

## Build Glider Prototypes: Taking Flight with the Wright Brothers

**Activity Type:** Hands-On Activity

**Grade Level:** 6–8

### An RIF Guide for Educators

**Objective:** Students will build and test four paper glider prototypes to identify how different variables affect the gliders' flight capabilities.

**Content Connections:** Literacy, History, Science

**Standards:**

- **CCSS.ELA-LITERACY.RH.6–8.2:** Determine the central ideas or information of a primary or secondary source; provide an accurate summary of the source distinct from prior knowledge or opinions.
- **CCSS.ELA-LITERACY.RH.6–8.3:** Identify key steps in a text's description of a process related to history/social studies (e.g., how a bill becomes law, how interest rates are raised or lowered).
- **CCSS.ELA-LITERACY.RH.6–8.7:** Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.
- **CCSS.ELA-LITERACY.RH.6–8.9:** Analyze the relationship between a primary and secondary source on the same topic.

**Summary:** In this Hands-On Activity, students take the role of early flight engineers working with the Wright brothers to develop a glider prototype. Students will review the steps involved in the scientific method and apply those steps in their development and testing of paper gliders. Students will test their gliders and record the results in a data log. They will be asked to draw conclusions about the designs of the four prototypes.

### Before the Activity

**Explore the Wilbur and Orville Wright Papers Teacher Page:**

The [Teacher's Guide Primary Source Set - The Inventive Wright Brothers](#) at the Library of Congress provides an overview biography of the Wright Brothers and suggestions for teaching techniques with primary source materials. There are also links to a variety of useful additional resources.

The [Teachers Page to The Wilbur and Orville Wright Papers at the Library of Congress](#) provides standards alignment information, links to the [Collection Highlights](#) page, the collection [Finding Aid](#), and a list of additional [Related Resources](#).

**Explore the following online resources:**

[Overview of the Wright Brothers' Invention Process](#): This online timeline describes the scientific process the Wright brothers followed in developing their aircraft. This process is still followed by NASA engineers.

[The Wright Brothers and The Invention of the Aerial Age](#): This online exhibit from the Smithsonian National Air and Space Museum has many fascinating facts and images about the Wright brothers and their efforts.

[The Golden Age of Flight](#): This online exhibit explores the American fascination with flight during the 1920s and '30s, a period when pilots and airplane designers pushed the limits of powered flight.

[Paper Airplane Physics](#): This site provides basic information on the physics involved in paper airplane flight. Concepts such as aerodynamics, gravity, and force of the throw are covered. There are also helpful links to descriptions of air streams and drag.

### Tips for Exploring the Collection:

- Be sure to read the collection components identified in the Reading section of the Student Edition.
- Browse through some of the [featured documents](#) the librarians and archives have selected and highlighted.
- Use the filtering features in the [collection](#) to select for year, format, location, and other factors.
- Read some tips and record your notes as you read through the documents you are responding to using the [Taking Notes Worksheet](#).

## During the Activity

### Warming Up

Direct students to complete the Warming Up activity. Have students review the photographs and record their responses to the questions on paper or on their devices. After students have time to respond to the questions, discuss their responses as a class. Record ideas on the board. You may want to revisit students' ideas as they work to build their model gliders. They may want to test their ideas for increasing an object's aerodynamics.

### Sample responses:

**Shared characteristics:** wings set perpendicular to the main body of the aircraft; long slender body; wheels on the underside of the aircraft's body

**Differences:** The airplane body is longer than the body of the glider. The gliders do not have long noses like the aircraft in the images on the bottom. The aircraft on the bottom left has a narrow pointy nose, while the airplane on the bottom right has a wider, rounder nose.

**Conclusions:** Aircraft should be long and slender for air to be able to travel around it easily. Aircraft need wings to help it glide.

### Getting Started

Have students read the introductory paragraphs and real-world topics. After students read, lead the class in a brief discussion to gather students' thoughts about the Wright brothers' process as described in the first paragraph. Ask: What does the first paragraph teach about the brothers' scientific process?

### Student responses:

Answers may vary, but students may point out that the brothers completed multiple tests on their glider. They observed how their glider performed and then went back to the drawing board to improve their design and get more positive results.

### Readings

Students may read the suggested readings on their own or in pairs of small groups. For students who may need support understanding the readings' key ideas, use the suggested comprehension questions below. Ask questions during or after students' reading time and encourage students to record the responses in the [Research Note Taker](#).

- [Family Papers: Correspondence—Wright, Wilbur, 1900-1901](#) Images 2–3
  - Where is Wilbur planning to travel by boat? *Kitty Hawk, North Carolina*
  - Why is Wilbur traveling here? *He is traveling to study the flying question and perform experiments. He chose Kitty Hawk because it has the ideal conditions for his tests.*
  - Why is this location ideal for his experiments? *There are no hills or trees; it is a safe place to practice. In addition, the winds are stronger there than any place near home. He can test there constantly instead of another location where it might be days between suitable breezes.*

- What does Wilbur promise his father at the end of the letter? *He promises him that he does not expect to be injured and plans to experiment carefully and not take too many risks.*
- [Family Papers: Correspondence—Wright, Wilbur, 1900-1901](#) Image 5
  - What does Wilbur say about risks? *Carelessness and overconfidence are more dangerous than deliberately accepted risks.*
  - What safety precautions does Wilbur take? *He built his flier to hold more than five times his weight, and he tested every piece he built.*
  - Is Wilbur pursuing his goal of flight for profit? Explain. *No, Wilbur is pursuing his goal for pleasure. He understands that fame may result from his work, but this is not his motivation.*
- [Family Papers: Correspondence—Wright, Wilbur, 1900-1901](#) Image 20
  - What kind of apparatus has Wilbur been experimenting with? *one that measures air pressure*
- [Some Aeronautical Experiments From the Smithsonian Report for 1902](#) [Wilbur Wright, Government Printing Office]
  - According to President Chanute, what has been the primary challenge for those seeking to add an engine to a flying machine until recently? *The technology available has produced only very heavy engines until recently.*
  - According to Wilbur Wright, what problem, if solved, will truly usher in the “age of flying machines”? *The one engineering problem that has yet to be solved is that of balancing and steering a plane while in flight. Solving this problem, he claims, will make many other things possible.*
  - What is the advantage of putting the pilot in a horizontal position instead of the upright position used by the machines of Lilienthal, Pilcher, and Chanute? *With the pilot in a horizontal position, the wind resistance would be greatly reduced.*
  - Why were the Wright brothers unable to get the glider to stay aloft with a headwind of 17 miles per hour? *The lifting capacity of the glider was barely a third of what they anticipated through their calculations.*
- [Chanute, Octave—Photographs, Kitty Hawk, North Carolina, Originals, 1901](#)
  - What do the photographs show? *Wilbur and Orville testing the gliders*
  - What does the glider look like? *The glider looks like a rectangle with many vertical bars across it. A person can lie or sit along the flat bottom of the rectangle.*

**Activity: Build Glider Prototypes**

Students will construct two paper airplanes. One will be of standard weight, 8.5 × 11 inch white printer copy paper, while the other will be constructed of standard weight 8.5 × 11 inch construction paper. The construction paper can be of any color or an assortment. Both white copy paper and construction paper should be free of creases when the students begin the glider construction process.

**Note:** The construction paper will be uniformly denser and heavier than standard weight white printer copy paper.

Have students construct both gliders at the same time. Ensure that the gliders are the same size, and that the folds in the gliders are equally sharp and tight.

**Note:** A glider that does not have as sharp-edged fold on the wing, for example, will fly differently than one with the correct edge.

Observe students as they launch their gliders. Ensure no student places a foot beyond the “Start” line. Launching technique can affect how well the glider flies, so try to ensure that all students launch with approximately the same force, etc.

Students should record distances as accurately as possible. Since they will be taking an average of the distances, they can round up or down to the nearest half-inch.

**Note:** The Flight Record Sheet indicates four flights. This can be any number above two, as time allows. The more flights, the more data, and the more accurate the average recorded data will be.

## After the Activity

**Elaborate:** Consider having the students expand their experiments by adding a paperclip on each wing and repeating the flight tests. Then, they can add two paperclips to the tail or some combination of paperclips on different parts of the glider to see how the addition of weight affects the glider’s flight. Some configurations might result in a better, longer flight. Ask students to think about how additional weight in certain places might help a glider fly better.

### Analyze:

1. The quality of the flight is dependent on the original force of the throw. Since copy paper weighs less than construction paper, it should travel farther IF the original force of the throw is strong enough. The extra weight of the construction paper will inhibit distance to a degree.
2. Adding drag slows down a flight. The air has to flow over the top of the bent paper instead of flowing directly back. This is a principle of aerodynamics. Think of a commercial airplane that is coming in for a landing. You will see that the pilot raises the ‘flaps’ on the wings. This provides substantial drag, slowing down the plane.

**Reflect:** Have students reflect on the following prompts, either in written form or through a class discussion. Student answers will vary.

How did the use of primary documents help you better understand the significance of the accomplishments of the Wright brothers? And what did the primary documents you researched reveal about how the Wright brothers used the engineering design process?