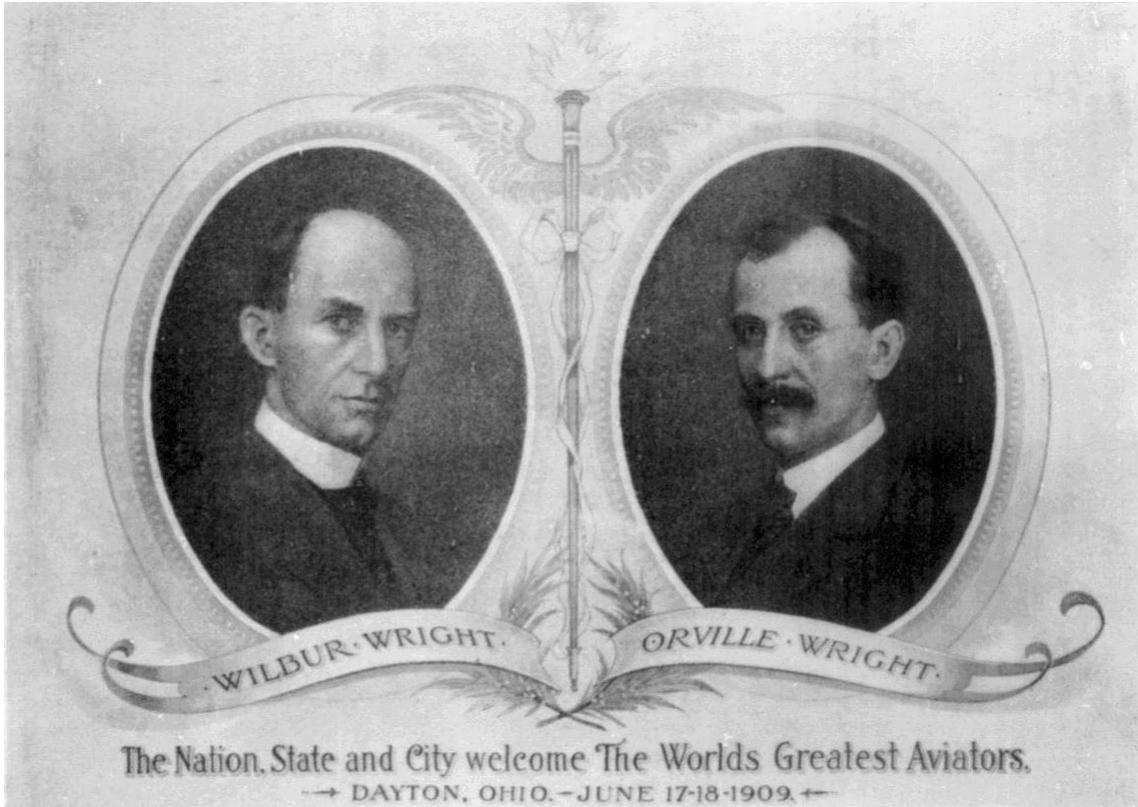


Teacher Guide
Primary Source Set
The Inventive Wright Brothers



The Nation, State and City Welcome The Worlds Greatest Aviators
[http://memory.loc.gov/cgi-bin/query/r?ammem/wright:@field\(DOCID+@lit\(wright003347\)\)](http://memory.loc.gov/cgi-bin/query/r?ammem/wright:@field(DOCID+@lit(wright003347)))

Everyone must crawl before they can fly. Such was the fate of Wilbur and Orville Wright, born 4 years apart, brothers by blood as well as by achievement..

A Well-Grounded Childhood

Wilbur and Orville's parents, Milton and Susan Wright, encouraged their children's intellectual curiosity. Milton Wright was a bishop in a local church and he traveled extensively to preach. He also kept two large libraries that aided the brothers in their intellectual development from an early age.

In 1878, a toy forever changed the lives of Wilbur and Orville. Milton gave the boys a toy helicopter, a simple device made of bamboo, paper, and cork and powered by a rubber band. Wilbur and Orville would later recall that their father's gift sparked their interest in the science of flight. The helicopter was based on the design of Alphonse Penaud of France, who made great strides in aeronautics during the 1860s and 1870s by developing the Planophore, which used propellers powered by rubber bands to sustain flight over short distances.

Milton moved his family to Richmond, Indiana, and became a circuit preacher. He began publishing a religious newspaper. Wilbur invented a machine that folded the papers for mailing, demonstrating a knack for engineering. In 1884, the family permanently moved back to Dayton, Ohio.

Brothers in Business

Wilbur was a star athlete and scholar bound for Yale, but a blow to the face during a game of hockey in 1886 changed his mind about studying there. Orville had also been an excellent student, but became disinterested in his studies and eventually dropped out of high school. He completed two printer's apprenticeships as a teenager and went into business printing small items such as business cards.

Wilbur helped Orville build a printing press, and their father bought 25 pounds of used type for print jobs. By 1889, they began printing under the name "Wright Bros." The printing presses they built attracted a number of admirers. They gradually ended their printing endeavors as they took up a growing national activity – cycling.

Friends often came to them for help with bicycle repair and maintenance. In 1893, they began repairing and manufacturing bicycles. Within three years, Wilbur and Orville were running a bustling enterprise. Their ventures with the bicycle turned their attention back to the pursuit of sustained human flight.

Wilbur and Orville Look to the Skies

Orville and Wilbur faced the momentous task of finding a way to control flight. They read voraciously to learn from others' experiences and they corresponded with aeronautical pioneers such as the American engineer Octave Chanute.

In 1896, the death of German glider pilot Otto Lilienthal during a flight experiment led the brothers to think more about questions of aeronautics and flight. Lilienthal's study of the flight of birds as a possible basis for human flight also influenced the Wright brothers. Wilbur often observed buzzards near Ohio's Great Miami River. He noticed that the birds maintained their balance in flight by adjusting the angle and position of their wings. The brothers designed wings that could adjust their shape the way a bird's wings did and developed a kite with a biplane – two sets of wings. The tips of the wings were made to adjust and move at opposing angles to maintain balance. They tested the new system in the sand dunes near Kitty Hawk, North Carolina in 1900 and 1901. The gliders did not yield the results the Wrights were looking for and the experiments sent them back to the drawing board.

In 1901, Wilbur and Orville built a wind tunnel in order to study how their wing designs reacted to air resistance. This helped them improve the amount of lift provided by the wings. The glider they built using this data was the first to have three different sets of controls. Since a flying machine had to move on three different axes, each axis would need a control to maintain balance while in the air. One was the "warped wing," which stabilized the plane's horizontal movement. The "elevator" controlled the vertical angle of the nose. Finally, they added a moveable rudder, connected to the wing warping mechanism to prevent the craft from spinning out of control, to control the plane's forward movement.

When they tested their third glider at Kitty Hawk in 1902, it flew 622 feet in about 26 seconds. Their breakthroughs in wing design made this glider the world's first controllable aircraft. Nonetheless, to achieve powered flight the Wrights still needed to develop a propulsion system. They built an engine with the help of their mechanic, Charlie Taylor, and had devised a transmission and set of propellers for their plane by mid-1903.

They tested the first powered craft at Kitty Hawk in September 1903. Wilbur was the test pilot of the Wright Flyer, which only stayed in the air for 3½ seconds. This didn't discourage them, and after repairs the brothers attempted to test the Wright Flyer once again on December 17. Orville's first flight of the day was the first manned, powered, and controlled flight in history. It lasted 12 seconds and spanned 120 feet. By the fourth flight, Wilbur managed to keep the Flyer in the air for 59 seconds and made a trip of 852 feet. They had been sending telegrams to their father detailing their progress. A December 17 telegram informed him that they would be home in time for Christmas. Their story, however, does not end with this great feat of human ingenuity.

The Business of Flight

As the brothers worked to achieve powered flight, they also worked to secure a patent for their invention. This was not only to recoup the significant costs of their experiments, but also to prevent others from stealing their design. Their aeronautical rivals had not come as close as they had to achieving powered and controlled flight, but they came close enough to make the brothers cautious. The brothers finally received a patent on May 23, 1906, but they spent many years in legal battles with aviators and inventors who made their own claims to originality. Among their rivals was famed inventor Alexander Graham Bell.

The brothers worked tirelessly to perfect their flyers while attempting to attract the business of private firms and government entities such as the U.S. military. Although they won some contracts, the Wright Company's success was tentative. Pursuing their various patent suits against their numerous rivals and competitors absorbed much of their time and proved inconclusive. After Wilbur died of typhoid in May 1912, Orville became despondent and sold not only the Wrights' 1906 patent, but also the Wright Company in 1915. Though not always successful in their business lives, the Wright brothers will long be known for their momentous invention.

Suggestions for teachers

Consider Orville and Wilbur as children. What do their early letters tell you about their personalities? Their teamwork? What early jobs did they have and how did this help them develop problem solving and mechanical skills?

Select a passage from one letter and match it to an image from the set.

Arrange the items in chronological order. Select a few items to read or study closely.

- Where did they find inspiration?
- What can you learn about how their ideas changed after each attempt?
- How did their experiments follow the scientific method?

Imagine our world without human mechanical flight. What impact would the lack of flight have on your life?

How important was photography in the Wright brothers's research? How did Edison and Bell use photography for their research?

What obstacles did the Wrights have to overcome in the early years and in their later years? How did their achievement affect their lives?

Attempt to recreate the Penaud ornithopter as the Wrights did as children. Chart the success and failures, and modifications necessary.

Research other flight pioneers: Lilienthal, Langley, Chanute, Bell, Edison, or others.

Create a timeline of flight.

Create a resume for each of the Wright brothers: Critique their educations, early experiences and consider for what jobs each would be hired today.

Debate the statement: The Wright brothers made the most significant invention of the 20th Century.

Discuss the inter-relationships of science, technology and human activity.

Additional Resources

[American Treasures: First Flight \(Exhibition\)](http://www.loc.gov/exhibits/treasures/trr019.html)

<http://www.loc.gov/exhibits/treasures/trr019.html>

[The Dream of Flight \(Exhibition\)](http://www.loc.gov/exhibits/treasures/wb-home.html)

<http://www.loc.gov/exhibits/treasures/wb-home.html>

[First Flight \(Today in History\)](http://memory.loc.gov/ammem/today/dec17.html)

<http://memory.loc.gov/ammem/today/dec17.html>

[From Fantasy to Flight: Wright Brothers \(Feature presentation\)](http://memory.loc.gov/learn/features/flight/wright.html)

<http://memory.loc.gov/learn/features/flight/wright.html>

[Ohio: Their First Love: The Wright Brothers and Printing \(American Folklife Center\)](http://lcweb2.loc.gov/diglib/legacies/OH/200002919.html)

<http://lcweb2.loc.gov/diglib/legacies/OH/200002919.html>

[Photographs Taken by the Wright Brothers of Aviation Experiments, Home, and Family \(Prints and Photographs\)](http://www.loc.gov/rr/print/coll/236_wright.html)

http://www.loc.gov/rr/print/coll/236_wright.html

[Summary of Resources Related to the Wilbur and Orville Wright Papers](http://memory.loc.gov/ammem/ndlpedu/collections/wright/wrtintro.html)

<http://memory.loc.gov/ammem/ndlpedu/collections/wright/wrtintro.html>

[The Wilbur and Orville Wright Papers \(American Memory\)](http://memory.loc.gov/ammem/wrighthtml/wrighthome.html)

<http://memory.loc.gov/ammem/wrighthtml/wrighthome.html>

[Wilbur and Orville Wright's First Flight \(America's Library\)](http://www.americaslibrary.gov/cgi-bin/page.cgi/jb/progress/flight_1)

http://www.americaslibrary.gov/cgi-bin/page.cgi/jb/progress/flight_1

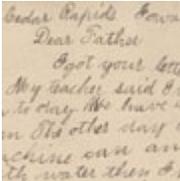
[Wright Brothers: Customized Research and Analytical Services \(Federal Research Division\)](http://www.loc.gov/rr/frd/wright_bros/home.html)

http://www.loc.gov/rr/frd/wright_bros/home.html

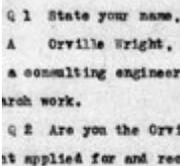
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The Nation, State and City Welcome The Worlds Greatest Aviators. Poster. From Library of Congress, *Wilbur and Orville Wright Papers, Scrapbooks*, January-December 1909: page 0162. <http://hdl.loc.gov/loc.mss/mwright.05002589>



Wright, Orville. *Orville Wright to Bishop Milton Wright.* Letter. April 1, 1881. Image 1 and 2. From Library of Congress, *Wilbur and Orville Wright Papers, Family Papers: Correspondence--Wright, Orville, 1881, 1888-1898.* <http://memory.loc.gov/cgi-bin/ampage?collId=mwright&fileName=02/02037/mwright02037.db&recNum=1>



Wright, Orville. *Deposition.* January 13, 1920. Image 2. From Library of Congress, *Wilbur and Orville Wright Papers, Subject File: Legal Cases--Montgomery v. Wright-Martin Airway Corp.* <http://hdl.loc.gov/loc.mss/mwright.04099>



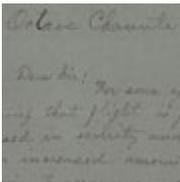
Wright, Orville. *Penaud-style Ornithopter.* Drawing. ca. 1929. From Library of Congress, *American Treasures Exhibition: Dream of Flight, The Achievement.* <http://www.loc.gov/exhibits/treasures/wb-achieve.html>



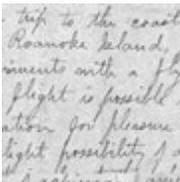
Wright, Wilbur. *West Side News.* May 11, 1889. Image 5. From Library of Congress, *Wilbur and Orville Wright Papers, Subject File: Printing & Publishing Business.* <http://hdl.loc.gov/loc.mss/mwright.04143>



Wright, Orville. "[Wilbur Wright working in the bicycle shop.]" Photograph. [1897.] From Library of Congress Prints and Photographs Online Catalog. <http://hdl.loc.gov/loc.pnp/ppprs.00540>



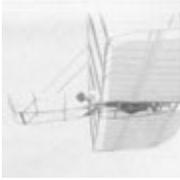
Wright, Wilbur. *Wilbur Wright to Octave Chanute.* Letter. May 13, 1900. Images 1-6. From Library of Congress, *Wilbur and Orville Wright Papers, Octave Chanute Papers: Special Correspondence--Wright Brothers, 1900.* <http://hdl.loc.gov/loc.mss/mwright.06001>



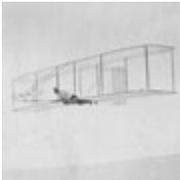
Wright, Wilbur. *Wilbur Wright to Bishop Milton Wright.* Letter. September 3, 1900. Image 1. From Library of Congress, *Wilbur and Orville Wright Papers, Family Papers: Correspondence--Wright, Wilbur, 1900-1901.* <http://hdl.loc.gov/loc.mss/mwright.02055>



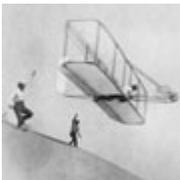
Wright, Wilbur and/or Orville. "[Crumpled glider wrecked by the wind on Hill of the Wreck.]" Photograph. [Oct. 10, 1900]. From Library of Congress Prints and Photographs Online Catalog.
<http://hdl.loc.gov/loc.pnp/ppprs.00544>



Chanute, Octave. "Kitty Hawk Photo #3." 1901. From Library of Congress, *Wilbur and Orville Wright Papers, Subject File: Chanute, Octave--Photographs, Kitty Hawk, North Carolina, Originals, 1901.*
<http://hdl.loc.gov/loc.mss/mwright.04003>



Chanute, Octave. "Kitty Hawk Photo #20." 1901. From Library of Congress, *Wilbur and Orville Wright Papers, Subject File: Chanute, Octave--Photographs, Kitty Hawk, North Carolina, Originals, 1901.*
<http://hdl.loc.gov/loc.mss/mwright.04003>



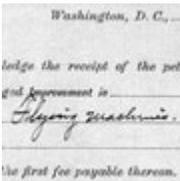
Chanute, Octave. "Kitty Hawk Photo #30." 1901. From Library of Congress, *Wilbur and Orville Wright Papers, Subject File: Chanute, Octave--Photographs, Kitty Hawk, North Carolina, Originals, 1901.*
<http://hdl.loc.gov/loc.mss/mwright.04003>



Wright, Orville and /or Wilbur. "[Side view of glider flying as a kite near the ground, Wilbur at left and Orville at right.]" [1901.] Photograph. From Library of Congress Prints and Photographs Online Catalog.
<http://hdl.loc.gov/loc.pnp/ppprs.00580>



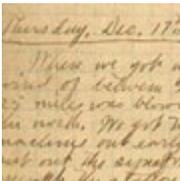
Wright, Orville and /or Wilbur. "[Visitors and fellow campers in the Wrights' work shed at Kitty Hawk, North Carolina.]" Photograph. [1901.] From Library of Congress Prints and Photographs Online Catalog.
<http://hdl.loc.gov/loc.pnp/ppprs.00581>



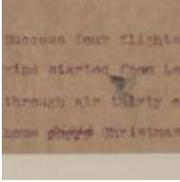
Flying Machine Patent. March 14, 1903. Image 13. From Library of Congress, *Wilbur and Orville Wright Papers, Subject File: Patents--By Wright Brothers--USA.*
<http://hdl.loc.gov/loc.mss/mwright.04135>



Wright, Orville and /or Wilbur. "First flight, December 17, 1903." Photograph. December 17, 1903. From Library of Congress Prints and Photographs Online Catalog.
<http://hdl.loc.gov/loc.pnp/ppprs.00626>



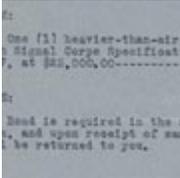
Wright, Orville. *1903 Journal.* December 17, 1903. Images 28-33. From Library of Congress, *Wilbur and Orville Wright Papers, Diaries and Notebooks: 1903, Orville Wright.*
<http://hdl.loc.gov/loc.mss/mwright.01007>



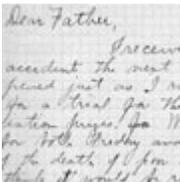
Wright, Orville. *Telegram, Orville Wright to Bishop Milton Wright announcing the first successful powered flight.* December 17, 1903. From Library of Congress, *Words and Deeds in American History: Selected Documents Celebrating the Manuscript Division's First 100 Years.*
[http://lcweb2.loc.gov/cgi-bin/query/r?ammem/mcc:@field\(DOCID+@lit\(mcc/061\)\)](http://lcweb2.loc.gov/cgi-bin/query/r?ammem/mcc:@field(DOCID+@lit(mcc/061)))



Wright, Orville and /or Wilbur. “[Wilbur and Orville Wright with their second powered machine; Huffman Prairie, Dayton, Ohio.]” Photograph. [May, 1904.] From Library of Congress Prints and Photographs Online Catalog.
<http://hdl.loc.gov/loc.pnp/pprs.00621>



United States War Department. *Heavier-than-air Flying Machine Purchase Order.* February 10, 1908. Image 30. From Library of Congress, *Wilbur and Orville Wright Papers, Subject File: United States--War Department--Army Signal Corps--Correspondence, 1908.*
<http://hdl.loc.gov/loc.mss/mwright.04164>



Wright, Wilbur. *Wilbur Wright to Bishop Milton Wright.* Letter. September, 22, 1908. Images 32 and 33. From Library of Congress, *Wilbur and Orville Wright Papers, Family Papers: Correspondence--Wright, Wilbur.*
<http://hdl.loc.gov/loc.mss/mwright.02067>



Wright, Wilbur. *Wilbur Wright to Orville Wright.* Postcard. September 28, 1908. Image 43 & 44. From Library of Congress, *Wilbur and Orville Wright Papers, Family Papers: Correspondence--Wright, Wilbur, September 1908.*
<http://hdl.loc.gov/loc.mss/mwright.02067>



“Wilbur Wright and Orville Wright , 7 Hawthorne St., Dayton, Ohio.” Photograph. 1909. From Library of Congress Prints and Photographs Online Catalog.
<http://hdl.loc.gov/loc.pnp/cph.3b13001>



Wright, Orville. “[Katharine Wright, wearing a leather jacket, cap, and goggles, aboard the Wright Model HS airplane with Orville, 1915.]” Photograph. [1915.] From the Library of Congress Prints and Photographs Online Catalog.
<http://hdl.loc.gov/loc.pnp/pprs.00588>



Dayton Homecoming, June 17-18, 1909. Poster. Dayton, Ohio: Walker Lithography Co., 1909. Image 125. From Library of Congress, *Wilbur and Orville Wright Papers, Scrapbooks: January-December 1909.*
<http://hdl.loc.gov/loc.mss/mwright.05002>