



PROJECT Nº 3

Bernoulli Airfoil



AUTHORIZED AMA
STE(A)M PROGRAM

AGE GROUP: 5-13 BEGINNER



PROJECT Nº 3

INFO FOR PARENTS:

Instructions for both Flight Pack and DIY are included.

Using a hair dryer or small fan should probably only be entrusted to older students. Adults will definitely want to operate these devices for younger students and monitor them closely while running around as well.

GOALS & OBJECTIVES

Fine motor skills: The assembly of the airfoil will require thinking ahead and careful construction.

How fluids behave: What is a fluid? What properties do they possess and what can we accomplish with this knowledge?

MATERIALS

- Pencil or writing utensil
- Kite string
- Pre-cut foam wing or cardstock
- Tape
- 1/4" dowel rod, 18" long
- Scissors

BACKGROUND INFORMATION

In 1738, a scientist named Daniel Bernoulli discovered that as the speed of a noncompressible fluid increases, its pressure decreases, and vice versa. In the case of airfoils, the upper surface is curved, while the lower surface is flatter. This means that as the wing moves through the air, the oncoming airflow traveling over the upper surface has a greater distance to travel in the same amount of time than the lower air flow, so it travels faster. This creates a low-pressure area above the wing and a high-pressure area beneath it, producing an upward force or lift.

GO FURTHER

Become familiar with the specific terminology related to airfoils and how they interact with the surrounding air. As a wing travels through the air, the edge directly meeting the air flow, or relative wind, is the leading edge, while the rear of the wing, where the airflows divided by the leading edge meet again, is the trailing edge. The chord line of an airfoil is the imaginary straight line that can be drawn between the leading and trailing edges, while the camber line is an imaginary curved line drawn between the same two points exactly halfway between the upper and lower surfaces of the wing. The angle that can be measured between the relative wind and the chord line is the angle of attack, which is among the most crucial factors in the flight performance of an aircraft, and even its ability to stay in the air at all.

CREATIVE TIPS

If space permits, hold your rod out horizontally and run through a hallway or outside to see if you can create a fast enough air flow for your airfoil to generate lift!

If you do not get dizzy easily, try holding your airfoil assembly and spinning in a circle. Does it behave similarly? What differences do you observe?

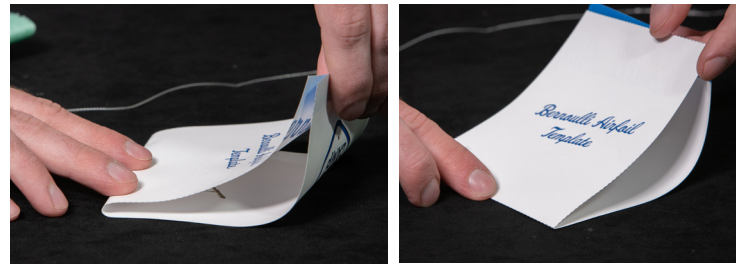
INSTRUCTIONS

1. If you have a Flight Pack, you can gather your supplies and skip ahead to step 5.

2. Cut the wing shape out of the template provided.



3. Fold along the dotted line, dividing the paper and crease. Notice that the dotted line does not divide the paper into two equal halves.

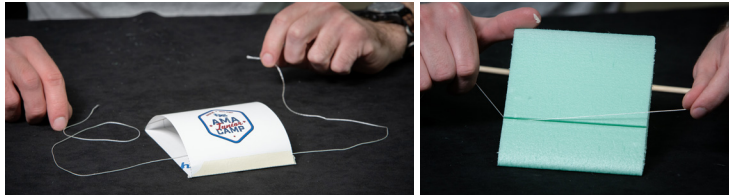


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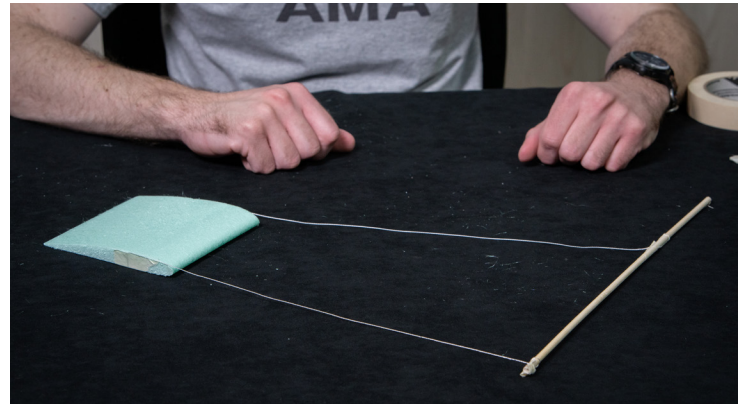
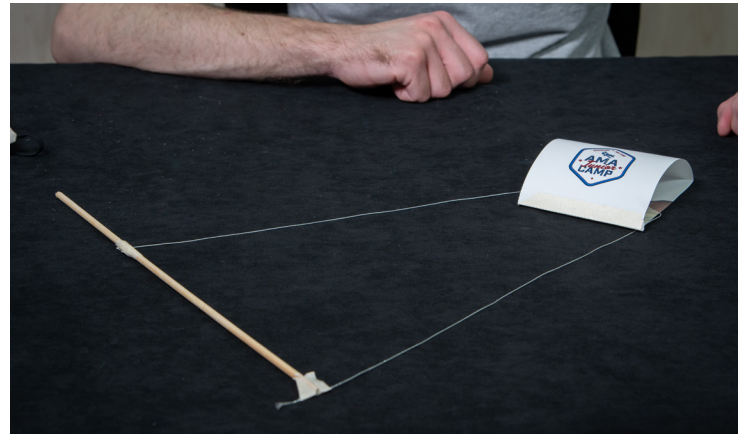
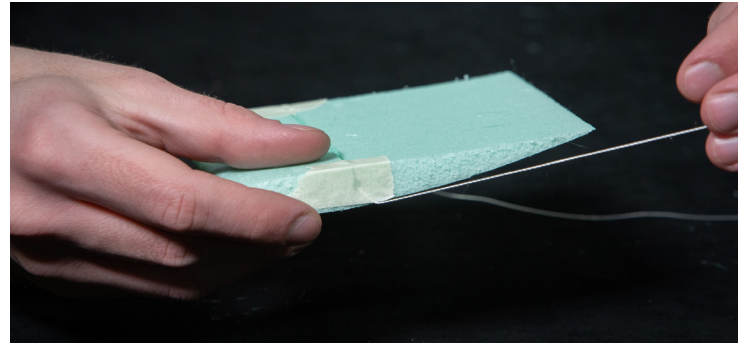
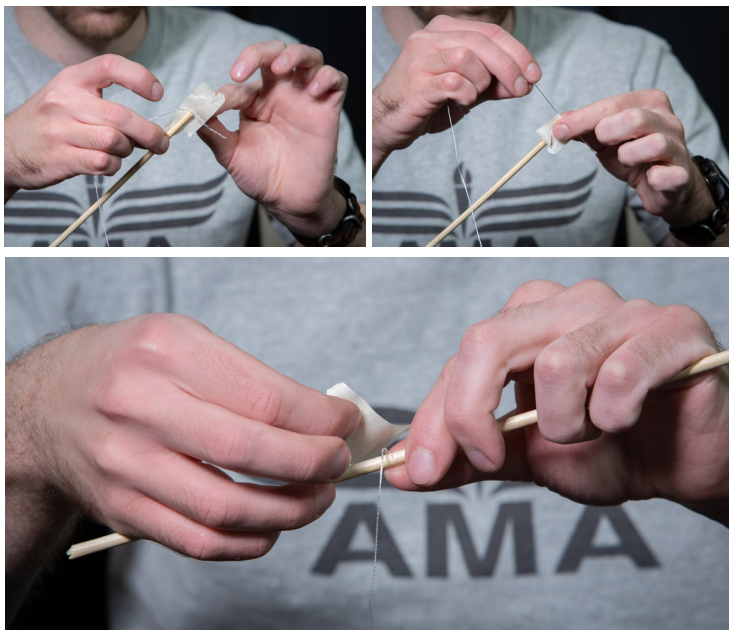
4. Tape the short edges of the paper together. The longer “half” of the paper will be curved, and the shape we have just formed is our airfoil.



5. Slide the string through the sides of the airfoil. One end should be dangling off each edge.



6. Tape one end of the string to the end of your dowel rod, and tape the other end to the rod ten inches from the end. Position the airfoil at the midway point of the string and secure with tape at the edges.



7. Hold the dowel rod near the end opposite the string attachments. If space permits, swing the assembly forward quickly and smoothly. Spinning in a slow circle can also work! What does the airfoil do?

8. If you have a hair dryer, compressor, or high-speed fan, see if you can create an air flow pointed toward the edge of your airfoil. What happens?

Bernoulli Airfoil Template

FOLD HERE

