



“I AM CONVINCED THAT HUMAN FLIGHT IS POSSIBLE AND PRACTICAL.”  
Wilbur Wright 1899

# THE SECRET OF FLIGHT PROGRAM



An encounter between your students  
and the innovative minds of the Wright Brothers.



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## WHAT'S IN A STORY?

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WRIGHT BROTHERS  
AEROPLANE CO.  
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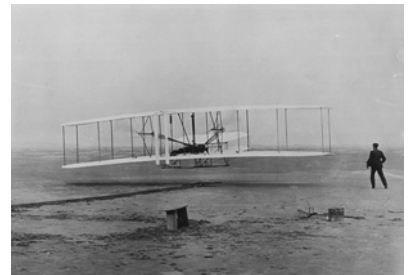
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Company is a DBA of the First to Fly  
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### A tale worth telling

The story of the Wright brothers and the invention of the airplane are woven deep into American history and culture, so deep that it profoundly affects how we see ourselves. Their tale, in fact, may be every bit as important as their accomplishments. There's no denying that mechanical flight has changed the course of history. But their *story* has changed the course of lives.

The Wright tale is as unforgettable as a nursery rhyme and as inspiring as a hymn. Two bicycle mechanics from Dayton, Ohio, with no resources other than their own pluck, out-invent the world's best scientific minds and achieve the age-old dream of flight by virtue of their imagination, determination, and courage. Once you know the basic story, it becomes a metaphor in your own life, confirming the worth of your dreams and the work you do to achieve them. For this reason alone, it's a story worth telling our children again and again.

It is also a wonderful vehicle for getting across a wide range of proficiency requirements in science, technology, math, and social studies. And it crosses many age levels from K through 12, but is especially relevant and potent for 3<sup>rd</sup> through 8<sup>th</sup> grades.



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**Bringing the story to life**

To tell a good story, you need experience with your subject. So we conduct **expeditions in aviation archaeology**, recreating the invention of the airplane. We have built all the experimental aircraft the Wright brothers designed between 1899 and 1905 in their quest for a practical flying machine – their scientific kites, gliders, and powered Flyers. And we fly them, traveling to the North Carolina Outerbanks near Kitty Hawk where we can experience the winds and sands that were the Wright brothers' laboratory.

We have documented our adventures in words, photographs, and video. These are woven into our school presentation. To us, the Wright gliders and Flyers aren't historical artifacts, but actual flying machines. Your students watch as Major Dawne Dunlop of the US Air Force loses control of the 1902 glider and cartwheels across the sand. They see Lt. Cmdr. Klas Ohman of the US Navy grimace as he struggles to keep the Wright glider in the air. Second by second they follow Capt. Connie Tobias of United Airways as she becomes the first woman to successfully pilot the 1903 Flyer. We don't just tell the Wright story. We bring it to life.



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**Cool stuff**

Every teacher knows you can get your point across better and easier with visual aids. So we created a "portable museum" of the Wright brothers especially for schools. It includes:

- **Wright Bat** – A toy helicopter the brothers built when they were kids.
- **Wright Bicycle** – Wil and Orv's introduction to control and balance.
- **Control Demonstrator** – Showing how to control an aircraft in roll, pitch, and yaw.
- **Inner Tube Box Experiment** – Reliving the discovery that inspired a revolutionary new control system.
- **Not Quite Wright Kite** — So students can fly the Wrights' first controlled flying machine.
- **Wind Tunnel and Balance** – Allowing students to repeat the Wright's lift experiments.
- **1903 Wright Flyer Flight Simulator** – So students can relive the adventure of the first controlled, powered flights.

Three of these items – the inner tube box, kite, and wind tunnel – are things that your students can easily make from common, inexpensive materials. The plans can be downloaded from our web site. Use these to prepare for our visit or to reinforce the lessons after we leave.



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**An historic aircraft**

The centerpiece of this museum is a full-size replica of the **1902 Wright Glider**, the world's first fully controllable aircraft, the basis of the Wrights' grandfather patent of the airplane, and the granddaddy of everything that flies. It has an impressive 32-foot wing span when it's assembled, but it breaks down so we can fit it through an ordinary door. This lets us set up in a cafeteria, gymnasium, large classroom, anywhere you have space for an airplane.

More important, this glider was *built and flown by kids*. We worked with 8<sup>th</sup>-grade students from Russia, Ohio to build this aircraft, then took them to Kitty Hawk, North Carolina and taught these same 8<sup>th</sup>-graders to fly it. It's one thing to show kids an aircraft built by stuffy old archaeologists, quite another to show them one that was built and flown by their own peers. The message is loud and clear. The video of young people flying a Wright glider of their own creation inspires and empowers the young people who view it.



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### Interacting with the Wright brothers

Along with this portable museum, we send one of our “curators” who has hands-on experience with building and flying Wright aircraft and an in-depth knowledge of the history and science involved. The curator spins a spirited and humorous tale of two ordinary men – Wilbur and Orville Wright – who did something extraordinary by virtue of their imagination, perseverance, and courage.

Our people don’t just deliver a lecture, however. This is an *interactive* presentation, requiring the attention of and input from your students. They participate in demonstrations, perform experiments, offer information, and draw conclusions. Some even get a little “stick time” aboard the Wright glider! They repeat the same intellectual journey that Wilbur and Orville navigated as together our curator draws them along on the adventure that was the invention of the airplane.

At your request, we will also conduct hands-on workshops, teaching your students to build a Not Quite Wright Kite, wind tunnel, or wing ribs that will be used as part of the airframe of our next Wright airplane.



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**Relevant and proficient**

We offer two presentations, each lasting the length of a standard class period (about 45 minutes), although either can be made longer or shorter to suit you. Our most popular program traces the development of the airplane control system – aerodynamic control was the most important contribution the Wrights made to aeronautics. The other centers on the Wrights’ wind tunnel experiments, showing students how to conduct a scientific investigation.

Both presentations are built around national academic standards for social studies, science, technology, and math. We touch upon dozens of benchmarks for each grade level, explaining some and reinforcing others. Here are just a few, chosen from the academic benchmarks for the 3/4/5 and 6/7/8 grade levels:

**Social Studies**

- *Explain how new developments contributed to the growth of the United States.* The invention of the airplane led to a new industry and faster transportation, creating new jobs and opportunities. Today the aerospace industry is the largest in the country, affecting every other industry in some way.

- *Explain how historians and archaeologists interpret the past.* Historians interpret the written and graphic records of past events, archaeologists study the artifacts left behind by peoples and cultures. Some archaeologists also build and use these artifacts to gain a better understanding of the past. This is called *experimental archaeology*, and it’s what the Wright Brothers Aeroplane Company does.



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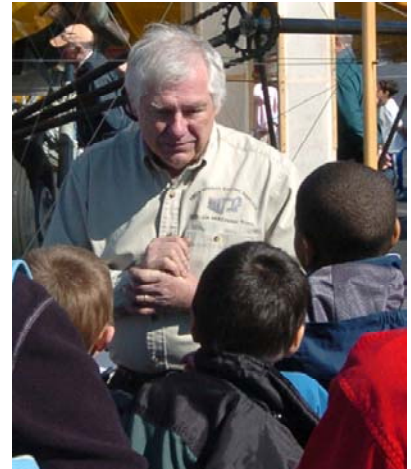
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### Science

- *It is important to keep detailed records of investigations.* The Wright brothers recorded the results of their experiments, but nothing else – we can only guess at their hypotheses, methods, and conclusions. There is not enough information to successfully repeat their experiments, which is why we use the techniques of experimental archaeology to fill in what we don't know.
- *Describe forces that affect the motion of an object.* The Wright brothers designed control surfaces that generated aerodynamic pressure to move or balance an airplane in three ways. Warping wings or ailerons *rolled* the craft right and left. The elevator *pitched* the plane up and down, and the rudder *yawed* it from side to side.
- *Hypotheses are valuable even when they are wrong.* The Wright brothers pursued many possible solutions to the “flying problem” that just didn't work. Their first two gliders were flops in their own estimation. But each failure suggested new avenues of experimentation and eventually led to the invention of a practical flying machine.



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### Technology

- *Technological systems often connect to one another.* The Wright brothers learned how to use tools from their mother and grandfather, how to construct and troubleshoot mechanical systems from building printing presses, and how to balance and control vehicles from designing bicycles. They used parts of all three technologies when inventing the airplane.
- *Transportations vehicles are made up of subsystems.* In 1799, Englishman Sir George Cayley first described an airplane in scientific terms and divided it into four subsystems – wings to *lift* the aircraft into the air, *propulsion* to drive it forward, *controls* to balance and navigate the craft, and a *framework* on which the other systems would be mounted.
- *Scientific principles can be used to solve technical problems.* When the Wrights built their first glider, they wondered how big should they make the wings. Scientists before them had determined that wind blowing over a wing created pressure that forced the wing upward – this was lift. By adding the weight of the glider and the pilot, the brothers figured how much lift they needed to fly. They plugged this number into the lift equation to determine how big to make the wings.



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### Math

- *Use the properties of right triangles to find angles and length of sides.* The Wright brothers were the first investigators ever to measure the performance of airplanes in flight. There were two important forces they had to know – the amount of *lift* the wings generated and the *drag* or air friction that held the airplane back. They visualized lift and drag as the sides of an imaginary triangle. When they flew their gliders as kites, they noticed the tether ropes described the hypotenuse of that triangle, and the tension on that rope was the result of the combined forces of lift and drag. Measuring the tension and the angle of the tether rope provided the information needed to find the sides of this imaginary triangle. In this way they determined lift and drag.
- *Represent and interpret data as a graph.* The Wright brothers tested wing shapes at various angles to the wind in their tunnel, then plotted the lift or drag produced at each angle. The plots traced curves, and these curves helped the brothers compare the performance of various wing shapes.



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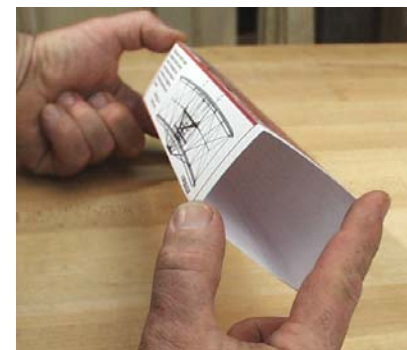
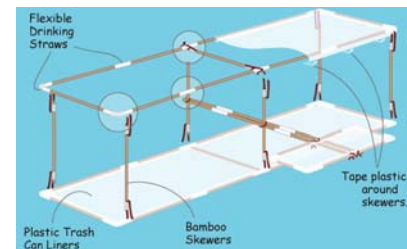
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### Making a good story even better

When students become excited about a subject, they want to know more. So we provide the means for them to learn as much about the Wright Brothers, early aviation, and aeronautics as they would like to know. Our web site, **[wright-brothers.org](http://wright-brothers.org)**, is the largest single source of information about the Wright Brothers on the Internet. Its unique "layered" presentation allows a student to dive into any topic as briefly or as thoroughly as their interest dictates. We even provide primary and secondary sources for the Wright story, helping students to do scholarly research for social studies projects.

Our special hands-on section, "Will and Orv's Workshop," provides plans and instructions for building simple flying machines and scientific instruments, such as the wind tunnel and Not Quite Wright Kite. In "Help with Homework," we offer public domain photos and videos to use in reports, web sites, and media projects. And there is a long list of reading materials, instructions for how to use interlibrary loan (to obtain books that aren't in their local library), aviation museums, and links to other aviation web sites.



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## Our requirements

### Setting Up

To set up our exhibits and present them to your students, we need an area of 1500 square feet or more. (The 1902 glider has a wingspan of 32 feet and is 17 feet from nose to tail.) Because our displays are engineered to break down into small enough pieces to get through an ordinary door, we can set up in an auditorium, library, gymnasium, cafeteria, or large classroom. Set-up takes about one and a half hours.

### Schedule

We can do up to five presentations a day in the course of a normal school day, usually three in the morning and two in the afternoon. Because these presentations are interactive, we ask that you not schedule more than 200 students at a time. If you would like us to do workshops, we can do up to two per day – one in the morning and one in the afternoon, and we will work with a maximum of 50 students. If we spend two days or more at your school, we would be happy to make an **evening presentation** for parents or the public.

### Fee

We charge \$1200 for the first day and \$800 for additional days. The shipping charge is \$0.75 per mile round trip from Dayton, Ohio. We normally send two people with the museum – a presenter and an assistant – and we also require meals and rooms in modest motels for them for the duration of the trip.

Many schools ask businesses or foundations to fund our visit, and we will gladly help you to prepare a request by providing descriptions of our services and recommendations from schools that we have visited since we began in 1999.

### Engagements

If your school is further from Dayton, Ohio than a day's drive (400 miles), we require at least a two-day engagement. Oftentimes, two or more schools in a region engage us for a day each. On occasion, we have been engaged by an entire school system in a region. If you would like to split the cost of a visit with other schools, we are happy to oblige. However, we cannot set up at more than one school in a day's time.

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**DREW ACHTERMANN**  
Chief Builder

**LOUIS CHMIEL**  
Wright Historian

**Kind words from others**

Our innovative educational programs have earned acclaim from many quarters. Three times the Ohio State Legislature has awarded commendations for our efforts, including one specifically for the Secret of Flight Program. More to the point, we've been complimented by every school we've visited. Here are what a few educators have had to say:

*"The school was truly abuzz with word of your visit and marvelous Wright brothers glider replica."*

Suzanne Weichselbaum,  
Liaison for Greenhill School  
Dallas, Texas

*"Teachers, students, and administrators are still raving about the program."*

Susan Smith, Director  
Challenger Learning Center  
Brownsburg, Indiana

*"Your rapport with the children was 'magical.'"*

Susan Coleman, Chairman  
Indian Creek School  
Crownsville, Maryland

*"I had no idea how much you touched the lives of our students until I read through their notes to you."*

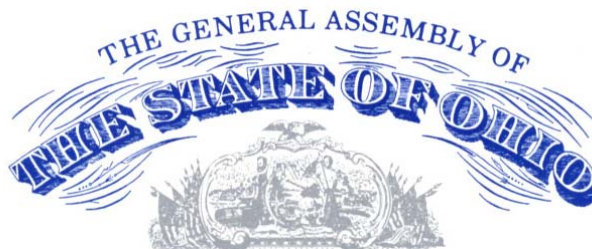
Sheila Faulkner,  
Fifth Grade Teacher  
Sugar Grove School  
Frederick, Ohio

The best commendations, however, come from the kids themselves. We've received hundreds of letters and e-mails written under the watchful eye of a teacher, telling us that we have really cool stuff (true) and that they never knew the Wright brothers covered their airplanes with women's underwear (not quite true – they used a cotton weave that was favored for undergarments). But our favorite letters all say something like this:

*"I would like to learn even more now."*

Kathleen Heit,  
Fourth Grade Student  
Indian Creek School  
Crownsville, Maryland

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