# Foam Rockets

**Overview:**
This activity builds on the previous rocket activity. Youth will build rubber band powered foam rocket they can take home.

**Goals:**
- Learn about rocket stability and trajectory.

**Time Required:** 1 hour

**Materials:**
For each student:
- One 30-cm (12 inch) long piece of polyethylene foam pipe insulation (for ½ in. size pipe)
- One Size 64 Rubber Band
- One 21.5 cm x 13.8 cm (8.5x5.5 inches) sheet of craft foam (any color)
- Scissors
- Duct Tape (multiple colors make for colorful rockets)

**Background:**
"The foam rocket flies ballistically. It receives its entire thrust from the force produced by the elastic rubber band. The rubber band is stretched. When the rocket is released, the rubber band quickly returns to its original length, launching the foam rocket in the process. Technically, the foam rocket is a rocket in appearance only. The thrust of real rockets typically continues for several seconds or minutes, causing continuous acceleration, until propellants are exhausted. The foam rocket gets a quick pull and then coasts. Furthermore, the mass of the foam rocket doesn't change in flight. Real rockets consume propellants and their total mass diminishes. Nevertheless, the flight of a foam rocket is similar to that of real rockets. Its motion and course is affected by gravity and by drag or friction with the atmosphere. The ability to fly foam rockets repeatedly (without refueling) makes them ideal for classroom investigations on rocket motion.

The launch of a foam rocket is a good demonstration of Newton's third law of motion. The contraction of the rubber band produces an action force that propels the rocket forward while exerting an opposite and equal force on the launcher.

In flight, foam rockets are stabilized by their fins. The fins, like feathers on an arrow, keep the rocket pointed in the desired direction. If launched straight up, the foam rocket will climb until its momentum is overcome by gravity and air drag. At the very top of the flight the rocket momentarily becomes unstable. It flops over as the fins catch air. The rocket becomes stable again when it falls back to the ground."

*NASA JPL Foam Rockets:* [https://www.jpl.nasa.gov/edu/teach/activity/foam-rocket/](https://www.jpl.nasa.gov/edu/teach/activity/foam-rocket/)

**Procedure:**

Build your rocket:

1. Using Scissors, cut four equally spaced slits at one end of the tube. The slits should be about 11 cm (4 ¼ inches) long. The fins will be mounted through these slits.
2. Cut a 12-cm (5-inch) length of duct tape down the middle to make two pieces. Place one piece over the other, sticky to shiny side to make the tape double-strong.
3. Slip a rubber band over the tape and press the tape around the nose end of the rocket (opposite the end with the slits). Press the tape tightly and reinforce it with another length of tape wrapped around the tube.
4. Cut the piece of craft foam down the middle lengthwise so that you have two pieces that are approximately 14 cm x 11 cm (4.25 x 5.5 inches). These pieces will make the fins.
5. To attach the fins to the rocket, cut a notch in the fins so they can be slid together. Different shapes can be used but they should still "nest" together.
6. Slide the nested fins into the slits cut in the bottom of the rocket. Use strips of duct tape to secure the fins in place.

Ready for launch:

1. To launch your rocket, hook the rubber band over the fingertip of your index finger.
2. Use your opposite hand to hold onto the back end of the rocket and pull it back stretching the rubber band.
3. Release the back end of the rocket and watch it fly!!
4. Challenge students to land their rocket in a target (use a hula hoop, bucket, etc for a target).

**Common problems / Additional guidance:**

- Be sure to reinforce safety guidelines with the rockets – do not launch rockets at other people, make sure your launch area is clear of people / objects before launching!
- See the full lesson from NASA for some background on rockets, launch angles and trajectory. Complete lesson includes instructions for a launcher that can be made using a meterstick to investigate launch angles and trajectory.

**Reflection:**

1. Encourage youth to draw and label a picture of their rocket. Use the following labels: Nosecone, Fuselage, Fins.
2. Look up pictures of real rockets, compare the rocket students made to real rockets. How are they similar? How are they different?
3. How does the launch angle affect the trajectory of your rocket?

**Adapted from the following lesson:**

- NASA Foam Rocket Activity from the NASA Rockets Educator Guide: https://www.nasa.gov/stem-ed-resources/foam-rocket.html
- This video shows how to build a slightly different foam rocket using zip ties instead of the duct tape: https://www.jpl.nasa.gov/edu/teach/activity/foam-rocket/