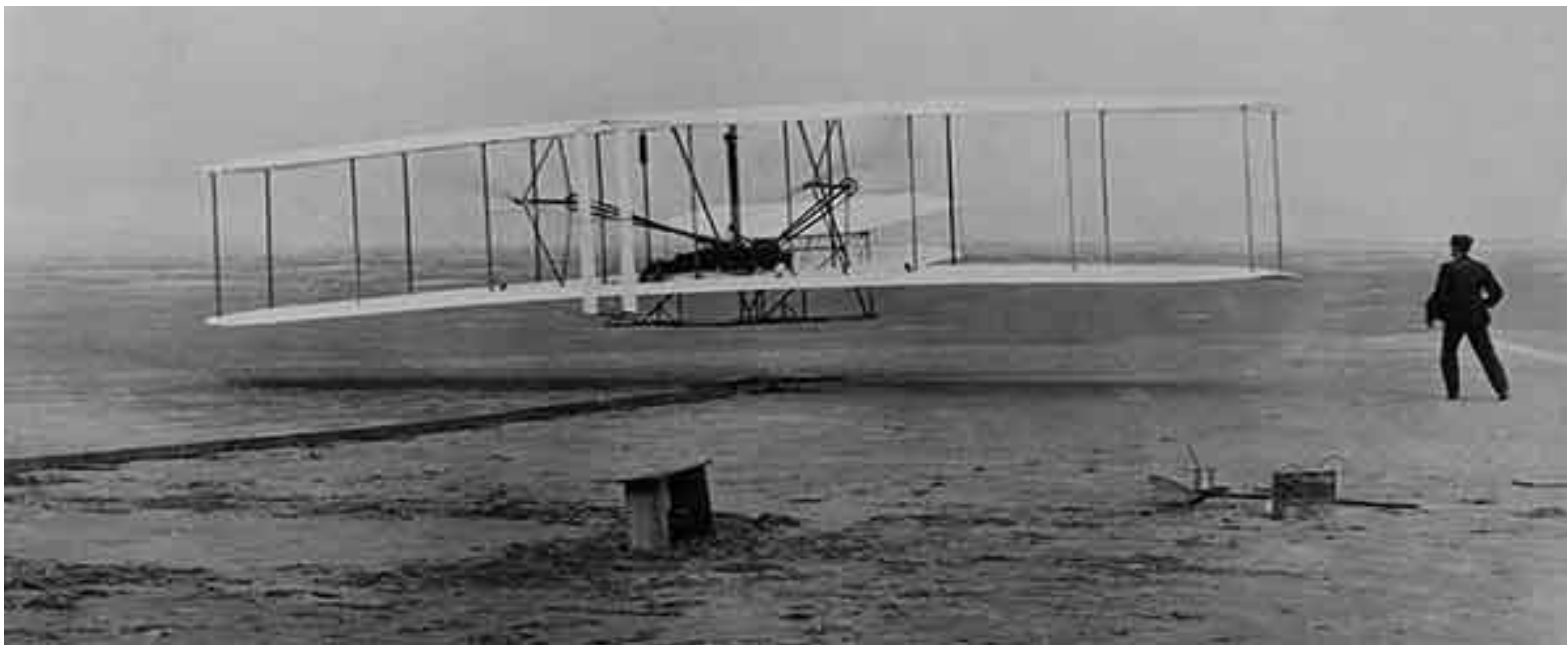


Those Crazy Young Men...

How the Wright Brothers Invented the Aero-plane

by Gary T. Palamara



The First Flight - 10:35 AM - December 17, 1903

On a cold December morning in 1903, two brothers from Dayton, Ohio stood atop a sandy hill near the shores of North Carolina and flipped a coin. It was hoped the toss would propel the winner into the history books by becoming the first person to ascend into the heavens in a powered, heavier-than-air vehicle and return safely back to earth. It was December 14, and Wilbur Wright took his position amidst the twin propellers, bicycle chain and 12 horsepower gasoline engine. Tethered to ground, on top of wooden rails, the biplane's homebuilt engine spun two counter-rotating propellers. At release, the vehicle slid down the ways as Wilbur's younger brother Orville ran along side, attempting to stabilize the biplanes' wing. The craft abruptly shot several feet into the air before crashing back to the ground. Though they traveled more than 100 feet, the entire event lasted only 3 ½ seconds. While the Wright brothers did not consider this to be an actual flight, nevertheless, they were pleased with their progress. Before starting to repair the craft, the Wrights sent a telegram to their father back in Ohio:

"Misjudgment at start reduced flight to hundred and twelve. Power and Control ample. Rudder only injured. Success assured. Keep quiet." 1

There had been great technological achievements before 1903, but there had never

been anything quite like the invention of the Aero-plane. As far back as Leonardo da Vinci, serious, learned men, had worked on the problem of manned flight, and had failed. Then in 1783, one hundred and twenty years before the Wright brothers, man soared into the heavens using gas filled balloons. While a balloon does achieve lift, forward motion and control would not come until the invention of the dirigible. The first crude attempts at horizontal control of a balloon were made in France, around 1852. One hundred years after the invention of the airplane, balloons and blimps still remain largely at the mercy of the wind.

Like many great inventors of their time, the Wright brothers were experimenters and entrepreneurs, as well as self-taught practical engineers. From the start of their journey, the brothers were humbled by the many knowledgeable and well known names that already littered the pathway to aerial success. Even the great Thomas Edison and Alexander Graham Bell had devoted considerable time and money, to solving the problems of manned flight, without success.

Wilbur and Orville Wright were two of five children born to Susan and Milton Wright. Milton Wright was a Minister in the United Brethren Church and that calling, meant the family traveled a great deal throughout the boys' childhood. Eventually, the Wright family would settle in the southwest Ohio community of Dayton, where Milton, would later become Bishop Wright.

Though neither had a formal high school diploma, the two Wright brothers were always learning and trying new things. As young adults they preferred the business world, to academic study. The first formal business operated by the Wright brothers was a small printing shop, located on the west side of their hometown of Dayton. Orville Wright built much of the machinery for the shop by hand. In 1889 the brothers expanded their business, by publishing a weekly newspaper, "*The West Side News*."

Bicycling was all the rage during the last half of the 1800s, and around 1892 the Wrights opened up a retail shop that catered to the new mode of transportation. Then, for a short while, the Wright brothers operated two companies, at the same time. With the increased success of the "Wright Cycle Company," eventually the printing shop was sold, so the brothers could devote all their energy to the sale of bicycles and supplies.

In 1895, the Wrights' focus began to shift again. After reading several accounts of European attempts at gliding, soon it was the lure of manned flight that held the interest and passion of the pair. But the new venture would be so fanciful, that no thought was given to profiting from it. Discovery alone would be the prime motivation for the Wrights to conquer flight.

Perhaps, the brothers' interest in flying had been sparked years before, when as small boys, a seed was unknowingly planted by their father. Bishop Wright had given them a rubber band powered toy "helicopter," inspired by the work of a young French Scientist named Alphonse Penaud. Within a short time, the brothers copied its design and made improvements.

After several more articles about gliding appeared in the local newspapers, the Wrights started thinking more seriously about taking on the challenge of manned flight. Around 1897, they began to gather as much technical information on the subject of flying as was available. Trips to the local public library however, yielded little in the way of assistance. Frustrated, with their lack of progress, in the first months of 1899, Wilbur Wright wrote to the Smithsonian Institute in Washington for guidance. The director of the Smithsonian at the time was a Virginian, Dr. Samuel P. Langley. Langley himself, had for some time been interested in manned flight. Using government funding, Dr. Langley designed several “flying machines,” and had published articles on the subject of manned flight.

Along with the writings of Langley, the response from the Smithsonian Institute led the Wright Brothers to much of the known work in the field of flying. Most notably were the writings of the Chicago engineer and builder, Octave Chanute, Frenchman Alphonse Penaud, and a German named Otto Lilienthal. Until his accidental death in 1896, while attempting to glide, Otto Lilienthal was considered by many to be the most advanced person in the field of manned flight, producing many tables and charts on the design of wing surfaces and lift.

The Wright brothers might have been daring young men, but throughout their quest to conquer flight, they made every effort to avoid undue risk. Partially because of Lilienthal’s death, they knew that before man could take to the skies in a powered craft, the obvious key to success would come from first learning how to fly. It was at this early point that the brothers would start to discover some of the fundamental concepts of flight that are still used today. While thinking about the skills needed for flying, the brothers began studying the movements of hawks and other soaring birds, seeking to unlock the secrets of nature. Wilbur was especially keen on gaining knowledge from the natural world, and wrote extensively on the subject in diaries and letters. The brothers dissected every movement and converted the designs of nature into the practical equivalents needed for manned flight.

In 1799 the English inventor, Sir George Cayley, was the first person to recognize the three basic principles that govern flight: forward motion or propulsion, lift and control. Controlling the air pressures that surround wing surfaces from front to back and left to right make controlled flight possible. The Wrights called controlled, level flight, reaching a state of “equilibrium.” Before the Wright brothers came along, equilibrium was attempted solely by shifting the weight of the operator from side to side. The Wright brothers knew the weight shifting method of control had led to the deaths of many early pioneers, and they decided to find a more efficient and safer way of achieving flight control.

One day, while in his shop, Wilbur became fascinated with a small paper box used to ship bicycle parts, envisioning it in his mind’s eye as a plane’s wing. He found that the entire box (or wing surface) could remain rigid while allowing the ends of the carton to twist and turn much the same as the wing tips of the birds he observed. Wilbur thought, that the incorporation of a similar technique would allow an aircraft operator to control the air pressure on either side of a plane’s wing, making sustained, controllable flight possible. The Wright brothers would later call this concept, “wing warping.”

The invention of “wing warping,” to achieve equilibrium, would lead directly to the Aileron principle still used by modern aircraft. In order to test out their theories, the brothers first built a scaled down glider with a dual wingspan of just five feet. They flew the model biplane as a kite, in the summer of 1899. The wing-warping feature seemed to work as imagined, but the real question was, would it work in a larger manned vehicle? So the brothers next built a full-sized version of the glider, in the winter of 1899-1900.

Even with the success of a scaled down machine, a good deal of uncertainty still remained. In addition to the unknowns surrounding the wing-warping feature, the first glider did not follow the exact engineering “standards,” as set forth in Lilienthal’s pioneering work on wing structures and lift. Not being trained engineers, the Wright brothers, built their 1900 glider, making what they believed to be prudent changes and approximations, based solely on their mechanical experience.

While the harsh Ohio winters limited the amount of time available for outdoor experimentation, it was the lack of a suitable soft landing area and wide-open spaces that ruled out Dayton, Ohio for the initial trials of a proposed craft. The brothers knew that if a vehicle did ascend to the heavens, the most dangerous part of the flight would be making a safe landing. So the brothers set out to find a safer location for their tests, with the sustained winds needed for a non-powered flight.

In response to a letter written to the United States Weather Bureau, it was suggested that the sandy beaches of North Carolina’s Outer Banks might provide the ideal conditions the Wrights needed for testing. Correspondence with local Kitty Hawk residents later confirmed the favorable conditions; however, they warned that the local weather could become unpredictable after mid-November. So it was to Kitty Hawk, North Carolina that Wilbur Wright traveled in the summer of 1900, scouting a location to set up a field camp. Orville would follow within the month.

Their chosen site for testing was near the ominous sounding parcel of sand called “Kill Devil Hill,” four miles south of Kitty Hawk, North Carolina. While the desolate Outer Banks might have been ideal for testing aero-planes, the Kitty Hawk area of 1900, provided little in the way of personal comfort or convenience. The brothers would be forced to import everything needed for the project via ship from the mainland. Over the next several years of testing they would build two small buildings for crew and equipment and sink a shallow well for fresh drinking water. But at first arrival on the island, they relied heavily on the generosity of the few local residents and the personnel of the Kitty Hawk Coast Guard station.

While some on-site work was done at the base camp, any major repairs or design changes to their machines had to be performed back in Dayton. Field tests of the first glider during the late summer and early fall of 1900 were encouraging, but the brothers knew that much more work was still needed. With winter approaching, they decided to end their first season at Kitty Hawk and return to Dayton, leaving the 1900 glider behind. One of the few Kitty Hawk residents, Mr. William J. Tate asked the Wrights if he might have the abandoned machine, to which the brothers’ agreed.

Tate, in turn, gave the sateen fabric that covered the glider's wings to his wife, who promptly made new dresses for the Tate daughters.



Believing that the published writings of the “experts” in the field of flying were well verified, over the winter of 1900-01, the Wrights built a larger machine. This time, they more closely followed, the “standard” tables for the curvature of wing surfaces, as

outlined by Lilienthal. But once back at Kitty Hawk the next summer, the glide tests during the 1901 season proved more disappointing than those of a year earlier. The wing warping principle seemed to work well enough, but the 1901 flyer did not travel as far as the machine of the previous year. Thinking about the results of their tests, the Wrights became convinced that the aspect ratios used for the wing designs of the 1900 flyer, which were only approximations, must have been more efficient than the published “standards” they later followed in 1901.

Now back in Dayton, uncertain as to the cause of their troubles and frustrated by the poor performance of their newest machine, the brothers' spirits were low. For a time the Wright brothers even considered giving up the flying project entirely.

From May of 1900, and until his death in 1910, the Wrights had carried on a regular correspondence with the Chicagoan, Octave Chanute. When Chanute heard about the problems with the 1901 glider, he tried to encourage the boys to continue. Writing to Wilbur, Chanute invited him to come to Chicago and speak to a scientific symposium, about the gliding experiments. Apprehensive about speaking before such a large group of engineers, and feeling that he was not an expert on the subject of flying, Wilbur Wright declined the invitation. But Chanute persisted and eventually convinced Wilbur to give a talk to the group in December of 1901. In later years Orville Wright would credit Octave Chanute with providing the encouragement the brothers needed to continue at that low point.

During his Chicago talk, Wilbur Wright told the assembly that although more testing was needed, the brothers believed that the formulas of Otto Lilienthal were inaccurate. Back in Ohio, when Orville heard that Wilbur had openly criticized the famous German experimenter, he was not pleased. The Wrights had no scientific backing for their claim that Lilienthal's data was wrong. Now, even though they had considered quitting the project, Orville knew they had to clear the Wright family name, by either proving or disproving the Lilienthal formulas.

Throughout the long winter months in their Ohio bicycle shop, the Wrights performed hundreds of static tests on wing and structural supports. Using scale models and a wind tunnel of their own design, the brothers disproved many of the accepted “standards” of Lilienthal and other leaders in the field of flying. With the knowledge gained from the wind tunnel experiments, the Wright brothers were confident that they could now build a glider

capable of manned flight.

In the spring of 1902, they designed and built a new machine, and returned to Kitty Hawk in the late summer. During the hundreds of test flights that followed, the Wrights succeeded in gliding longer and farther than anyone else in history, with near perfect control of their craft. Returning to Dayton in late fall, it was now time to add propulsion to their machine.

To be considered an actual “powered flying machine,” the Wrights knew an aircraft would have to propel itself into the air, sustain controlled flight, and return safely back to earth, anything less would still be gliding. With the problems of lift and control nearly perfected using the glider, in the winter of 1902-03 the Wright Brothers built their largest flying machine to date, and now added propulsion. The 1903 biplane, with operator and gasoline, weighed approximately 745 pounds, and would put nearly 500 square feet of wing surface aloft with a dual wingspan of 40 feet 6 inches.

The Wrights estimated that a gasoline-powered engine of 12 horsepower, weighing no more than 150 pounds, would be required for flight. Attempting to secure an engine from several commercial manufacturers proved futile. So out of desperation, they decided to try building a suitable motor of their own design. Luckily, the brothers were experienced machinists. At this same time, laboratory work also began on a propeller design for the flyer.

When the Wrights first began work on adding power to their gliding machine, they assumed that a propeller suitable to push a biplane through an ocean of air could be modeled after marine propellers used for watercraft. This assumption turned out to be incorrect and the Wrights were forced to come up with a new design all their own. Eventually, the Wrights came to realize that the thrust of a propeller was similar to the lifting force of a wing surface. In their design, they simply treated the propeller as if it was a wing traveling around a circular course... and it worked.



After a busy summer, the bicycle season ended in Dayton, and the Wrights made plans to head east to Kitty Hawk in September 1903. Arriving at their shore-side camp on September 25th, they began work assembling a building to house the newly designed biplane. Once completed, they then began putting together the powered craft. During this time, the brothers would also take turns honing their flying skills by soaring with the 1902 glider from high atop Kill Devil Hill. Assembling the new machine took more than three weeks to complete but by early November, all was ready for a powered test.

After several failures and at least two trips back to Dayton to remanufacture broken propeller shafts, the Wrights waited for the remnants of an early winter storm to pass over the Outer Banks of North Carolina. Winds were clocked at seventy-five miles per hour only days before the failed attempt of December 14th.

The Wrights first had hoped to be home for Thanksgiving; soon they feared they might not return to Dayton in time for Christmas. It took two days to repair the damage from the crash of the 14th. The morning of December 16th was cold, with puddles of icy water dotting the sand dunes. By that afternoon, the flyer was finely ready for another test, but with higher than expected winds still sweeping across the sandy shores, all the brothers could do was huddle around a makeshift wood stove and wait.

By the morning of the 17th, the winds at the Kitty Hawk Life Saving Station were from the North East, averaging 27 miles per hour. In spite of the high winds, the Wright brothers decided to try another test. In later years, Orville would question the judgment that led the brothers to resume testing with winds of that speed.

The failed attempt of the 14th meant that it was now Orville's turn to man the controls. At 10:34 am, the home built motor began to spin with Orville in his position lying next to the engine. Upon release at 10:35 am on December 17, 1903, the craft slipped the bonds of earth as it lifted off of the wooden rails. Forward motion was slow, due to the higher than normal head winds. With Wilbur along side to steady the wings, Kitty Hawk Coast Guardsman John T. Daniels squeezed the bulb type shutter release on Orville's camera, capturing the historic photograph. Although the highest altitude was only 9 feet, during the 12-seconds aloft the craft traveled 120 feet across the sand, and most importantly, it flew!

As the morning progressed, the off shore winds continued to decline and flight two, three and four followed in quick succession. Each of the Brothers took turns flying the aircraft. Wilbur made the fourth and longest flight of the day, lasting 59 seconds and covering a distance of 852 feet. The brothers had hoped to fly the nearly four miles distance to the Coast Guard Station at Kitty Hawk, but at the end of flight four, the aircraft would require a days worth of repair, when a hard landing damaged the front of the machine.

After completing the last flight, Orville and Wilbur quietly discussed their progress. Suddenly, a gust of wind caught the Wright Flyer in an updraft. Within seconds the brothers found themselves' helpless as they watched their biplane tumble across the sand, landing several hundred feet away. Coast Guardsman Daniels was injured, as he and several others attempted to hold down the biplane. The 1903 flyer was all but destroyed, and manned flight had come to an abrupt end, at least for the 1903 season. Before packing up camp for the year, Orville walked to the life saving station and sent a brief telegram to their father back in Dayton:

“Success four flights Thursday morning... longest 59 seconds inform press home Christmas” 2

The Wright brothers invented the aero-plane in little more than four years, and spent less than one thousand dollars on the entire project. The brothers went about their discovery in a methodical, deliberate manor, and for the most part, they were confident that success was only a matter of time and effort. What the Wright Brothers lacked in education and

financing they made up for in determination, and a single-minded devotion to the task at hand. While their work was never “secret,” as businessmen, they shunned publicity for fear of losing the race to another.

After their success at Kitty Hawk in December of 1903, the Wright Brothers went back to their hometown of Dayton, Ohio for the winter. Rather than exaltation, they were largely met with indifference by the press. The fifty-nine second flight in North Carolina was thought by most news organizations, either too insignificant or unbelievable to receive much attention. The few newspapers that did report the event, lacking many of the hard facts, saw fit to sensationalize the story. The result, was that an already “impossible” feat of engineering, became even less believable to many. The fledgling community of flight enthusiasts around the globe, at first found it difficult to divine the significance of the brothers’ achievement, from such inaccurate reporting. But gradually, word began to spread about the Kitty Hawk flights.



When the news first broke of a successful manned flight, the lack of openness that surrounded the Wrights’ work created a credibility problem for the pair. Scientific journals as far away as France and Great Britain openly questioned how two brothers with little money and formal education could do the impossible.

The Wright brothers’ flying machine, gave man, bird like freedom to fly through the air in any direction and land safely. In the century that followed their creation, the flying machine has gone to the edge of the universe and back again. So monumental was their achievement that several more years would pass, before the Wright brothers would finally convince the world, that man could fly!

1,2 Miracle at Kitty Hawk the letters of Wilbur and Orville Wright

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Photo Captions:

Photo One: First Flight

Photo Two: The Wright Brothers Memorial atop Kill Devil Hill overlooks two reconditioned Wright buildings.

Photo Three: The Wright Brothers Memorial - Kitty Hawk, North Carolina

Photo Four: Bronze Wright Brothers plaque at Kitty Hawk.

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