

## Banana Man Glider

**Grades:** 5-8

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**Goals:** National Science Standard B: Motions and Forces  
National Science Standard E: Abilities of Technological Design  
NCSCOS: Grades: 6-8 Goal 1: The learner will design and conduct investigations to demonstrate an understanding of scientific inquiry.  
NCSCOS: Grade: 5 Goal 4: The learner will conduct investigations and use appropriate technologies to build an understanding of forces and motion in technological designs.  
NCSCOS: Grade 6-8: Goal 2: The learner will demonstrate an understanding of technological design.

**Objectives:** Students will build a glider that will safely transport a banana to the ground. By doing this, students will apply principles of flight.

**Engagement:** Have you ever wondered how airplanes fly? What makes them glide through the air so effortlessly? During this project you will be creating glider to transport someone home safely. Meet Mr. B. A. Nana.

**Materials:** Balsa Wood of various sizes, Hot Glue, various fabric swatches, string, tape, one small banana per group, toothpicks, tissue paper, Elmer's Glue, manila folder, foam chunks, stopwatches, measuring tape \* *All materials are arbitrary, however make sure to have various and diverse materials available since this is a free form activity. The more materials you have available, the more diversity you will have in your gliders.*

**Procedure:** Tell students that they will be building a glider that will be judged on three criteria. These criteria are 1. Time in flight 2. Distance from the release point, and 3. Condition of Mr. Nana after the flight. Mr. Nana's condition could be rated on a three point scale: 1 point for major damage, 2 points for some damage, and 3 points for slight damage. Students will have access to all materials and there are no limitations for size and weight. Students should be free to design and build with little input from the teacher. Groups should work together to determine how to build the best glider. You may wish to do this over the course of multiple class periods or for an afternoon activity.

**Banana Rights Issues:** In order to ride in the glider Mr. Nana may not be glued, cut, taped, punctured or damaged in any way deemed inhumane. He may not be peeled. He may wear a seatbelt. He may sit in a custom seat. He may rest in any position, lying down is acceptable.

Once the gliders are complete, choose a location to fly them. All gliders should start from the same point. At least two people should have stopwatches in case of any disputes or technical difficulties. Write down the time and distance for each gliders flight. Also compare and record the condition of Mr. Nana before and after each flight.

**Pre Build Discussion:** These are questions that you may want to bring up before the build. Consider the size of gliders that carry humans. Maybe get photos and show students pictures of actual gliders. This should convince students not to build a 12 inch wingspan glider. You may want to refrain from actually showing pictures of gliders if you want your students to start from scratch.

Consider the center of gravity. The students could build various paper airplanes with pennies taped to different places on the airplane. Discuss what happens when the weight is further from the center of gravity. This may help them to determine the center of gravity of their own glider and therefore also know where to place Mr. Nana.

You may wish to teach the concept of an airfoil; an airfoil being a cross-section of the shape of a wing that creates lift. You could also explain lift; this being produced by the curve of the top of the wing creating a low pressure area which lifts the plane upward.

An airplane wing has a special shape called an airfoil. As a wing moves through air, the air is split and passes above and below the wing. The wing's upper surface is shaped so the air rushing over the top speeds up and stretches out. This decreases the air pressure above the wing. The air flowing below the wing moves in a straighter line, so its speed and air pressure remain the same. Since high air pressure always moves toward low air pressure, the air below the wing pushes upward toward the air above the wing. The wing is in the middle, and the whole wing is "lifted." The faster an airplane moves, the more lift there is. And when the force of lift is greater than the force of gravity, the airplane is able to fly. Acknowledgements:

[http://www.boeing.com/companyoffices/aboutus/wonder\\_of\\_flight/airfoil.html](http://www.boeing.com/companyoffices/aboutus/wonder_of_flight/airfoil.html)

For a simple demonstration, you can cut a thin strip of paper about 5" x 2". Holding the 2" side of the paper near your mouth, blow over the top of the paper. It should lift up so that it is extending straight out in front of you now rather than drooping down. This is an example of Bernoulli's principle. The air coming out of your mouth (above the paper) is moving faster than the air below the paper, therefore creating lift. Your breath lifts the paper.

For a more elaborate demonstration, see the following activity page. Acknowledgements:  
<http://www.smm.org/LT/ipsd2003/aerofoil.html>

## AEROFOIL ACTIVITY (courtesy of [Queensland Science Centre](#))

### SUPPLIES:

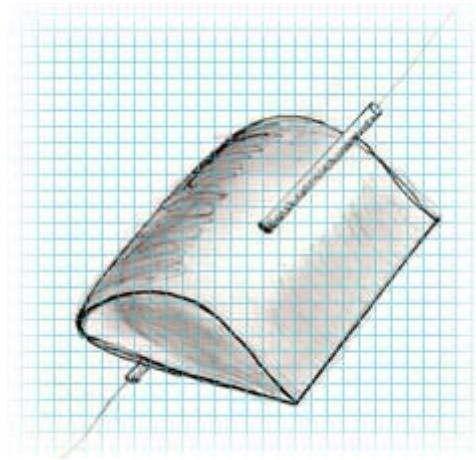
Cardstock or thin cardboard sheet

Tape

Drinking straw –not flexible

Fishing line or cotton string

Hair dryer



### WHAT TO DO:

- Step 1 - Fold the cardboard in two leaving a 1 cm overlap - don't crease the one side, you want it to be rounded. Push and tape together the overlapping ends. (see diagram above)
- Step 2 - Use a pen to pierce a hole through the center of the wing (top and bottom). Make sure not to make the hole too big, you want the drinking straw to fit snugly.
- Step 3 - Carefully push a straw through the holes.
- Step 4 - Now thread a piece of fishing line through the drinking straw.
- Step 5 - Tape one end of the fishing line to the floor (or to a tabletop), and the other to the ceiling.
- Step 6 - Point the hair dryer's air stream HEAD-ON at the aerofoil. The force of the air will cause the aerofoil to travel up the fishing line.

### WHAT'S HAPPENING??

Bernoulli's principle is demonstrated perfectly here. In motion, air hits the leading edge (front edge) of the wing. Some of the air moves under the wing, and some of it goes over the top. The air moving over the top of the curved wing must travel farther to reach the back of the wing; consequently it must travel faster than the air moving under the wing, to reach the trailing edge (back edge) at the same time. Therefore the air pressure on the top of the wing is less than that on the bottom of the wing. This combination of pressure decrease above the airfoil and increase below the airfoil produces lift.

### TRY THIS –

Make modifications to your aerofoil, leave a longer overlap, and leave a shorter overlap. Try making it flat on the bottom. Try flipping it over with the flatter, shorter end on top.

Attach a fuselage (body) to your aerofoil and turn it into a glider. Does it fly? What happens if you add a tail to the glider?

Acknowledgement: <http://www.smm.org/LT/ipsd2003/aerofoil.html>

**Follow-Up Questions:**

**Share what you did:**

What materials did you find most useful in building your glider?

How did your design compare to most of the others in your class?

How did teamwork issues affect your success? What aspects of teamwork were most important

**Process what's important:**

How would a heavier or lighter banana affect your gliders performance?

Did your glider climb or dive?

\*Why do think this might have happened?

Was wind a factor in your gliders performance?

**Generalize to your life:**

What would our world be like if we didn't have flight?

**Vocabulary:**

Lift

Pressure

Mass

Airfoil

Bernoulli's Principle

**Resources:**

[http://www.wannalearn.com/Just\\_for\\_Fun/Making\\_Paper\\_Airplanes/](http://www.wannalearn.com/Just_for_Fun/Making_Paper_Airplanes/) instructions for making various paper airplanes

<http://www.idahoptv.org/ntti/nttilessons/lessons2001/KarenByersflight.html> a teachers unit on making gliders

[http://www.pbs.org/safarchive/4\\_class/45\\_pguides/pguide\\_603/4563\\_wing.html](http://www.pbs.org/safarchive/4_class/45_pguides/pguide_603/4563_wing.html) PBS site explaining how to make gliders. This site also explains the concept of an airfoil.

[http://www.diam.unige.it/~irro/profilo1a\\_e.html](http://www.diam.unige.it/~irro/profilo1a_e.html) demonstrations of how wind flows around wings (airfoils).

