ROCKETRY V: RUBBER BAND ROCKET GLIDER

Modified from the Fresno Community Science Workshops for the EAA

Concepts Illustrated:

(1) Newton's Laws of motion
(2) Three forces of rocket flight
(3) Elastic energy in a rubber band catapult

Time Requirements: 60 Minutes

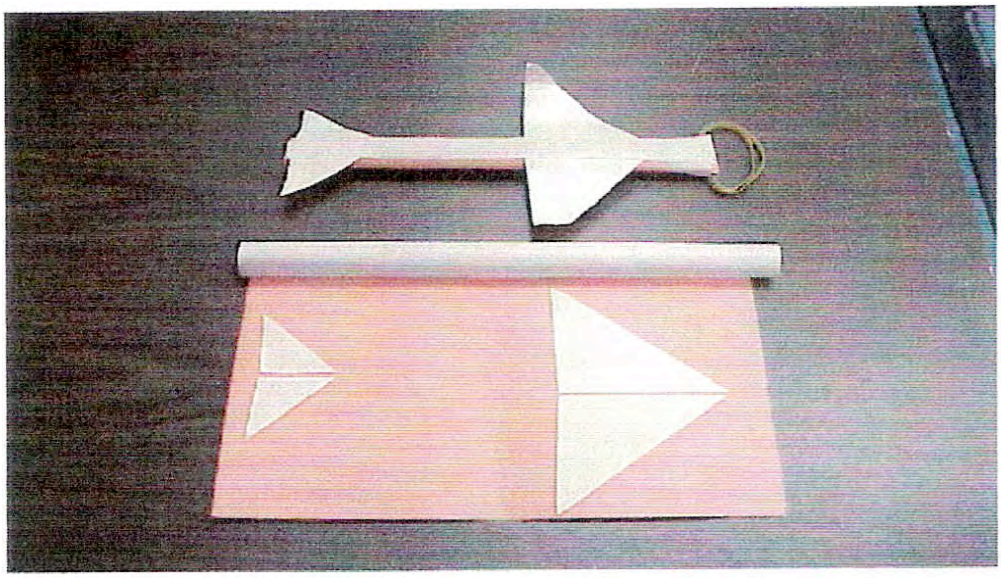
Grade Level of Audience: This activity is primarily suited for kids in grades 5-8.

I. Materials and Equipment Utilized

(Materials needed for a group of 20 students)

1. ½" x 12" PVC pipe
2. 2 rubber bands
3. masking tape
4. 1 piece of construction paper
5. 1 piece of hard stock paper
6. scissors

II. Description of Set-up and/or Construction of Apparatus



1. To construct the rocket, first roll a piece of construction paper into a cylinder, lengthwise, using the 12" PVC pipe. The paper should be rolled

loose enough so that the pipe can slide out of the cylinder. Secure the seam of the paper cylinder at the ends and in the middle using three, two-inch pieces of masking tape. Then seal the seam lengthwise with another piece of masking tape, from top to bottom.
2. Next, remove the paper cylinder from the PVC pipe, pinch one end closed and fold each corner over to form an upside-down V. Then, fold the top over the two rubber bands and seal with more masking tape.
3. Cut out a square piece of hard stock approximately 4" x 4". Cut this square in half diagonally, from corner to corner, to form two triangles - these will be used as wings for the rocket.
4. Next, hold the two wings together so that they form one larger triangle. Place the triangle on to one side of the rocket body, near the top where the rubber bands were attached, and separate the wings slightly by placing one finger between the two smaller triangles. The wings should then be approximately a fingers' width apart.
5. Now, take a two-inch piece of masking tape and place it widthwise across the two wings and the rocket, towards the top of the wings. Repeat this step with a second piece of tape, this time placing the tape near the bottom of the wings.
6. Next, take a six-inch piece of masking tape and place it lengthwise down the rocket, between the wings to secure them further. Now, cut out a 2" x 2" square piece of hard stock, again cutting the square in half diagonally. These two triangles will form the fins of the rocket. Place the fins on to the rocket in the same manner as the wings. The fins, however, will be attached towards the bottom opening of the rocket cylinder. Also, because the fins are smaller, they can be attached widthwise with one, two-inch piece of masking tape and lengthwise with a four-inch piece.
7. Now the rocket glider is complete! To launch, simply place the thumb of one hand against the rubber bands, stretch the rubber bands by grasping the open end of the rocket cylinder with the thumb and forefinger of the other hand and pulling the rocket towards yourself, then release the rocket by letting go of the open end

III. Details of Student Implementation

1. Introduction

A rocket in its simplest form is a chamber enclosing a gas under pressure. A small opening at one end of the chamber allows the gas to escape, and in doing so provides a thrust that forces the rocket in the opposite direction. A good example of this is a balloon. The balloon’s rubber walls compress air inside the balloon. The air pushes back so that the inward and outward pressing forces balance. When the nozzle is released, air escapes through it and the balloon is propelled in the opposite direction.

When we think of rockets we rarely think of balloons. *What do you think of when they hear the word rocket* (giant vehicles that carry satellites into orbit and spacecraft to the Moon and planets). Although a rocket and a balloon don’t seem to be similar there is a strong similarity between the two. The only difference is the way the pressurized gas is produced. With space rockets, the gas is produced by burning propellants that can be solid or liquid. *How is the*

pressurized gas produced with balloons (the pressurized gas is produced when we blow air into the balloon).

2. Forces Affecting Flight

- **Gravity**

  Gravity is the downward force applied to all objects on earth. More force is required to lift a heavy rocket than a light rocket. The heavier the rocket, the more thrust required to lift the rocket into space.

- **Drag**

  Drag is the amount of air resistance or friction on the rocket as it flies.

- **Thrust**

  Thrust is the force generated by a rocket engine that propels the rocket forward. Thrust must be greater than the pull of gravity for the rocket to fly upwards.

3. Newton's 3rd Law and Thrust

- Thrust is created by the power of the rocket. This is caused by Newton's Third Law: to every action is an equal and opposite reaction.
- *Demonstrate Newton's Third Law*. Blow up a balloon and let it go. Draw a balloon on the board and ask what direction the air is traveling in inside the balloon, (Every direction). Ask how we got the balloon to move through the air, (Let it go). The action is the air coming out the bottom of the balloon and the reaction is the balloon traveling in the opposite direction. When you let go of the balloon you are opening up the bottom. This causes the air traveling in that direction to leave the balloon. The air in the opposite direction is still pushing on the top of the balloon.
- *Demonstrate Newton's Third Law* using the play foam rockets. Show or ask where the action and reactions are.

4. Instructional Ideas

- What makes the paper rocket move?
- If the straw does not fly level, students may add some tape near the front of the glider or just behind the fins. Under what flight conditions would tape be added (A) to the front? Or (B) to the back?
- The rockets may be launched for air time, distance, or accuracy. Many presentations have students shoot the straw rockets through hula hoops or other suspended rings.
- How else could these rockets be modified to increase their times of flight or distance of travel? Brainstorm and make the appropriate modifications.
- Students should not aim these at each other.
- When launching the rockets the students can experiment by launching the rocket at various angles and directions. If there is wind, they can experiment further by launching into and away from the wind to show how it can affect flight.