

The Wright Stuff

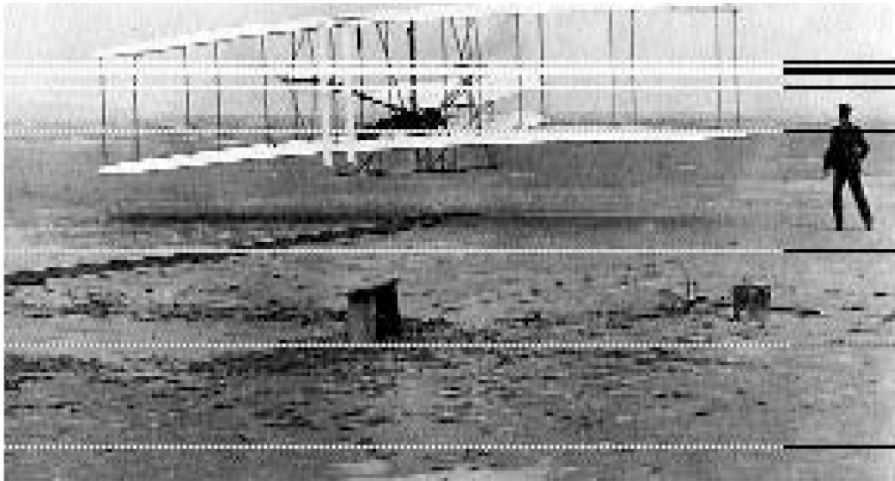
October 9, 2017
Stephens Auditorium



**Classroom
Study
Guide
Student Pages**

by Steve Perigard

Co-produced by the Carpenter Science Theatre Company
of the Science Museum of Virginia and the Virginia Aviation Museum



The Stuff

It all started with the gift of a toy helicopter. Orville and Wilbur Wright's fascination with flying began when they were young boys and their father brought home a toy helicopter. The two young boys experimented with the toy and dreamed of one day building a flying machine that would be big enough to carry them through the sky.

In *The Wright Stuff*, Orville, Wilbur and their sister Katherine share their life story. From their childhood in Dayton, Ohio, to their days as young entrepreneurs, to fulfilling their dream and becoming the fathers of flight. The Wright family works together to overcome personal tragedy, and to pursue a goal that many thought was unattainable.

In this personal glimpse of three ordinary people who lived extraordinary lives we see what it means to have "*The Wright Stuff*."

How do scientists work?

They are curious!

They research what is already known.

They define the problems to be solved.

They experiment, make observations and predictions, and verify data.

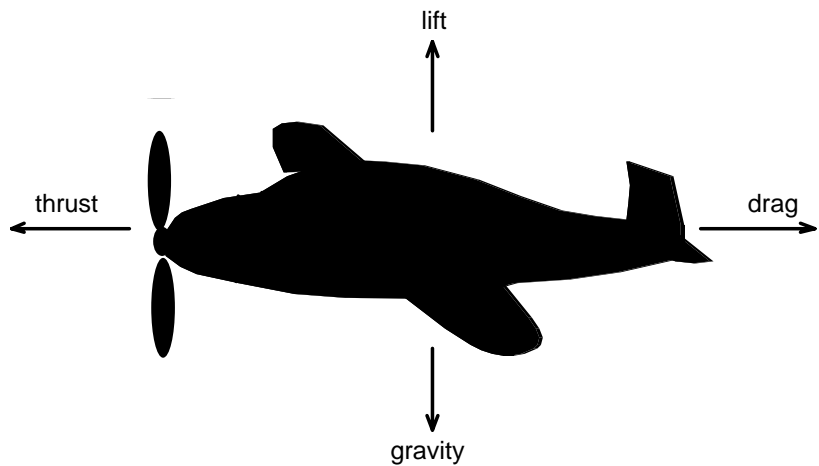
They reach conclusions.

They continue to test and expand their ideas.

They make generalized rules or laws to describe their discoveries.

Why Does an Airplane Fly?

There are four forces that act on an airplane in flight: **thrust**, **drag**, **gravity**, and **lift**.



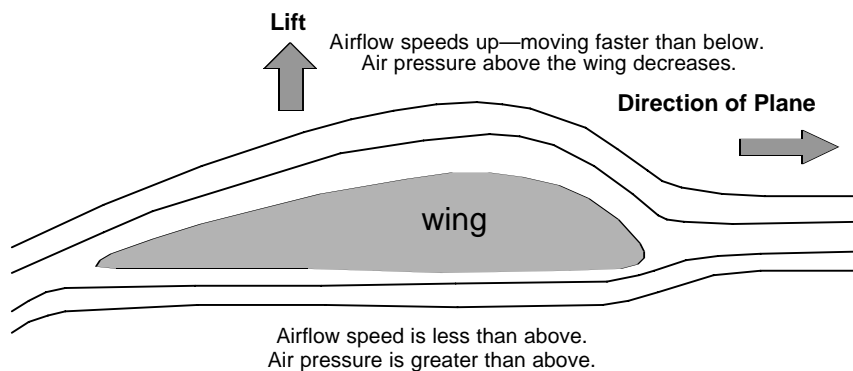
Thrust is the force that carries the airplane forward. It can be provided by the propeller or by jet propulsion.

Drag is the force that resists the forward motion of the plane. The amount of drag that a plane has depends on its shape and its surface.

The **gravity** that pulls downward on the plane is the force of the attraction between the Earth and the plane. Gravity must be overcome before the plane can fly.

Lift is the force that overcomes gravity. It is caused by the motion of the air over and under the wings of an airplane. Lift can be produced in two ways - by the push of the air against the slanted wing and by the **Bernoulli effect**.

The **Bernoulli effect** is named for Daniel Bernoulli, the Swiss mathematician who first described the phenomenon. The Bernoulli Principle says that swiftly moving air creates an area of low pressure.



How does this help to create lift? The air that flows over a curved airplane wing moves faster than the air beneath the wing. The air molecules spread apart and there is less pressure above the wing than there is below the wing. The result is that air pushes up against the wing and lifts it.

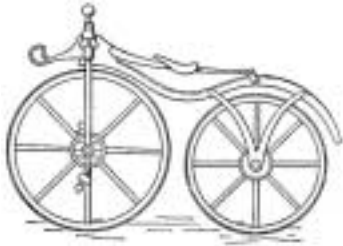
The Wright Brothers

Wilbur Wright (1867-1912)

Orville Wright (1871-1948)

Wilbur and Orville Wright invented, built, and flew the world's first successful airplane. 'Will' and 'Orv' were the third and fourth children of Milton Wright and his wife Susan Koerner Wright. The close-knit family circle included four sons, Reuchlin, Lorin, Wilbur and Orville, and a daughter named Katherine. Read about the following milestone events in their lives and try to answer the questions connected with some of these events.

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1893 Wilbur and Orville established the Wright Cycle Company and soon began to put their considerable mechanical skills to work designing and repairing bicycles.

? **Question:** *Can you think of some ways that their experience in the bicycle business may have helped them as they set out to invent a working airplane?*

1903 On Dec. 17, near Kill Devil Hill, N.C., Orville Wright made the first controlled, sustained flight in a heavier-than-air vehicle. His flight was 120 feet in length and lasted 12 seconds. Later the same day, Wilbur flew 852 feet in 59 seconds.

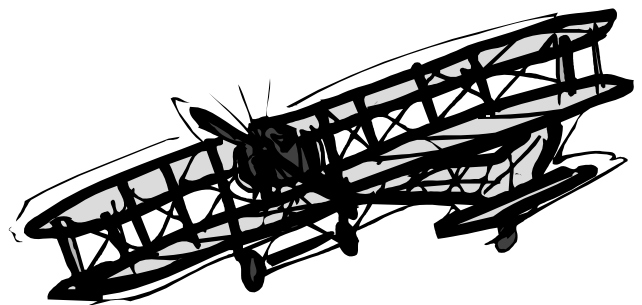
? **Question:** *How did the invention of the airplane change the world? Can you list the ways?*

1908 The Wright brothers signed a contract with the U.S. government for the construction of the first military airplane. A year later they formed the Wright Company to manufacture airplanes of their own design.

1912 After Wilbur's death, Orville continued to work on alone, winning the Collier Trophy in 1913 for the development of an airplane stabilizer.

? **Question:** *What world event began in 1914 that made the invention of the airplane so significant?*

1948 A special ceremony on Dec. 17 celebrated the installation of the Wright Flyer in the Smithsonian Institution. The text written to hang below the Wright's first airplane reads, "By original scientific research, the Wright brothers discovered the principles of human flight. As inventors, builders, and flyers, they further developed the aeroplane, taught man to fly, and opened the era of aviation."



? **Question:** *Can you think of an invention or discovery in the news today that might have the same kind of impact as the invention of the airplane?*

Would you like to know more about the lives of the Wright brothers? Visit these websites.

Henry Ford Museum & Greenfield Village: <http://www.hfmqv.org/exhibits/wright/>

Wright Brother's Home and Cycle Shop: <http://www.hfmqv.org/village/invent/wright/wright.html>

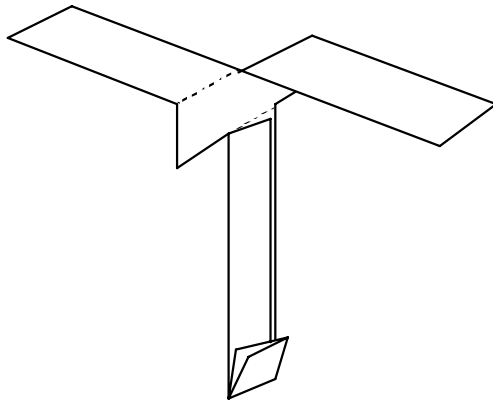
How Do Scientists Work?

How did the Wright brothers solve the problems that had baffled would-be fliers for years? They succeeded because they were excellent scientists, whose work provides a striking example of the scientific process.

Their great adventure began when they were still boys, curious about the toy flying machine called "the Alphonse Penaud helicoptère," which was made of bamboo, paper, and cork. They examined the device closely and then made their own versions. They were already using two important parts of the scientific process - **observation** and **experimentation**.

R Can you follow the Wright example by designing a series of experiments with the helicopter pattern shown here?

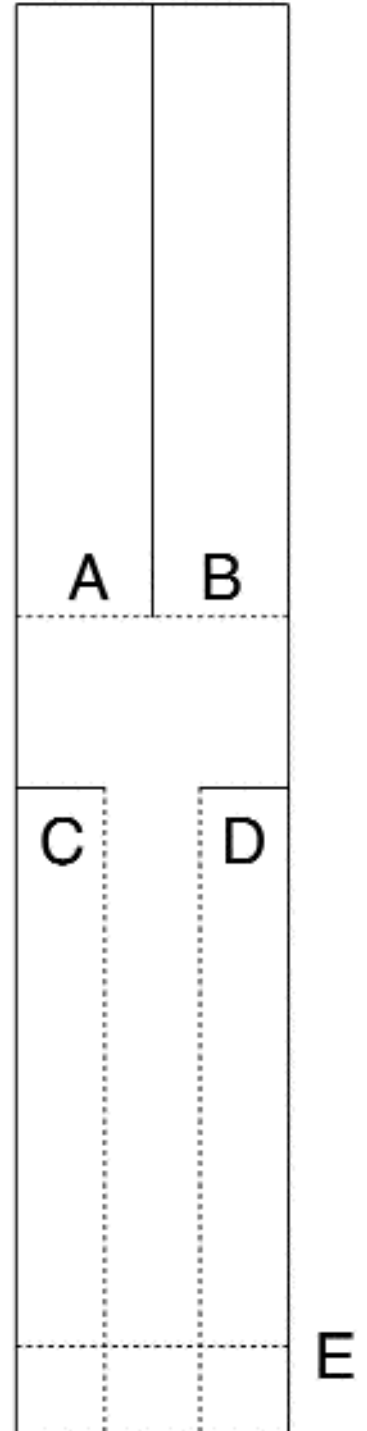
- Copy this pattern onto medium stiff paper.
- Cut along the solid lines.
- Fold A forward.
- Fold B backward.
- Fold C forward.
- Fold D backward. Bend the stem at E.
- The finished helicopter should look like the picture below.



Hold the stem upright and drop your helicopter from a high place. What happens when you reverse the direction of the flaps? What happens if you add a paperclip to the bottom of the helicopter to add weight? Add more paperclips and make a chart of your results.

Learn more about inventions and inventors at these websites:

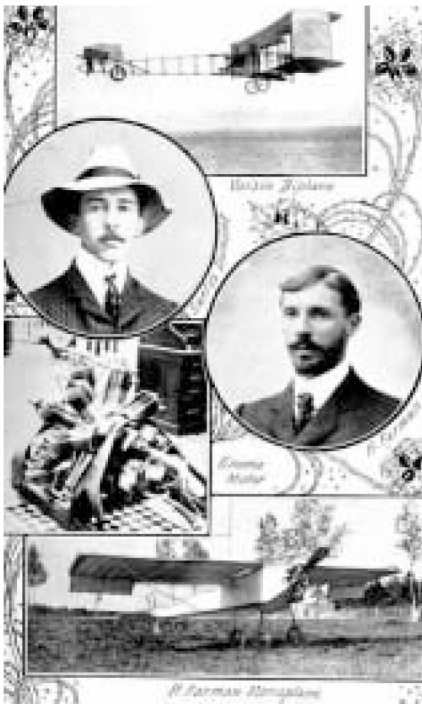
National Inventors Hall of Fame: <http://www.invent.org/book/>
 "How We Made the First Flight" by Orville Wright:
<http://www.aero-web.org/history/wright/first.htm>



From Kite to Wright: History of Flight



- c. **350 B.C.E.** The first kite may have been invented by Archytus of Tarentum in ancient Greece.
- c. **206 B.C.E.** Many sources claim that the Chinese general Han Sin invented the kite in 206 B.C.E. for use in warfare.
- c. **215 B.C.E.** Archimedes discovered why things float. His discovery is known as the Archimedes principle. This discovery was essential about 2,000 years later as inventors began to make balloons.
- c. **100 B.C.E.** Hero of Alexandria learned to use jet propulsion to make objects move.
- c. **1490** Leonardo da Vinci made drawings of parachutes, helicopters, propellers and a flying machine with wings. He also studied the anatomy of birds.
- c. **1290** Roger Bacon, an English scientist, wrote that he believed that very light objects could float in air just as light objects floated in water. He proposed filling a balloon with "liquid fire" to make it rise. He also proposed the construction of an ornithopter, which could flap its wings.



1783 C. E. On Oct. 15, 1783, François Piltre de Rozier made the first lighter-than-air ascent in a hot air balloon designed and built by the Montgolfier brothers.

1852 Henri Giffard built and flew the first successful engine-powered airship. It could reach six miles an hour!

1842 William Samuel Henson patented the plans for an "aerial steam carriage." It described all of the parts of a modern plane except the ailerons.

1846 The first aviation magazine, called "The Balloon," was founded by the Englishman Henry Tracy Coxwell.

1891 Beginning in 1891, German scientist Otto Lilienthal made thousands of flights in gliders, proving that heavier-than-air flight was possible.

1903 Orville and Wilbur Wright succeeded in flying an engine-powered, heavier-than-air airplane on Dec. 17, 1903, an event that marked the beginning of the modern era of aviation.

THEATRE IV
114 West Broad Street
Richmond, Virginia 23220
1-800-235-8687
www.TheatreIV.org

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THEATER ETIQUETTE

We are delighted to have you as our guest and want your experience to be an enjoyable one. Attending a live performance is very different from watching television or going to the movies. You are not simply watching what is happening on the stage; you play an active role. The artists have worked very hard to prepare this performance for you, so please remember the golden rule:

Treat others the way you would like to be treated.

Here are a few guidelines to help you—and your fellow audience members—enjoy the performance:

Be Prepared

- Arrive early. Please plan to arrive at the theater at least 15 minutes before curtain time. Be generous in your estimation of travel and parking time.
- Plan ahead to meet anyone in your group who travels separately. Once inside the theater, 'saving seats' for friends will only prove frustrating to all involved.
- Remember to turn off all beepers, cell phones, and watch alarms before entering the theater (And then double check!) and leave all laser pointers, cameras, etc. at home.

Be Courteous

- Walk, don't run, when entering or leaving the theater. The term "break a leg" means good luck to the performers not the audience!
- Do not take food or drink into the theater, and please – NO GUM!
- Please take children out of the theater if they become restless and disrupt other's ability to listen.
- Actors love to hear applause—it shows how much you enjoyed the performance. If you like something, applaud— if not, don't. It's rude to boo or whistle.

Be Aware

- It's ok to talk *quietly* with those sitting next to you before the performance; however, when the lights dim, it's time to be quiet and direct your attention to the stage.
- Practice the International Sign of "Quiet Please!" by **silently** raising your finger to your lips to politely remind a neighbor or friend. You communicate your wish for quiet without adding to the distraction. Excessive noise or motion can disturb not only other audience members, but the performers as well.
- Take everything you brought with you when you leave. Once the cast has taken their bows and the house lights come up, check under your seat for any items (coats, backpacks, etc) you might have placed there.

Be Open

- A good audience member is open to new sights and sounds. Enjoy!



GETTING TO AMES

Stephens Auditorium is part of the Iowa State Center located at the corner of University Boulevard (formerly Elwood Drive) and Lincoln Way in Ames, Iowa. Plentiful parking is available on all sides of the building. Please follow traffic directors' instructions if you are asked to park in a specific location. Handicapped-accessible and limited-mobility parking is available on the west side of the auditorium.

