

# The 1903 Flyer

Lesson 1 of 2

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**Grade Level:** 5-8

**Subject:** Science

**Prep Time:** < 10 minutes

**Activity Duration:** 45 minutes

**Materials Category:** General classroom

National Education Standards				
Science	Mathematics	Technology		Geography
		ISTE	ITEA	
8c				

**Objective:** To build a replica of the Wright brothers' 1903 flyer.

**Materials:**

- Two Styrofoam meat trays, minimum 11" x 9" each, preferably white
- 40-50 toothpicks (square/round tip)
- Wooden skewers (four to six per student)
- Two craft or Popsicle sticks
- White glue (low-temperature glue gun, if available)
- Scissors
- Exacto knife or razor blade (adult help needed here) and cardboard or layered newspaper to cut on
- Ultra-fine-tip black permanent marker
- Ruler
- Emery board
- Manila folders



## Related Links:

Lesson Adapted Wright Brother 1903 Model Instructions

<http://www.grc.nasa.gov/WWW/Wright/ROGER/1903model.htm>

The Wilbur And Orville Wright Story

<http://www.jsc.nasa.gov/er/seh/Wright1.html>

Federal Aviation Association (FAA) Aviation Education: Aviation Reading List

<http://www.faa.gov/education/resource/readinglst.htm>

FAA Aviation Education: 1903 Wright Flyer another model pattern

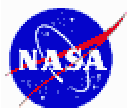
<http://www.faa.gov/education/resource/1903fly.htm>

Wright Brother video

<http://lava.larc.nasa.gov/MOVIES/LARGE/LV-2000-00009.mov>

1903 Wright Flyer Stats

<http://www.wrightflyer.org/Background/stats.html>



### The 1903 Flyer

#### Teacher Sheets

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#### Pre-lesson Instructions

- Gather material in advance. Many grocery store meat departments will provide the Styrofoam trays.
- Divide class into groups of four to six students.
- Print one to two sets of Students Sheets per group.

**Safety tip:** For the younger students, you need an adult to help cut the pattern from the Styrofoam.

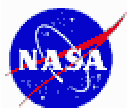
#### Background

The exploits of Otto Lilienthal, the German pioneer of gliders, inspired the Wright brothers to begin exploring the possibilities of powered flight in the 1890s. Lilienthal's death in an 1896 glider crash convinced the brothers that they not only must build successful airplanes, but must also learn to fly them correctly.

On December 17, 1903, Wilbur and Orville Wright became the first humans to fly a controllable, powered airplane. To unravel the mysteries of flight, the Wright brothers built and experimented extensively with model gliders. Gliders are airplanes without motors or a power source.

Building and flying model gliders helped the Wright brothers learn and understand the importance of weight and balance in airplanes. If the weight of the airplane is not positioned properly, the airplane will not fly. Too much weight in the front or nose will cause the airplane to dive toward the ground. The weight of the airplane must be distributed precisely to obtain the best flight characteristics.

Orville and Wilbur learned that the design of an airplane was very important. Experimenting with models of different designs showed that airplanes fly best when the wings, fuselage, and tail are designed and balanced to interact with each other. The Wright Flyer was the first airplane to complete a controlled takeoff and landing. To control flight direction, airplanes use control surfaces. Elevators are control surfaces that make the nose of the airplane go up and down. A rudder was used to move the nose left and right. Warping or twisting the wings rolled the Wright Flyer right and left to make turns. On modern airplanes, ailerons are used to control roll.



## Guidelines

1. Read orally the 5-8 NASAexplores article, "Practice Makes Perfect!" Then, read the background information from the Student Sheets.
2. Ask the students the following questions:
  - Have you ever flown in an airplane? Allow students to share some of their experiences.
  - How does flying help people?
  - What do you think travel would be like without airplanes? Explain.
  - What is the significance of December 2003 in relationship with flight? (*December 2003 marks the centennial or 100<sup>th</sup> anniversary of the first powered flight by the Wright Brothers.*)
3. Discuss the Wright brothers' impact on aviation.
4. Show the class pictures of the 1903 flyer. See the last page of the Teacher Sheets.
5. Pass out all materials needed to construct the model.
6. Tell students to work together building their replicas of the 1903 Wright Flyer.

## Discussion / Wrap-up

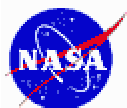
- Display finished models from the ceiling.

## Extensions

- Use this activity as a springboard into a unit on flight.
- Students create a letter from Wilbur and Orville to a possible manufacturer of their planes explaining what their flyer is and what it can do.
- Students design a drawing of a future flight vehicle, and describe how it works.



## 1903 Wright Flyer



### The 1903 Flyer

#### Student Sheets

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#### Background



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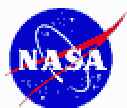
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#### Materials

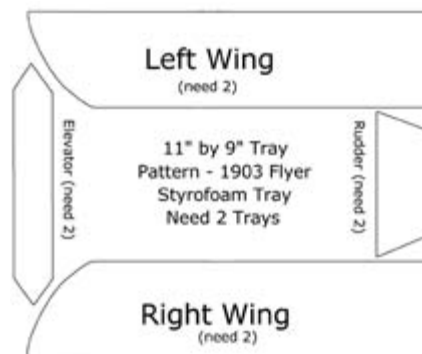
- Two Styrofoam meat trays, minimum 11" x 9" each, preferably white
- 40-50 toothpicks (square/round tip)
- Wooden skewers (four to six per student)
- Two craft or Popsicle sticks
- White glue (low-temperature glue gun, if available)
- Scissors



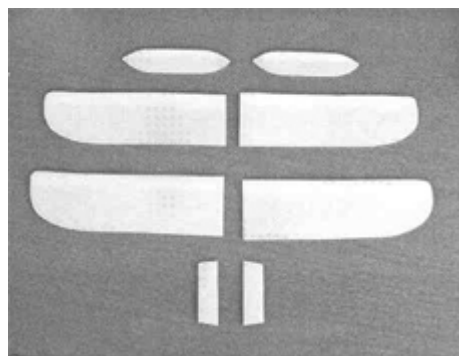
- Exacto knife or razor blade (adult help needed here) and cardboard or layered newspaper to cut on
- Ultra-fine-tip black permanent marker
- Ruler
- Emery board
- Manila folders

## Procedure

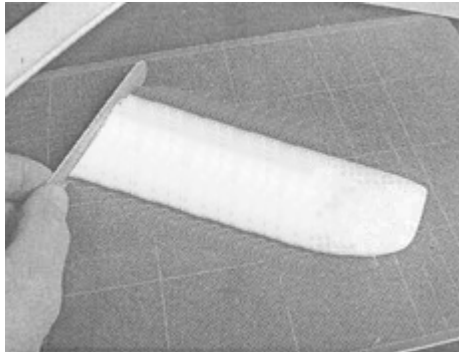
1. Cut out the pattern pieces from the Student Sheet called the 1903 Flyer Template.
2. Trace the pattern pieces of the wing, elevator, and rudder shapes carefully on the meat trays. Be sure the front edges of the wings go about two-thirds of the way up the curved sides of the tray. This will allow the front of the wings to have a slight curve like the original flyer. See the diagram below.



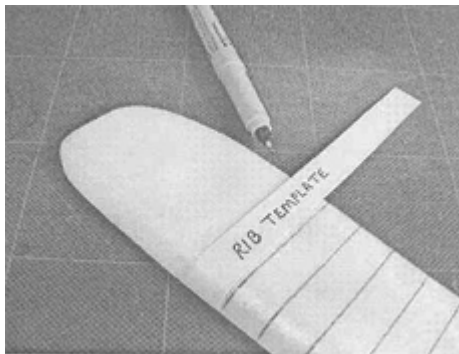
3. Place the two Styrofoam trays on cardboard or layered newspaper, and begin cutting out the patterns using an exacto knife or razor blade. **Remember to always cut away from you.** When finished, you should have the parts as shown below.



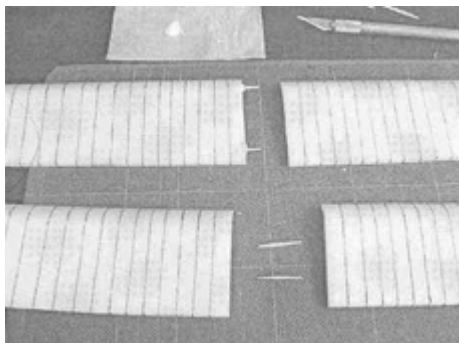
4. Use the emery board to smooth the cut edges from all the Styrofoam pieces. Make sure that the two halves of the upper and lower wings are flat where they will be joined.



5. Make a template about 1-cm wide and 10-cm long from a manila folder, so the end can be bent to conform to the rounded shaper of the Styrofoam.
6. Use an ultra-fine-tip black marker and template to make the rib lines on the tops and bottoms of the wing and elevator sections. Start at the center of each wing, and work out to the tip.

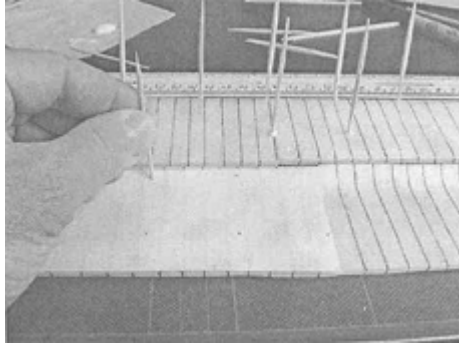


7. Cut four 3-cm toothpick sections, and sharpen the cut ends. Place glue on the flat edge of the upper and lower wing halves, insert two cut toothpicks, and join each wing as shown.

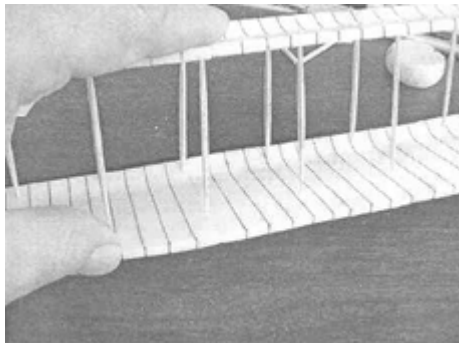




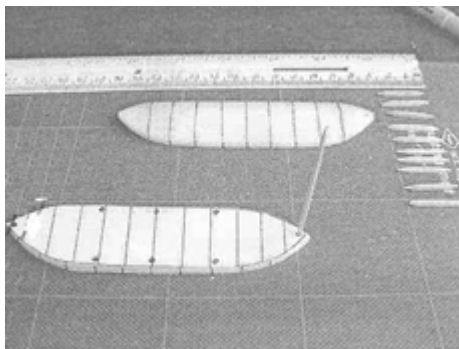
- Use the ruler and a sharp toothpick to mark the holes for the spars (toothpicks) 4 cm apart on the top surface of the lower wing and the bottom surface of the upper wing. Dip the toothpicks in glue, and set them upright in the lower wing. Try not to push them all the way through the wing. Be sure they are straight, and let them dry.



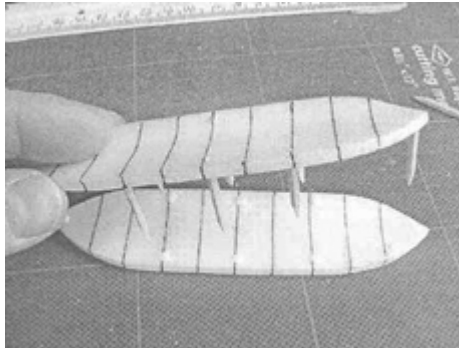
- Work with a partner to help get everything lined up, turn the lower wing upside down, and insert the spars (toothpicks) into the underside of the upper wing. Again, try not to push them all the way through the wing. Place a little spot of glue at the top of each spar to help secure them. See the diagram below.



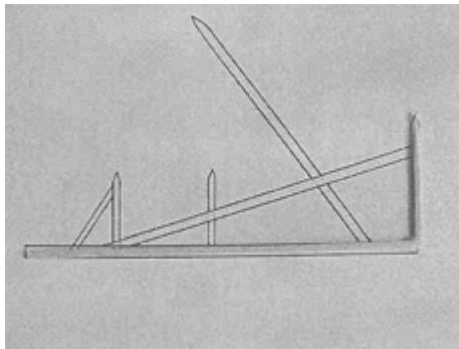
- Cut eight 2.5-cm long toothpick sections, and sharpen the cut ends. Mark the locations for these spars (toothpicks) in the upper surface of the lower elevator and the underside of the upper elevator 2 cm apart, just as you did previously with the wings. See the diagram below.



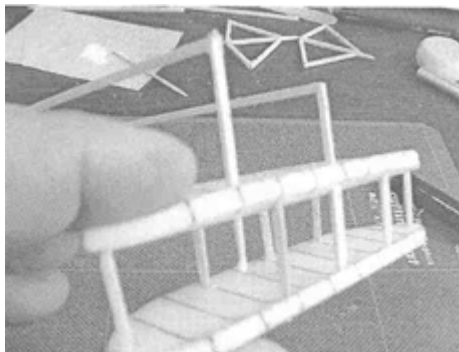
11. Dip one end of these short spars (toothpicks) in glue, and insert them into the lower elevator. Again, try not to go all the way through the Styrofoam. Once they are dry, turn them over, and repeat the process on the upper elevator.



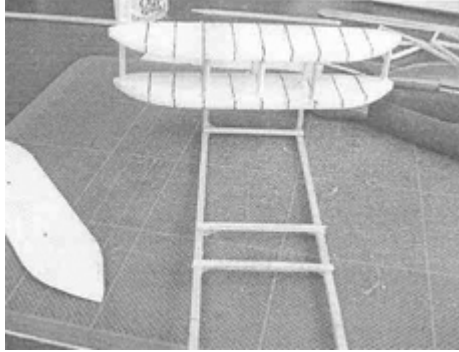
12. Cut two wooden skewers 14 cm. Using the diagram below, lay one cut skewer diagonally. Cut the right end at about a 45° angle. Cut a toothpick to 4.5 cm, with the cut end also being at a 45° angle. Glue the two 45° angle ends together to make a 90° angle, and repeat the process to make the second skid.



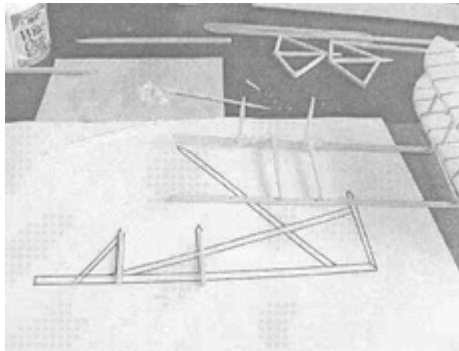
13. Turn the elevator assembly over, and poke a hole through the lower elevator midway between the pair of spars (toothpicks) next to the center pair. Push the top of the skid through the hole just made, add a bit of glue, and then stick the skid into the upper elevator.



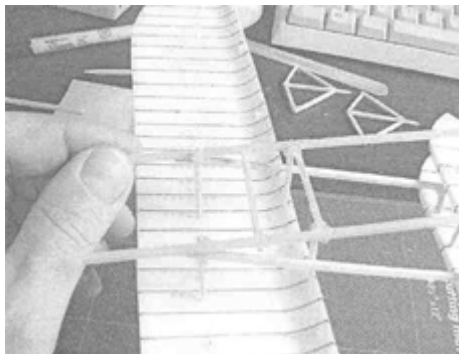
14. Cut the pointed ends off three toothpicks so that they are 4.5 cm in length, and place them as cross-braces across the skids. Glue one across at the right angle (or the end of the skid where it connects to the elevator), one at 7 cm from the right angle, and one at 9 cm.



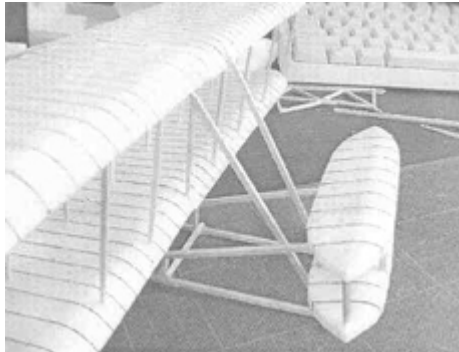
15. Cut four toothpicks 3-cm long. Glue two to each skid pointing up. The first two about 8 cm from the right angle, and the second two about 12 cm from the right angle. Cut two braces out of the wooden skewers to go from the rear skid support up to the elevator support.



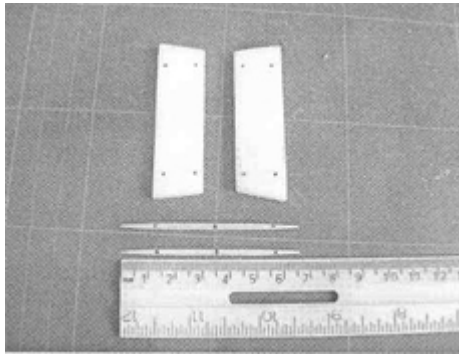
16. Turn the wing assembly over. Press the skid assembly into the lower wing. Try to keep from going through the Styrofoam. Add some glue to each support.



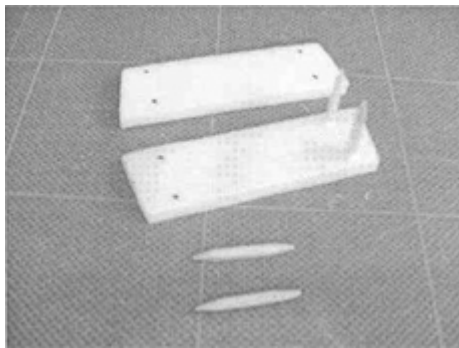
17. Leave the sharp end, and cut two 10-cm pieces from the wooden skewers. Insert the sharp end into the leading edge of the upper wing. Glue it to the brace and to the bottom skid.



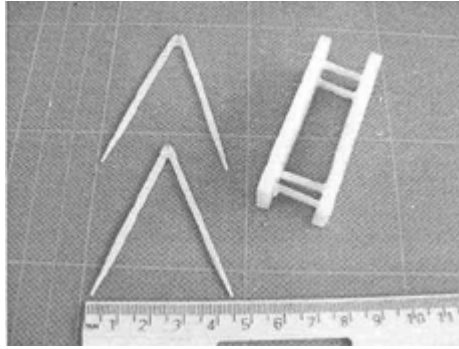
18. Mark the brace locations in the rudders as shown, and cut the ends off two toothpicks. Cut the remaining parts in half, and sharpen the cut ends.



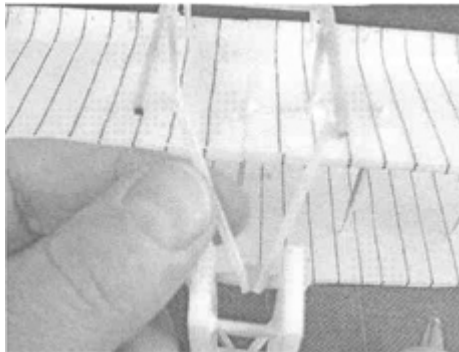
19. Dip the braces in glue, and insert them into the rudder. Turn the assembly over, and insert it into the other rudder. Add more glue for support.



20. Make two sets of braces to attach the rudder to the flyer. Lay a toothpick with one point at the end of the ruler, and cut the point off the other end. Place that end at an angle vertical to the ruler at the 2.5-cm mark. Place the second toothpick with one point at the 4.5-cm mark, and place the other cut-off end touching the first toothpick at the 2.5-cm mark. Glue the two cut-off ends together.



21. Glue the lower brace to the rudder and to the back end of the skids. Turn the flyer over, and glue the upper rudder braces to the back edge of the upper wing so that the rudder is vertical.



22. Cut a toothpick in half, and glue one piece to each of the two middle supports on the wings to make the propellers.
23. Allow time for the glue to dry.
24. Display your finished model. It is not designed to fly.



# 1903 Flyer Template

