Dayton, May 30, 1899

I have been interested in the problem of mechanical and human flight ever since as a boy I constructed a number of bats of various sizes after the style of Cayley's and Pénaud's machines. My observations since have only convinced me more firmly that human flight is possible and practicable. It is only a question of knowledge and skill just as in all acrobatic feats. Birds are the most perfectly trained gymnasts in the world and are specially well fitted for their work, and it may be that man will never equal them, but no one who has watched a bird chasing an insect or another bird can doubt that feats are performed which require three or four times the effort required in ordinary flight. I believe that simple flight at least is possible to man and that the experiments and investigations of a large number of independent workers will result in the accumulation of information, knowledge and skill which will finally lead to accomplished flight.

The works on the subject to which I have had access are Marey's and Jamieson's books published by Appleton's and various magazine and cyclopaedic articles. I am 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. I wish to obtain 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. I am an enthusiast, but not a crank in the sense that I have some pet theories as to the proper construction of a flying machine. I wish to avail myself of all that is already known and then if possible add my mite to help on the future worker who will attain final success. I do not know the terms on which you send out your publications but if you will inform me of the cost I will remit the price.

“Men of Genius”

Orville Wright
(1871–1948)



Wilbur Wright
(1867–1912)



“It is therefore incontestably the Wright brothers alone who resolved, in its entirety, the problem of human mechanical flight . . . Men of genius—erudite, exact in their reasoning, hard workers, outstanding experimenters, and unselfish . . . They changed the face of the globe.”

CHARLES DOLLFUS

This is Orville Wright’s own account of the world’s first powered, sustained and controlled flight. The article was published ten years after the Wright brothers had made that first flight, appearing in the December 1913 issue of the American

aviation journal, *Flying* and *The Aero Club of America Bulletin*. Because of the significance of this primary account of the events and activities surrounding that epochal achievement, it is reprinted in its entirety.

How We Made The First Flight

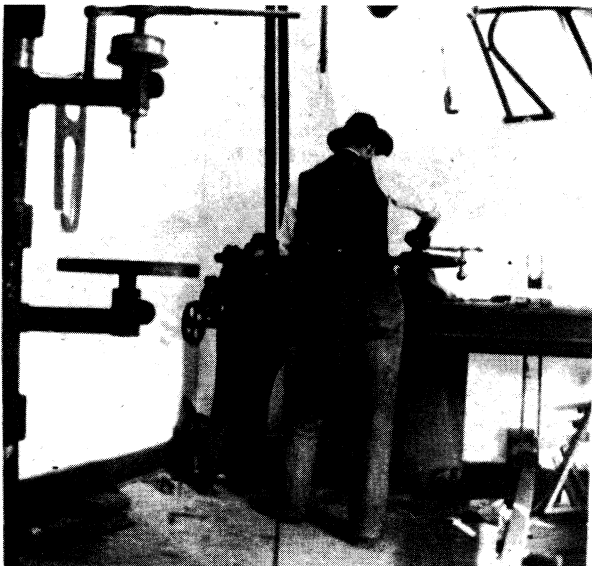
by Orville Wright

The flights of the 1902 glider had demonstrated the efficiency of our system for maintaining equilibrium, and also the accuracy of the laboratory work upon which the design of the glider was based. We then felt that we were prepared to calculate in advance the performance of machines with a degree of accuracy that had never been possible with the data and tables possessed by our predecessors. Before leaving camp in 1902 we were already at work on the general design of a new machine which we proposed to propel with a motor.

Immediately upon our return to Dayton, we wrote to a number of automobile and motor builders, stating the purpose for which we desired a motor, and asking whether they could furnish one that would develop eight-brake horse power, with a weight complete not exceeding 200 pounds. Most of the companies answered that they were too busy with their regular business to undertake the building of such a motor for us; but one company replied that they had motors rated at 8 h.p. according to the French system of ratings, which weighed only 135 pounds, and that if we thought this motor would develop enough power for our purpose, they would be glad to sell us one. After an examination of the particulars of this motor, from which we learned that it had but a single cylinder

of 4 inch bore and 5 inch stroke, we were afraid that it was much overrated. Unless the motor would develop a full 8 brake horse power, it would be useless for our purpose.

Finally we decided to undertake the building of the motor ourselves. We estimated that we could make one of four cylinders with 4 inch bore and 4 inch stroke, weighing not over two hundred pounds, including all accessories. Our only experience up to that time in the building of gasoline motors had been in the construction of an air-cooled motor, 5 inch bore and 7 inch stroke, which was used to run the machinery of our small workshop. To be certain that four cylinders of the size we had adopted (4" x 4") would develop the necessary 8 horse power, we first fitted them into a temporary frame



Wilbur Wright in the shop of the Wright Cycle Company, 1897



The Wright Cycle Company, Dayton, Ohio

of simple and cheap construction. In just six weeks from the time the design was started, we had the motor on the block testing its power. The ability to do this so quickly was largely due to the enthusiastic and efficient services of Mr. C.E. Taylor, who did all the machine work in our shop for the first as well as the succeeding experimental machines. There was no provision for lubricating either cylinders or bearings while this motor was running. For that reason it was not possible to run it more than a minute or two at a time. In these short tests the motor developed about nine horse

power. We were then satisfied that, with proper lubrication and better adjustments, a little more power could be expected. The completion of the motor according to drawing was, therefore, proceeded with at once.

WEIGHT AND THRUST

While Mr. Taylor was engaged with this work, Wilbur and I were busy in completing the design of the machine itself. The preliminary tests of the motor having convinced us that more than 8 horse power would be secured, we felt free to add enough weight to build a more substantial machine than we had originally contemplated.

Our tables of air pressures and our experience in flying with the 1902 glider enabled us, we thought, to calculate exactly the thrust necessary to sustain the machine in flight. But to design a propeller that would give this thrust with the power we had at our command, was a matter we had not as yet seriously considered. No data on air propellers was available, but we had always understood that it was not a difficult matter to secure an efficiency of 50% with marine propellers. All that would be necessary would be to learn the theory of the operation of marine propellers from books on marine engineering, and then substitute air pressures for water pressures. Accordingly we secured several such books from the Dayton Public Library. Much to our surprise, all the formulae on propellers contained in these books were of an empirical nature. There was no way of adapting them to calculations of aerial propellers. As we could afford neither the time nor expense of a long series of experiments to find by trial a propeller suitable for our machine, we decided to rely more on theory than was the practice with marine engineers.

It was apparent that a propeller was simply an aeroplane travelling in a spiral course. As we could calculate the effect of an aeroplane travelling in a straight course, why should we not be able to calculate the effect of one travelling in a spiral course? At first glance this does not appear difficult, but on further consideration it is hard to find even a point from which to make a start; for nothing stands still for a moment. The thrust depends upon the speed and the angle at which the blade strikes the air; the angle at which the blade strikes the air depends upon the speed at which the propeller is turning, the speed the machine is travelling forward, and the speed at which the air is slipping backward; the slip of the air backwards depends upon the thrust exerted by the propeller, and the amount of air acted upon. When any one of these changes, it changes all the rest, as they are all interdependent upon one another. But these are only a few of the many factors that must be considered and determined in calculating and designing propellers. Our minds became so obsessed with it that we could do little other work. We engaged in innumerable discussions, and often after an hour or so of heated argument, we would discover that we were as far from agreement as when we started, but that both had changed to the other's original position in the discussion. After a couple of months of this study and discussion, we were able to follow the various reactions in their intricate relations long enough to begin to understand them. We realized that the thrust generated by a propeller when standing stationary was no indication of the thrust when in motion. The only way to really test the efficiency of a propeller would be to actually try it on the machine.

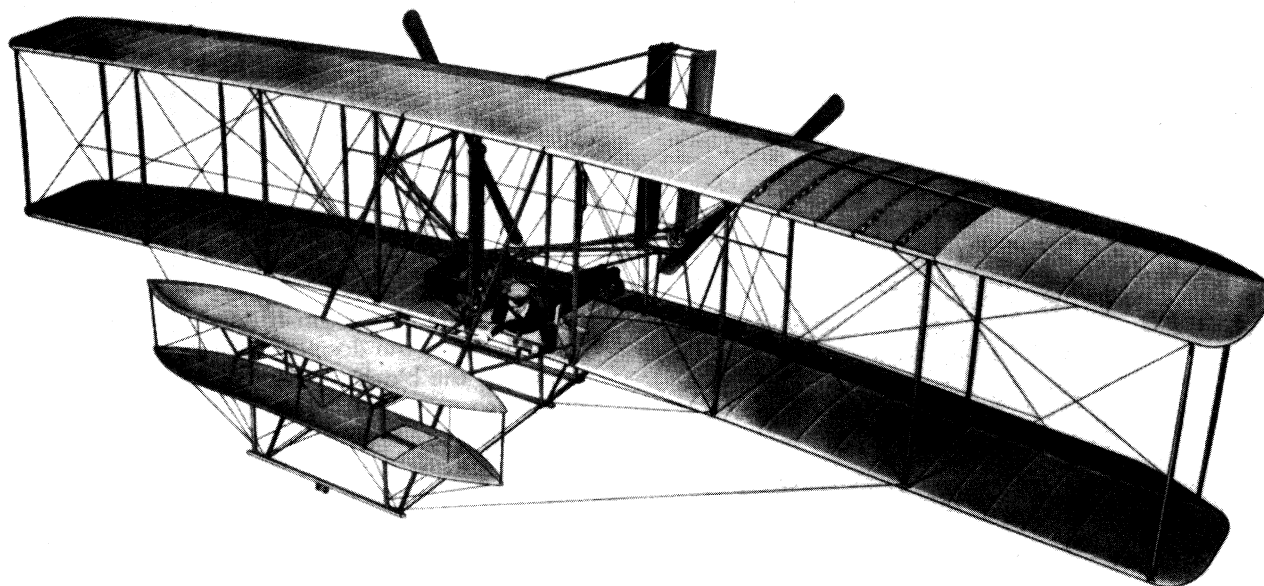
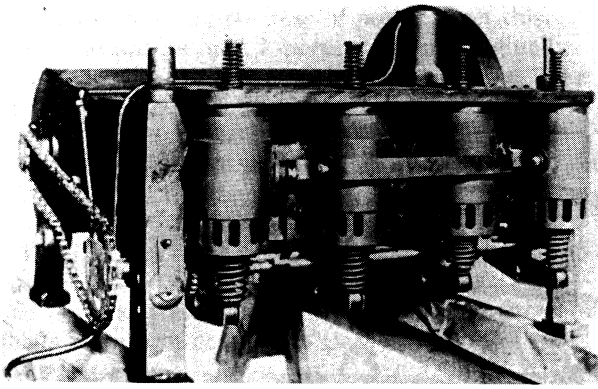
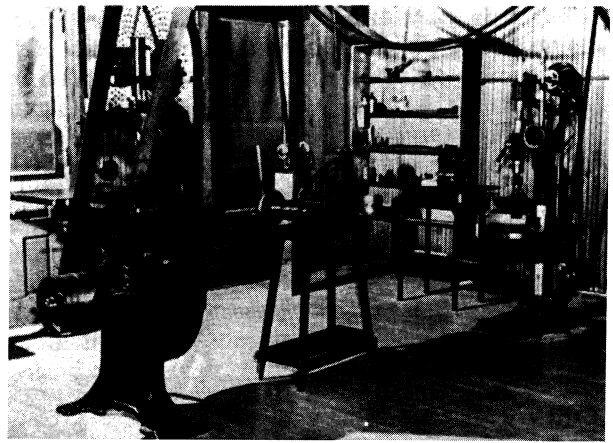


Illustration of the 1903 Wright Flyer by Robert McLarren and James Fisher.



The power plant the Wright brothers developed for their 1903 Flyer. It was a four-cylinder piston engine weighing 179 pounds, producing 12 horsepower at 1,090 revolutions per minute. The engine drove 2 propellers.

One of the two wooden propellers used in the 1903 Flyer. The Wright brothers developed and produced these highly efficient propellers after much careful research.



The drill and lathe were powered by a gasoline engine built by the brothers.

For two reasons we decided to use two propellers. In the first place we could, by the use of two propellers, secure a reaction against a greater quantity of air, and at the same time use a larger pitch angle than was possible with one propeller; and in the second place by having the propellers turn in opposite direction, the gyroscopic action of one would neutralize that of the other. The method we adopted of driving the propellers in opposite directions by means of chains is now too well known to need description here. We decided to place the motor to one side of the man, so that in case of a plunge head first, the motor could not fall upon him. In our gliding experiments we had had a number of experiences in which we had landed upon one wing, but the crushing of the wing had absorbed the shock, so that we were not uneasy about the motor in case of a landing of that kind. To provide against the machine rolling over forward in landing, we designed skids like sled runners, extending out in front of the main surfaces. Otherwise the general construction and operation of the machine was to be similar to that of the 1902 glider.

THE POWER PLANT

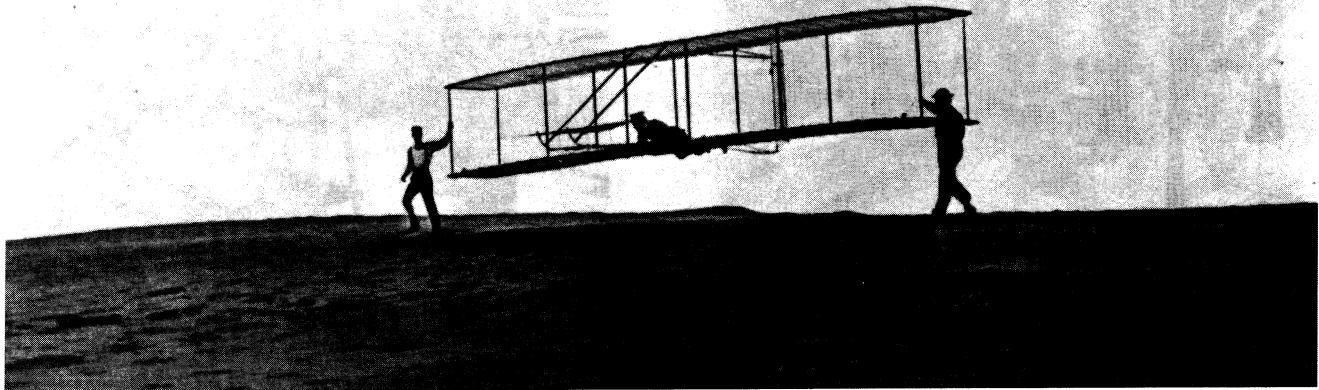
When the motor was completed and tested, we found that it would develop 16 horse power for a few seconds, but that the power rapidly dropped till, at the end of a minute, it was only 12 horse power. Ignorant of what a motor of this size ought to develop, we were greatly pleased with its performance. More experience showed us that we did not get one-half of the power we should have had.

With twelve horse power at our command, we considered that we could permit the weight of the machine with operator to rise to 750 or 800 pounds, and still have as much surplus power as we had originally allowed for in the first estimate of 550 pounds.

Before leaving for our camp at Kitty Hawk we tested the chain drive for the propellers in our shop at Dayton, and found it satisfactory. We found, however, that our first propeller shafts, which were constructed of heavy gauge steel tubing, were not strong enough to stand the shocks received from a gasoline motor with light fly wheel, although they would have been able to transmit three or four times the power uniformly applied. We therefore built a new set of shafts of heavier tubing, which we tested and thought to be abundantly strong.

FLIGHT TESTING AT KITTY HAWK

We left Dayton, September 23, and arrived at our camp at Kill Devil Hill on Friday, the 25th. We found there provisions and tools, which had been shipped by freight several weeks in advance. The building, erected in 1901 and enlarged in 1902, was found to have been blown by a storm from its foundation posts a few months previously. While we were awaiting the arrival of the shipment of machinery and parts from Dayton, we were busy putting the old building in repair, and erecting a new building to serve as a workshop for assembling and housing the new machine.



Orville Wright being launched by Wilbur (left) and Dan Tate for a glide in the modified 1902 glider. Kitty Hawk, N.C. October 1902.

Just as the building was being completed, the parts and material for the machines arrived simultaneously with one of the worst storms that had visited Kitty Hawk in years. The storm came on suddenly, blowing 30 to 40 miles an hour. It increased during the night, and the next day was blowing over seventy-five miles an hour. In order to save the tar-paper roof, we decided it would be necessary to get out in this wind and nail down more securely certain parts that were especially exposed. When I ascended the ladder and reached the edge of the roof, the wind caught under my large coat, blew it up around my head and bound my arms till I was perfectly helpless. Wilbur came to my assistance and held down my coat while I tried to drive the nails. But the wind was so strong I could not guide the hammer and succeeded in striking my fingers as often as the nails.

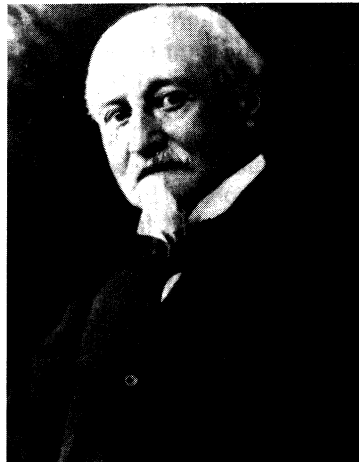
The next three weeks were spent in setting the motor-machine together. On days with more favourable winds we gained additional experience in handling a flyer by gliding with the 1902 machine, which we had found in pretty fair condition in the old building, where we had left it the year before.

Mr. Chanute and Dr. Spratt, who had been guests in our camp in 1901 and 1902, spent some time with us, but neither one was able to remain to see the test of the motor-machine, on account of the delays caused by trouble which developed in the propeller shafts.

CHANUTE'S EXPERIENCE

While Mr. Chanute was with us, a good deal of time was spent in discussion of the mathematical calculations upon which we had based our machine.

He informed us that, in designing machinery, about 20 percent was usually allowed for the loss in the transmission of power. As we had allowed only 5 percent, a figure we had arrived at by some crude measurements of the friction of one of the chains

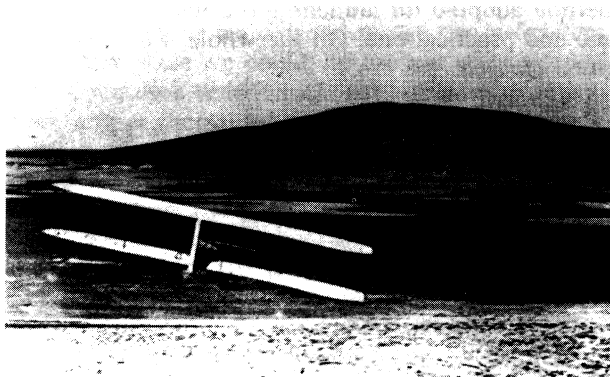


Octave Chanute (1830-1910)

when carrying only a very light load, we were much alarmed. More than the whole surplus in power allowed in our calculations would, according to Mr. Chanute's estimate, be consumed in friction in the driving chains. After Mr. Chanute's departure, we suspended one of the drive chains over a sprocket, hanging bags of sand on either side of the sprocket of a weight approximately equal to the pull that would be exerted on the chains when driving the propellers. By measuring the extra amount of weight needed on one side to lift the weight on

the other, we calculated the loss in transmission. This indicated that the loss of power from this source would be only 5 percent, as we originally estimated. But while we could see no serious error in this method of determining the loss, we were very uneasy until we had a chance to run the propellers with the motor to see whether we could get the estimated number of turns.

The first run of the motor on the machine developed a flaw in one of the propeller shafts which had not been discovered in the test at Dayton. The shafts were sent at once to Dayton for repair and were not received again until November 20, having been gone two weeks. We immediately put them in the machine and made another test. A new trouble developed. The sprockets which were screwed on the shafts, and locked with nuts of opposite thread, persisted in coming loose. After many futile attempts to get them fast, we had to give it up and went to bed much discouraged. After a night's rest we got up in better spirits and resolved to try again.



Wilbur Wright in same glider making a right turn. This glider is the first winged vehicle capable of full control in roll, pitch, and yaw axis.

While in the bicycle business we had become well acquainted with the use of hard tire cement for fastening tires on the rims. We had once used it successfully in repairing a stop watch after several watchsmiths had told us it could not be repaired. If tire cement was good for fastening the hands on a stop watch, why should it not be good for fastening the sprockets on the propeller shaft of a flying machine? We decided to try it. We heated the shafts and sprockets, melted cement into the threads, and screwed them together again. This trouble was over. The sprockets stayed fast.

Just as the machine was ready for test, bad weather set in. It had been disagreeably cold for several weeks, so cold that we could scarcely work on the machine some days. But now we began to have rain and snow, and a wind of 25 to 30 miles

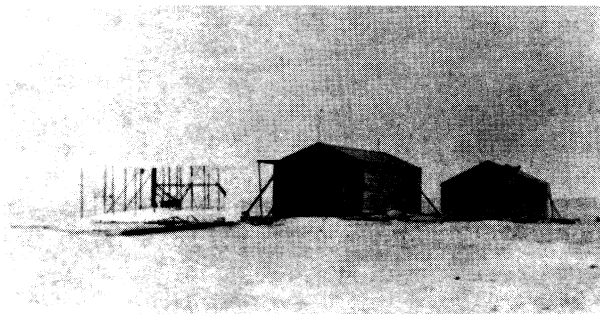
blew for several days from the north. While we were being delayed by the weather we arranged a mechanism to measure automatically the durations of a flight from the time the machine started to move forward to the time it stopped, the distance travelled through the air in that time, and the number of revolutions made by the motor and propeller. A stop watch took the time; an anemometer measured the air travelled through; and a counter took the number of revolutions made by the propellers. The watch, anemometer and revolution counter were all automatically started and stopped simultaneously. From data thus obtained we expected to prove or disprove the accuracy of our propeller calculations.

PROPELLER SHAFT TROUBLE

On November 28, while giving the motor a run indoors, we thought we again saw something wrong with one of the propeller shafts. On stopping the motor, we discovered that one of the tubular shafts had cracked!

Immediate preparation was made for returning to Dayton to build another set of shafts. We decided to abandon the use of tubes, as they did not afford enough spring to take up the shocks of premature or missed explosions of the motor. Solid tool-steel shafts of smaller diameter than the tubes previously used were decided upon. These would allow a certain amount of spring. The tubular shafts were many times stronger than would have been necessary to transmit the power of our motor if the strains upon them had been uniform. But the large hollow shafts had no spring in them to absorb the unequal strains.

Wilbur remained in camp while I went to get the new shafts. I did not get back to camp again till Friday, the 11th of December. Saturday afternoon the machine was again ready for trial, but the wind was so light, a start could not have been made from level ground with the run of only sixty feet permitted by our monorail track. Nor was there enough time before day to take the machine to one of the



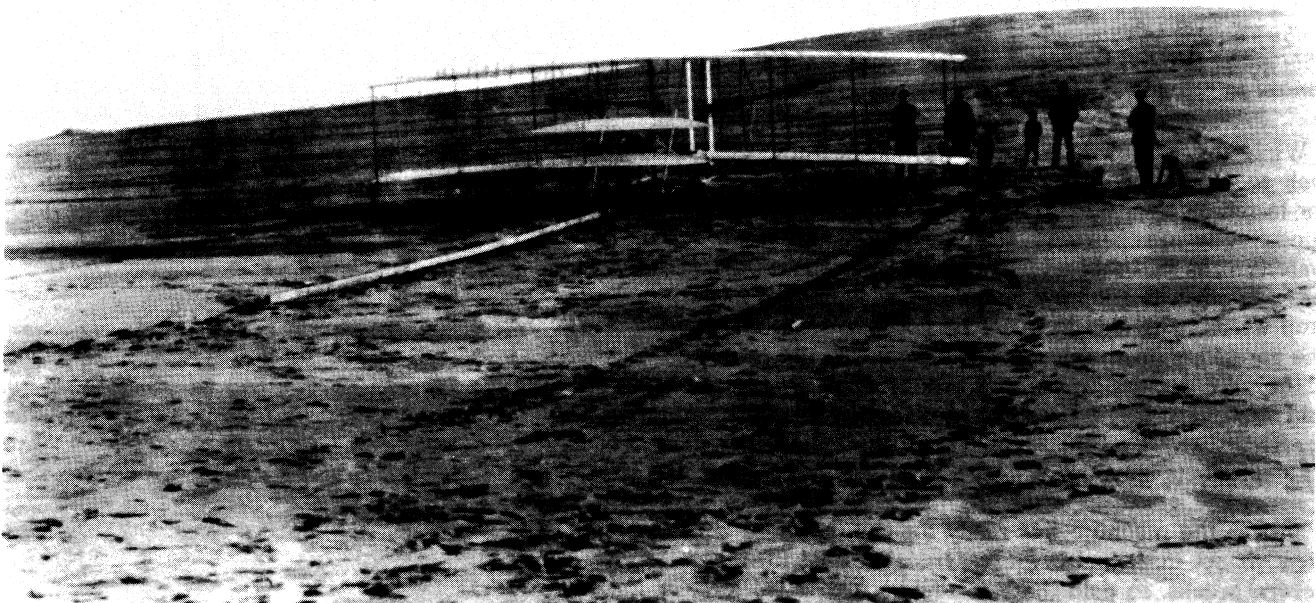
The 1903 machine and camp buildings. November 1903.

hills, where, by placing the track on a steep incline, sufficient speed could be secured for starting in calm air.

Monday, December 14th, was a beautiful day, but there was not enough wind to enable a start to be made from the level ground about camp. We therefore decided to attempt a flight from the side of the big Kill Devil Hill. We had arranged with the members of the Kill Devil Life Saving Station, which was located a little over a mile from our camp, to inform them when we were ready to make the first trial of the machine. We were soon joined by J.T. Daniels, Robert Westcott, Thomas Beacham, W.S. Dough and Uncle Benny O'Neal, of the Station, who helped us get the machine to the hill, a quarter mile away. We laid the track 150 feet up the side of the hill on a 9 degree slope. With the slope of the track, the thrust of the propellers and the machine starting directly into the wind, we did not anticipate any trouble in getting up flying speed on the 60 foot monorail track. But we did not feel certain the operator could keep the machine balanced on the track.

THE FIRST ATTEMPT

When the machine had been fastened with a wire to the track, so that it could not start until released by the operator, and the motor had been run to make sure that it was in condition, we tossed up a coin to decide who should have the first trial. Wilbur won. I took a position at one of the wings, intending to help balance the machine as it ran down the rack. But when the restraining wire was slipped, the machine started off so quickly I could stay with it only a few feet. After a 35- to 40-foot run, it lifted from the rail. But it was allowed to turn up too much. It climbed a few feet, stalled, and then settled to the ground near the foot of the hill, 105 feet below. My stop watch showed that it had been in the air just $3\frac{1}{2}$ seconds. In landing the left wing touched first. The machine swung around, dug the skids into the sand and broke one of them. Several other parts were also broken, but the damage to the machine was not serious. While the test had shown nothing as to whether the power of the motor was sufficient to keep the machine up, since the landing was made many feet below the starting point, the experiment had demonstrated that the method adopted for launching the machine was a safe and practical one. On the whole, we were much pleased.



The first attempt at flight. Wilbur Wright prepares to take off, poses with spectators. December 14, 1903

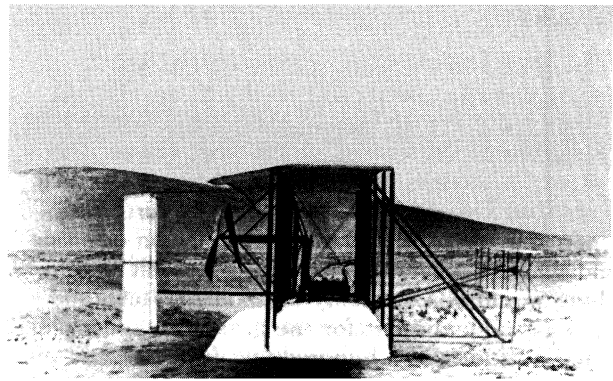
Two days were consumed in making repairs, and the machine was not ready again till late in the afternoon of the 16th. While we had it out on the track in front of the building, making the final adjustments, a stranger came along. After looking at the machine a few seconds he inquired what it was. When we told him it was a flying machine he asked whether we intended to fly it. We said we did, as soon as we had a suitable wind. He looked at it several minutes longer and then, wishing to be courteous, remarked that it looked as if it would fly, if it had a "suitable wind." We were much amused, for, no doubt, he had in mind the recent 75-mile gale when he repeated our words, "a suitable wind!"

During the night of December 16, 1903, a strong cold wind blew from the north. When we arose on the morning of the 17th, the puddles of water, which had been standing about the camp since the recent rains, were covered with ice. The wind had a velocity of 10 to 12 meters per second (22 to 27 miles an hour). We thought it would die down before long, and so remained indoors the early part of the morning. But when ten o'clock arrived, and the wind was as brisk as ever, we decided that we had better get the machine out and attempt a flight. We hung out the signal for the men of the Life Saving Station. We thought that by facing the flyer into a strong wind, there ought to be no trouble in launching it from the level ground about camp. We realized the difficulties of flying in so high a wind, but estimated that the added dangers in flight would be partly compensated for by the slower speed in landing.

FINAL PREPARATIONS

We laid the track on a smooth stretch of ground about one hundred feet north of the new building. The biting cold wind made work difficult, and we had to warm up frequently in our living room, where we had a good fire in an improvised stove made of a large carbide can. By the time all was ready, J.T. Daniels, W.S. Dough and A.D. Etheridge, members of the Kill Devil Life Saving Station; W.C. Brinkley of Manteo, and Johnny Moore, a boy from Nags Head, had arrived.

We had a "Richard" hand anemometer with which we measured the velocity of the wind. Measurements made just before starting the first flight showed velocities of 11 to 12 meters per second, or 24 to 27 miles per hour. Measurements made just before the last flight gave between 9 and 10 meters per second. One made just after showed a little over 8 meters. The records of the Government Weather Bureau at Kitty Hawk gave the velocity of the wind between the hours of 10:30 and 12 o'clock, the time during which the four flights were made, as averaging 27 miles at the



The Wright brothers built the famous Wright Flyer in Dayton, Ohio during the summer of 1903. They returned to Kitty Hawk with the aircraft in September. Flight trials began in December. View of Flyer from right side. View of Flyer from the front.

time of the first flight and 24 miles at the time of the last.

AUDACITY—AND CALCULATION

With all the knowledge and skill acquired in thousands of flights in the last ten years, I would hardly think today of making my first flight on a strange machine in a twenty-seven mile wind, even if I knew that the machine had already been flown and was safe. After these years of experience I look with amazement upon our audacity in attempting flights with a new and untried machine under such circumstances. Yet faith in our calculations and the design of the first machine, based upon our tables of air pressures, secured by months of careful laboratory work, and confidence in our system of control developed by three years of actual experiences in balancing gliders in the air had convinced us that the machine was capable of lifting and maintaining itself in the air, and that, with a little practice, it could be safely flown.

Wilbur, having used his turn in the unsuccessful attempt on the 14th, the right to the first trial now belonged to me. After running the motor a few minutes to heat it up, I released the wire that held the machine to the track, and the machine started forward in the wind. Wilbur ran at the side of the machine, holding the wing to balance it on the track. Unlike the start on the 14th, made in a calm, the machine, facing a 27-mile wind, started very slowly. Wilbur was able to stay with it till it lifted from the track after a forty-foot run. One of the Life Saving men snapped the camera for us, taking a picture just as the machine had reached the end of the track and had risen to a height of about two feet. The slow forward speed of the machine over the ground is clearly shown in the picture by Wilbur's attitude. He stayed along beside the machine without any effort.

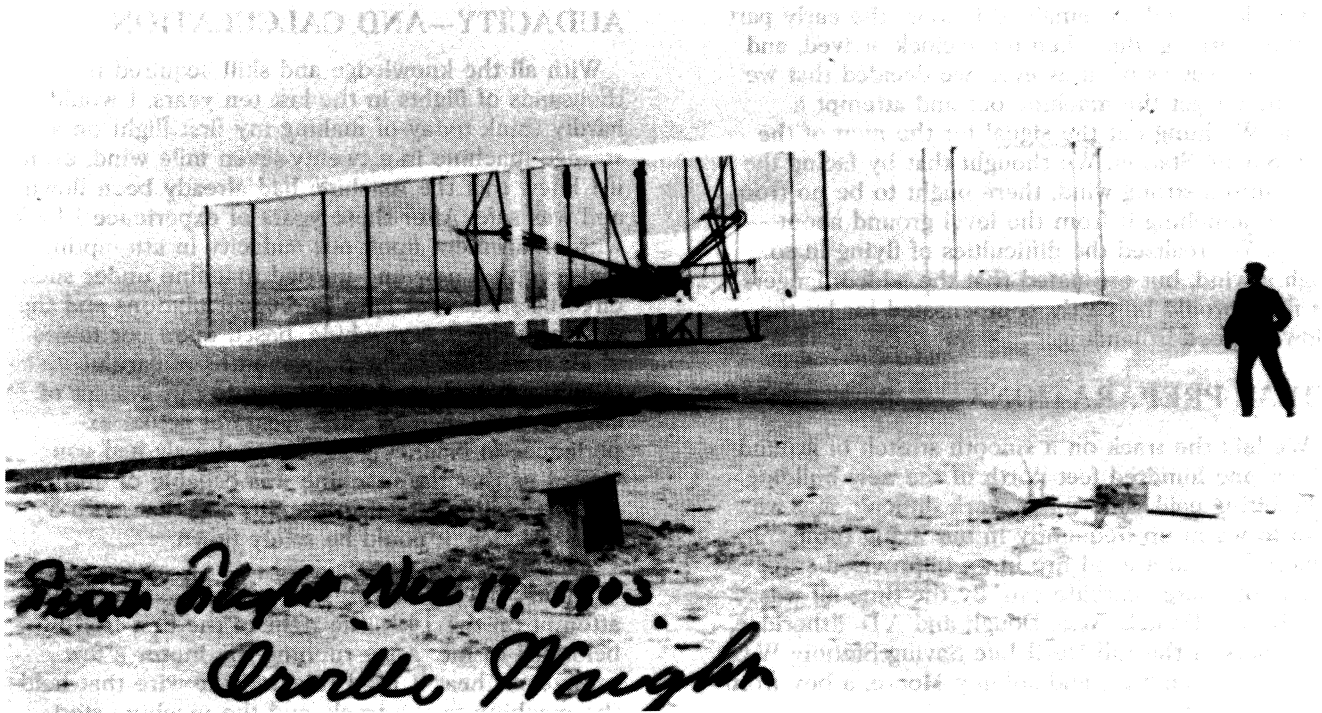
FLIGHT

The course of the flight up and down was exceedingly erratic, partly due to the irregularity of the air, and partly to lack of experience in handling this machine. The control of the front rudder was difficult on account of its being balanced too near the center. This gave it a tendency to turn itself when started; so that it turned too far on one side and then too far on the other. As a result the machine would rise suddenly to about ten feet, and then as suddenly dart for the ground. A sudden dart when a little over a hundred feet from the end of the track, or a little over 120 feet from the point at which it rose into the air, ended the flight. As the velocity of the wind was over 35 feet per second and the speed of the machine over the ground against this wind ten feet per second, the speed of the machine relative to the air was over 45

feet per second, and the length of the flight was equivalent to a flight of 540 feet made in calm air. This flight lasted only 12 seconds, but it was nevertheless the first in the history of the world in which a machine carrying a man had raised itself by its own power into the air in full flight, had sailed forward without reduction of speed and had finally landed at a point as high as that from which it started.

With the assistance of our visitors we carried the machine back to the track and prepared for another flight. The sting-wind, however, had chilled us all through, so that before attempting a second flight, we all went to the building again to warm up. Johnny Ward, seeing under the table a box filled with eggs, asked one of the Station men where we got so many of them. The people of the neighborhood eke out a bare existence by catching

The Dawn of The Era of Powered Flight

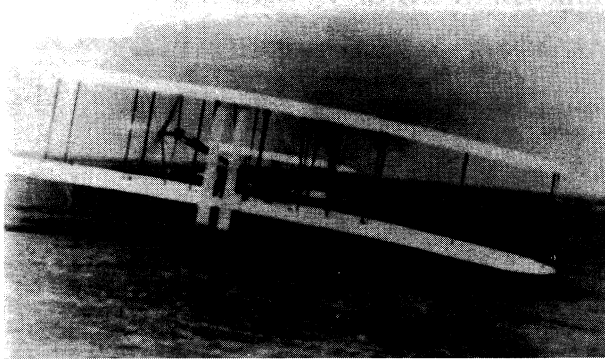


THE DAWN OF THE ERA OF POWERED FLIGHT

The first manned flight in history: December 17, 1903. At 10:35 a.m., Orville Wright takes off into a 27 mph wind. The distance covered was 120 feet; time aloft was 12 seconds. Wilbur is seen at right. Picture was taken with Orville's camera by John T. Daniels.

fish during the short fishing season, and their supplies of other articles of food are limited. He had probably never seen so many eggs at one time in his whole life. The one addressed jokingly asked him whether he hadn't noticed the small hen running about the outside of the building. "That chicken lays eight to ten eggs a day!" Ward, having just

seen a piece of machinery lift itself from the ground and fly, a thing at that time considered as impossible as perpetual motion, was ready to believe nearly anything. But after going out and having a good look at the wonderful fowl, he returned with the remark, "It's only a common looking chicken!"

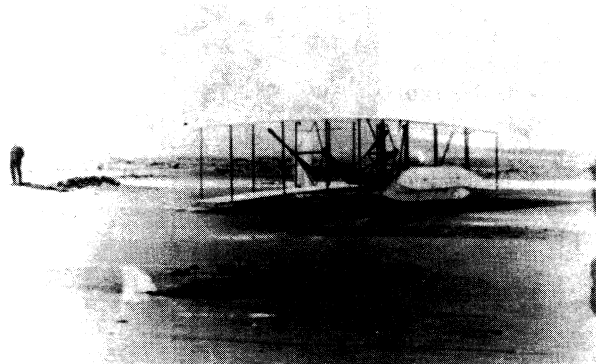


Three more flights were made on December 17. Here, on the third flight of the day, Orville skims over the dunes, flying a distance of 200 feet in 15 seconds.

THE SECOND AND THIRD FLIGHTS

At twenty minutes after eleven Wilbur started on the second flight. The course of this flight was much like that of the first, very much up and down. The speed over the ground was somewhat faster than that of the first flight, due to the lesser wind. The duration of the flight was less than a second longer than the first, but the distance covered was about seventy-five feet greater.

Twenty minutes later the third flight started. This one was steadier than the first one an hour before. I was proceeding along pretty well when a sudden gust from the right lifted the machine up twelve to fifteen feet and turned it up sidewise in an alarming manner. It began a lively sidling off to the left. I warped the wings to try to recover the lateral balance and at the same time pointed the machine down to reach the ground as quickly as possible. The lateral control was more effective than I had imagined and before I reached the ground the right

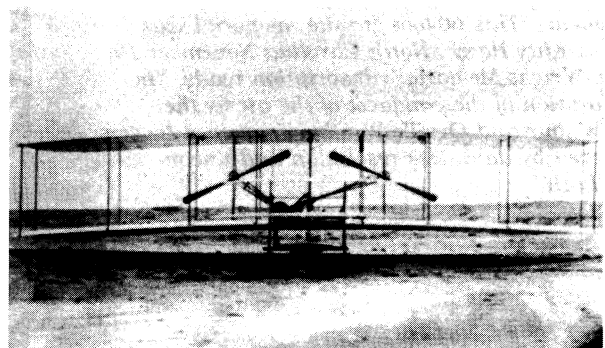


The fourth flight was the longest—852 feet in 59 seconds—with Wilbur Wright at the controls. It also resulted in minor damage to the elevator supports during a hard landing. shortly after this picture was taken, however, the machine was badly damaged by the gusty winds, ending flight testing for the year.

wing was lower than the left and struck first. The time of this flight was fifteen seconds and the distance over the ground a little over 200 feet.

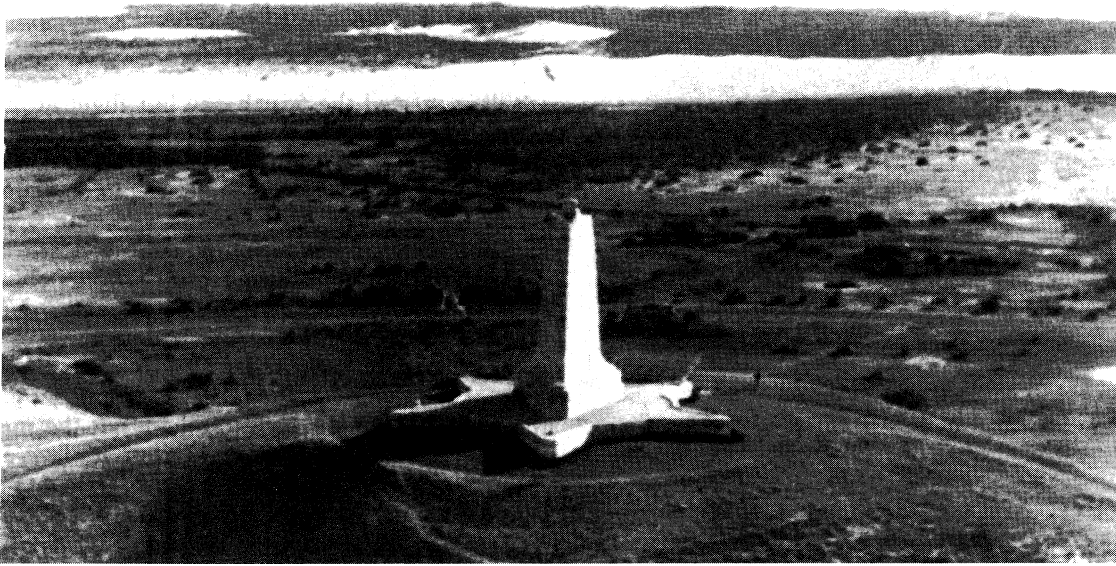
Wilbur started the fourth and last flight at just 12 o'clock. The first few hundred feet were up and down, as before, but by the time three hundred feet had been covered, the machine was under much better control. The course of the next four or five hundred feet had but little undulation. However, when out about eight hundred feet the machine began pitching again, and, in one of its darts downward, struck the ground. The distance over the ground was measured and found to be 852 feet; the time of the flight 59 seconds. The frame supporting the front rudder was badly broken, but the main part of the machine was not injured at all. We estimated that the machine could be put in condition for flight again in a day or two.

While we were standing about discussing this last flight, a sudden strong gust of wind struck the machine and began to turn it over. Everybody made a



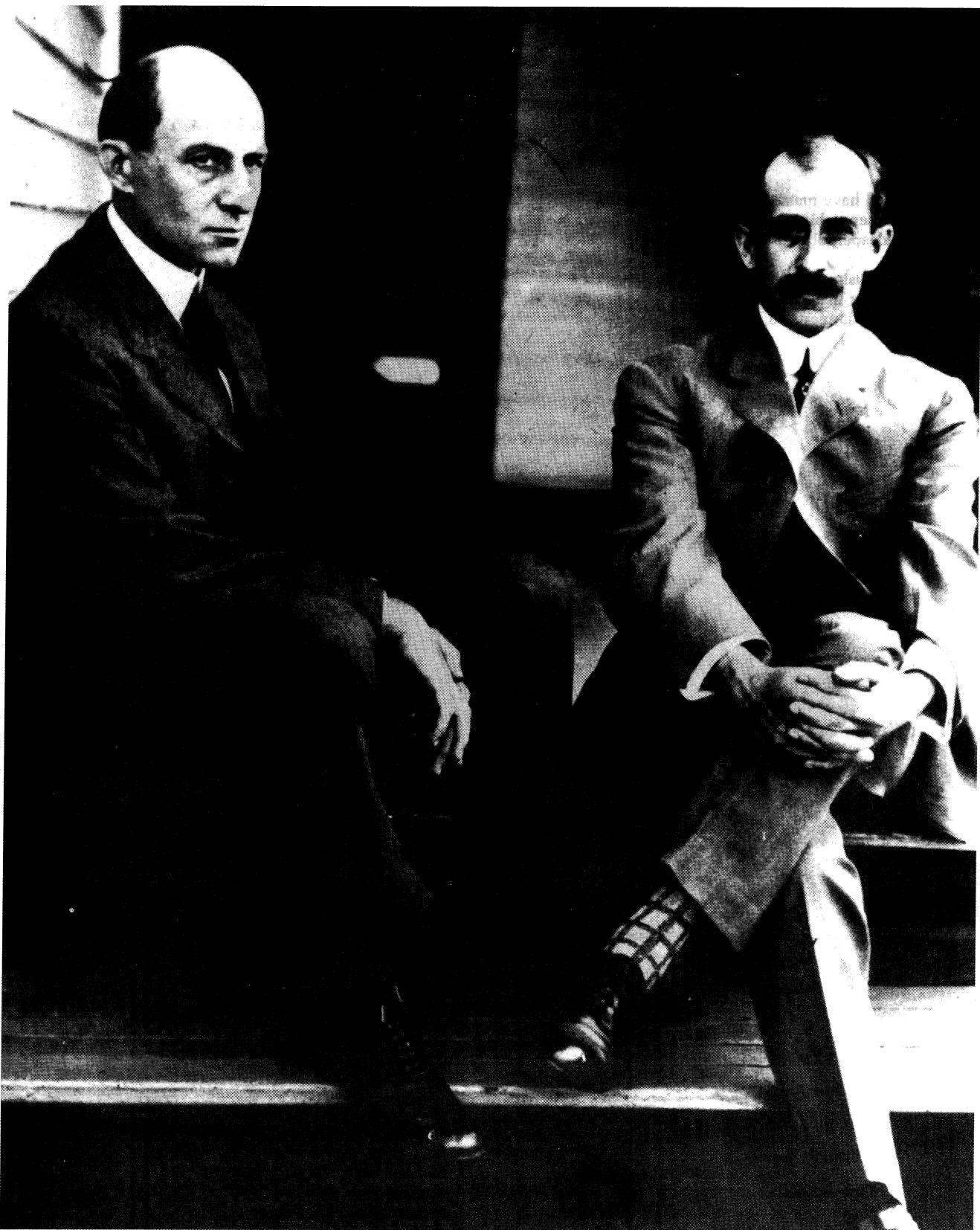
View of Flyer from the front.

rush for it. Wilbur, who was at one end, seized it in front, Mr. Daniels and I, who were behind, tried to stop it by holding to the rear uprights. All our efforts were in vain. The machine rolled over and over. Daniels, who had retained his grip, was carried along with it, and was thrown about head over heels inside of the machine. Fortunately he was not seriously injured, though badly bruised in falling about against the motor, chain guides, etc. The ribs in the surface of the machine were broken, the motor injured and the chain guides badly bent, so that all possibility of further flights with it for that year were at an end.



On March 2, 1927, President Calvin Coolidge signed legislation providing for the erection of a monument at Kill Devil Hill in honor of the Wright brothers' accomplishments. This 60-foot granite memorial was unveiled at Kitty Hawk, North Carolina November 19, 1932. The Wright Memorial's inscription reads, "In commemoration of the conquest of the air by the brothers Wilbur and Orville Wright. Conceived by genius, achieved by dauntless resolution and unconquerable faith."





Wilbur and Orville Wright, 1912

“Neither could have mastered the problem alone.
As inseparable as twins, they are
indispensable to each other.”

Bishop Milton Wright,
Father of Wilbur and Orville.
January 16, 1904.



“From the time we were little children my brother Orville and myself lived together. played together, worked together and, in fact, thought together. We usually owned all of our toys in common, talked over our thoughts and aspirations so that nearly everything that was done in our lives has been the result of conversations, suggestions and discussions between us.”

Wilbur Wright
April 3, 1912

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