Rockets Away!

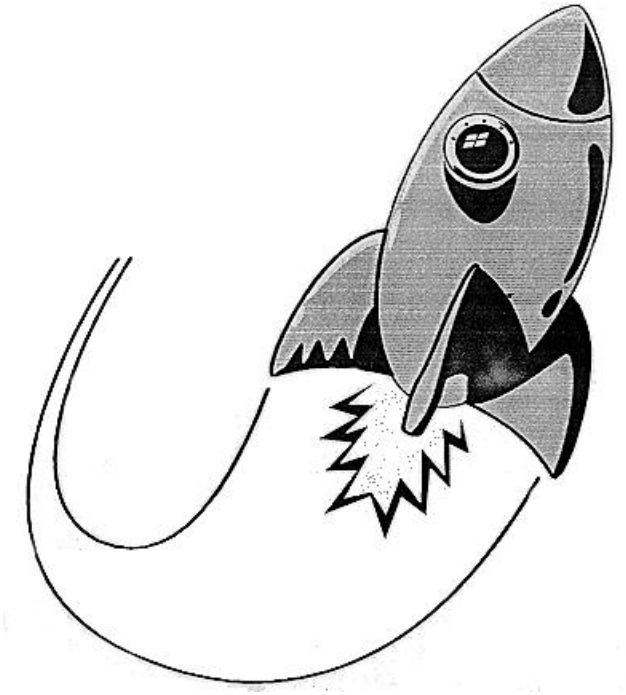
In this workshop, participants will use computer software to design, build and launch hydro-rockets (bottle rockets from plastic soda bottles.) As they try to design a successful rocket, 4-Hers will understand basic concepts of physics and rocketry.

Objectives
- Understand how computer technology can be applied to design
- Understand how to build a hydro-bottle rocket.
- Understand how the force of pressure makes bottle rockets fly.

Materials
Rockets away software, project manual and rocket launcher, empty plastic bottles, duct tape, scissors, paper for cone and fins (used manila folders, cardboard, mat board, or Styrofoam meat trays), coarse sand or pea gravel for nose cone weighting, paint, paper towel roll tubes to extend the length of the rocket for improved stability and performance

Introduction:

Welcome to the world of plastic bottle rockets and computer enhanced design. These rockets open a wonderful world of fun and education. They are fun to build and fly and provide a wealth of inexpensive opportunities to learn and quickly test many laws of physics, principles of flight, mathematical applications, and more. Costs are very low, turnaround time is short, repairs are relatively simple and easy, and good workmanship is usually rewarded with superior performance.



Part of the fun of building bottle rockets is learning, through experimentation, what makes them fly best. Here are some tips to get you started:

1. Open the Rockets away computer program to begin your rocket design. Select nose cone shape, wing design and weights. (Or log onto: **http://www.ag.ohio-state.edu/~rockets** for a simple version which has fewer options.)
2. Once you have developed your initial design, test it using various amounts of water and air pressure in the computer simulation. (a maximum of 75 pounds of air pressure)
3. After you have modified your design for maximum flight time and height, build your rocket.

Hints:

4. Don't make the fins too big or too small. Follow the computer design closely.
5. Place them well back on the rocket body, but not so far as to interfere with launching the rocket.
6. Use about two kid-sized hands full of course sand or pea gravel in the nose cone for weight forward ballast. Weight your gravel with the scale to match your computer model.

7. Attach the nose cone to the rocket with duct tape. Then cover the entire nose cone with duct tape. Unless you have figured out a recovery system for your rocket, this will prevent you from losing all of the sand or pea gravel when the rocket comes diving nose first into the ground. The better your rocket flies on the way up, the faster it will be traveling when it hits the ground!
8. Although there continues to be considerable discussion about how much pressure these bottles will safely hold, 75 pounds per square inch of air pressure is more than enough to give great performance. (The heights attainable by the rockets are more a matter of how well they are designed and built than how much air pressure you put in the rocket.)
9. Use two stop watches to time your rocket. Average the time and put them into the formula to determine how high your rocket flew. **Height = 16 (time/2)^2**
10. More detailed information can be found using the Rockets Away project manual from Ohio State University.

Launching your Rocket:

1. Locate an open area for launching your hydro-rockets. An area such as a grassy field is recommended. The rockets do not always fly straight up and down. You will want to be away from houses, cars, pets and people.
2. Fill your rocket up with water to the designed amount and then Air your rocket up to the design pressure, do not exceed 75 pounds.
3. Before launching your rocket have all the observers back up a safe distance.
4. Have everyone in the area join you in a count down to blast-off! 5…4….3…2….1….Blast-Off! This will insure everyone is watching and aware you are about to launch your rocket.
5. Use a stop watch to measure the flight time of your rocket. Record time for height calculation.
6. Be safety conscious and good-luck with your rocket program.

Recommended Weights and Pressure ranges

Cone Weight (.3-15 oz.)	10oz is a good starting point
Body Weight (.8-15 oz.)	
Tail Weight (.8-15 oz.)	
Water (0-64 oz.)	32oz is a good starting point
Pressure (1-75 psi)	Do not exceed 75 psi

References:

Ohio State University, 1994, Rockets Away! 4-H 501 Project Manual and Software

VERSEY ENTERPRISES
1258 North 1100 East
Shelley, Idaho 83274

(208) 357-3238 (work)
(208) 357-3428 (home)

Thank you for purchasing the finest 2 liter pop bottle launching base found anywhere. We stand behind the quality and workmanship in the assembly of this unit for a period of 30 days from the purchase date. Please treat it with caution and respect and it will provide you with many happy hours of rocketing.

WARNING

We do NOT accept any liability for bodily harm or injury resulting from improper and/or unsupervised use of the launcher. Like any potentially dangerous item, this unit must be used with CAUTION. Children should always have ADULT SUPERVISION and only be allowed to pressurize the bottles with a typical bicycle hand tire pump. Use ONLY soda bottles that are in good condition, without any flaws or scratches in them. We are NOT responsible for what the bottle does or where it goes after it is pressurized. ***NEVER AIM THE BOTTLE AT ANY OTHER PERSON, ANIMAL OR THING.***

We have recorded bottles being launched at pressures greater than 150 PSI. However, we do not warranty correct operation of the launcher at pressures greater than 100 PSI.

OPERATING INSTRUCTIONS

Observe the following tips on care and maintenance. The O-ring machined into the pipe which goes into the bottle must be kept free of abrasive materials such as dust, dirt, sand, etc. Occasional lubrications with a petroleum jelly product will extend the life of the O-ring. Check inside the neck of the bottle each time it is used to make sure there isn't any foreign material where the O-ring will go. The bottle must be properly seated by making sure the O-ring has engaged into the neck of the bottle by using a push twist motion.

At this point the U shaped pin is slipped into the pin holes so that it holds the bottle by way of the wide lip on the neck of the bottle. Make sure the pin holds the bottle on or you will be unable to pressurize it. You may then pressurize the unit with a tire pump or air compressor to the desired pressure by way of the valve stem with or without liquid in the bottle. If you use liquid in the bottle, we recommend that you fill the bottle no more than 1/3 full of the liquid.

You are now ready to fire off the bottle, either by hand holding the launcher or fashioning a solid mounting base into which the launcher can be mounted. We suggest drilling a 1 3/8" hole in something that is stationary and setting the bottom of the launcher into that hole and then attaching a string or cord to the pin so that it can be pulled remotely.

It is also nice to have some adjustment built into the stationary base so as to be able to change the trajectory of the launch. TIP: If you have problems losing the pin when pulled remotely, we suggest taking a piece of inner tube rubber and slipping it onto the two ends of the pin and sliding it down to the end where it will hold the cord from coming off the pin. Sometimes the pin will slide in easier on the one side than the other.

HAPPY ROCKETING,
Wayne Versey

Bottle Rocket Nose Cone Pattern
(Enlarge this pattern to fit your bottle)