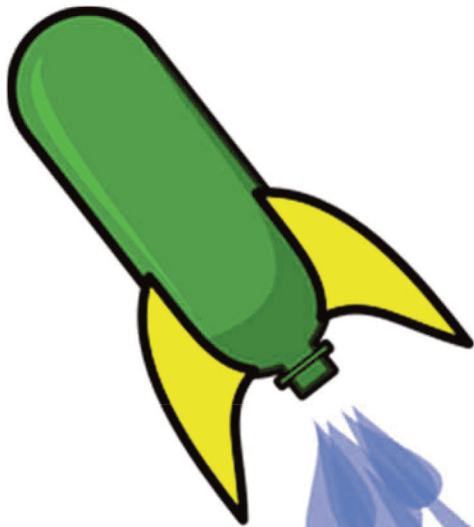


# STEM

-It really is rocket science



## Introduction

In the following pages are instructions on a simple-to-build 2 liter water rocket. Please note that both the nose cone and decorations are optional.

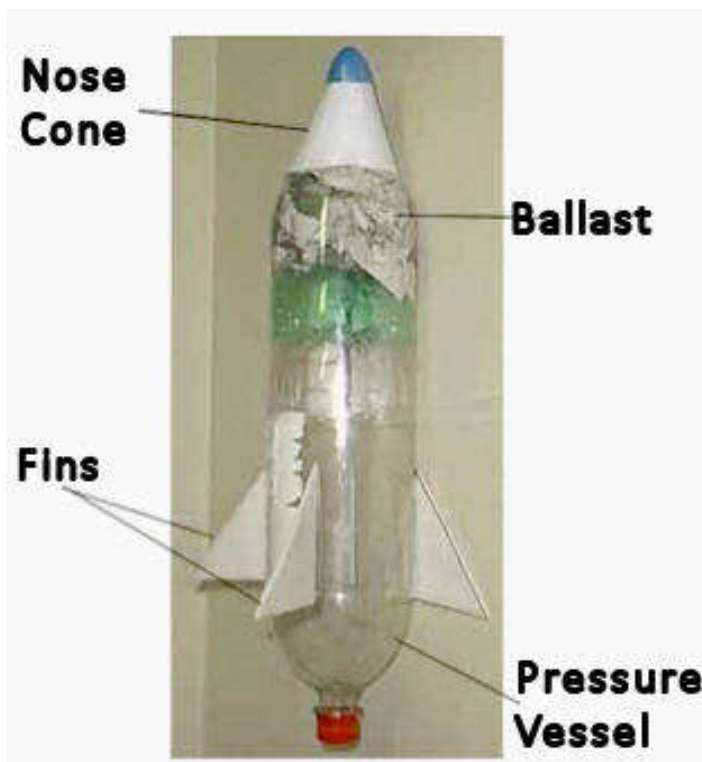
The launchers, air source, and rocket fuel (water) will all be provided, as well as an instruction session that will start with a focus on safety.

Most people are quite surprised when they witness their launch. The water rockets leave the launch pad at a speed of between 60 to 70 miles per hour! For that reason as well as in case we have a bottle that pops, the launch pad will be 50 feet away from people.

place the rocket on the launch pad, then they will go 50 feet away to "mission control". A member of staff will pressurize the rocket, then hand over the pull cord to a member of the patrol when ready to launch.

# Materials

- 2 –two liter bottles (for Rocket & Ballast sections)
- Newspaper (Ballast)
- Foam tray, old real estate sign or foam poster board (Fins)
- Paper or paper towel tube (Nose Cone) – Optional
- Plastic Easter Egg or Ping Pong Ball (Nose Cone) – Optional
- Packing tape or Duct tape
- Scissors
- Decorations (Spray paint, Markers, Stickers)
- Help from an adult



## Parts of the Rocket

- Nose Cone - for aerodynamics (Optional)
- Ballast - adds mass to increase stability
- Fins – for stability
- Pressure Vessel – source of propulsion

# Rocket Body

## Step 1

- Cut the bottom portion of one of the two bottles off.



## Step 2: Ballast

- Roll up newspapers into balls and place in top half of the cut bottle. You can use other material for the ballast such as foam peanuts.



## Step 3

- Push bottom half of two liter bottle upside down into top half – keeps ballast in place.
- Use small piece of tape to secure bottom piece inside bottle.



## Step 4

- Place the un-cut 2 liter bottle (pressure vessel) into top half. Try to make bottles straight. Use little pieces of tape to secure bottle. Once you have them lined up straight, wrap a piece of tape all the way around the seam.

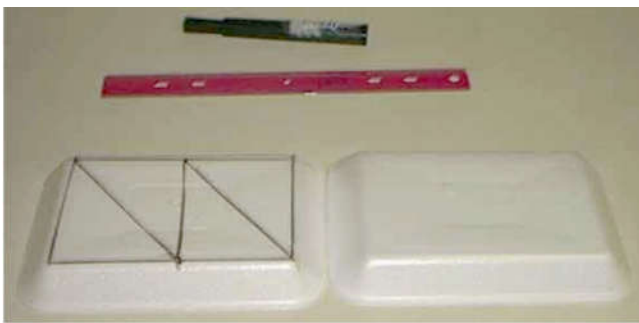




## Fins

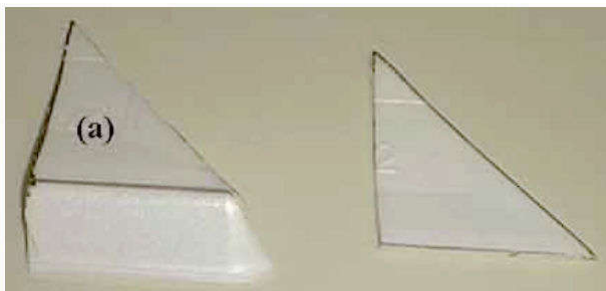
Use flat, waterproof materials such as:

- milk or juice cartons
- Foam trays
- Corrugated Plastic
- Elections signs (Only after election is over)
- Use cardboard only if you cover the entire fin with a layer of tape for waterproofing.



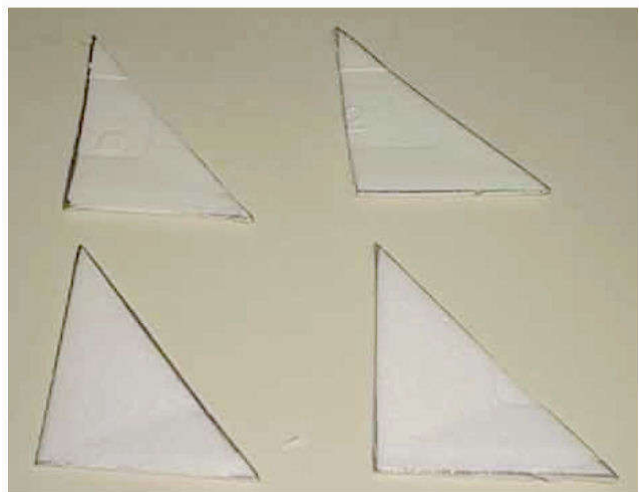
## Step 5

- Use a marker and ruler to draw three to four fin patterns on the foam trays. For best results, keep the fins the same shape.



## Step 6

- Cut fins out.
- Note: (a) if you leave the sides of the trays attached to the fins, the rocket will spin in flight.



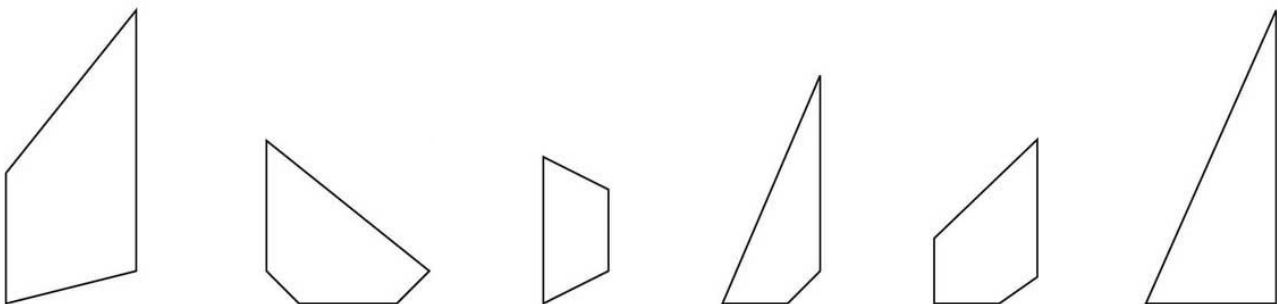
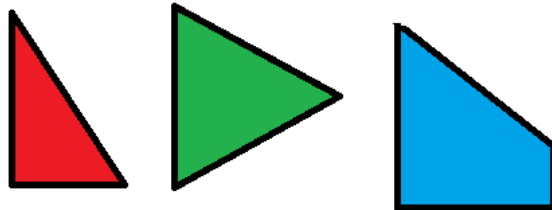
# Fins

## Step 7

- Attach fins evenly spaced around bottom section of bottle with small pieces of tape. Once you have them in place, tape both sides of each fin the full length to the bottle.



### Possible Fin Designs



# Nose Cone

Note, the nose cone is optional.

You can use many different materials for the nose cone. It is not safe to have a point on your nose cone so the tip must be rounded. To create a rounded tip you can use a ping pong ball, plastic Easter egg, or egg carton.



## Step 8

- Roll paper into a cone and secure the shape with a piece of tape. Place the ping pong ball or plastic egg on the cone as the tip and fasten with tape all the way around.

## Step 9

- Fasten nose cone to bottle with tape.



## Decorate:

- Be creative. You can personalize your rocket with spray paint, stickers, markers, etc. Make sure you have your troop numbers and patrol name somewhere on your rocket. Bottom end of rocket must remain clear of any paint or decoration. Fins cannot extend below the bottom section. And remember, have fun.

## Tips

- Try to make the body smooth (no kinks or ripples with the tape).
- Do NOT use epoxy or a hot glue gun to fasten parts together. It will weaken the bottle and can lead to detonation on the launch pad!  
PL adhesive in a caulking tube and Household Goop are ok if you want to use adhesive
- Do not leave two liter bottles in a hot car.

