Super Bottle Rocket Launcher

P4-2050

BACKGROUND:

Care and Maintenance:

Maintain your launch equipment. Never leave your unit outdoors where ultraviolet radiation can deteriorate the rubber parts and freezing can crack or distort the rigid parts.

Pre-launch Checklist

Before every use, inspect the unit to be certain that it has not been damaged or deteriorated in any way.

1. No cracks or broken joints in the plastic components

2. No obstruction of the valve stem

3. No dry, cracked, stretched, or distorted O-ring (It should remain pliable - applying a drop of oil or petroleum jelly periodically (we recommend every 5 launches) will keep the O-ring in good condition.) The O-rings are standard size 2.0mm x 18mm and replacements can be found at any local hardware store.

4. No frayed or deteriorated lanyard (i.e., string)

5. Lanyard is not less than 15 feet long.

6. No loose knot securing the lanyard. It should be tight to avoid a launch failure.

7. Launch Bottle (2-Litre Plastic Bottle) don't use a bottle smaller than 2 liters.

Launch Procedures

The Super Bottle Rocket Launcher should never should be operated from a hand-held position or pointed at anyone. It must always be launched straight up in an area with no overhead obstructions.

The maximum launch pressure is 60 psi. An over-pressure relief valve designed to release pressure exceeding 60 psi (visible as slots in the front leg).

- Fill the bottle to be launched with desired amount of water.
- Pick up the launcher and hold it upside down over the bottle.
- Press the bottle over the launch tube, covering the O-ring until it won't go any further.
- Turn both the launcher and attached bottle over and set it down on the ground, making sure that the bottle is standing straight up in the center of the launch area.
- Lay the lanyard out to its full 15 feet. Stake to ground firmly at back of "T" base with u peg. U peg is designed for soft ground only.
- Gently pull the lanyard to its full length in the direction of the long leg of the launcher tripod, and leave it on the ground.

LOAD THE COMPRESSED AIR

- Connect the air pump to the launcher valve.
- Gently lay the pump down, without disturbing the launcher, and retreat to the end of the lanyard.
- From the lanyard distance, check the launcher to ensure its vertical and free from obstructions.

PREPARE FOR LAUNCH

- All bystanders should be kept at least 15 feet from the launcher (safety zone).
- The best location is behind the launch officer who is located at least 15 feet from the launcher (length of the lanyard).

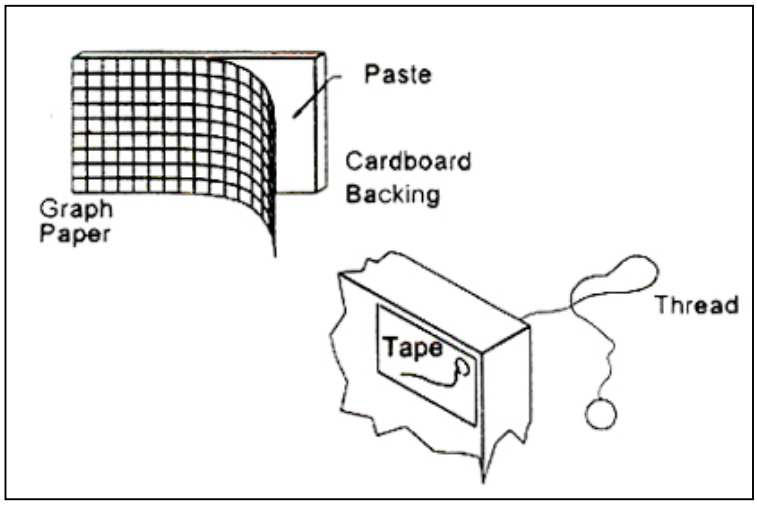
LAUNCH

- Call out the countdown. Launch duties can be divided, permitting one of the observers to join in the fun and perform the countdown.
- At 5! 4! 3! 2! 1!?Launch!, the Launch officer tugs the lanyard. A sharp, short, tug on the lanyard should is all that is necessary.
- Do not yank the lanyard, as this might cause the launcher to upset, and launch the vehicle in an unsafe direction!

Measuring the altitude of the bottle rocket

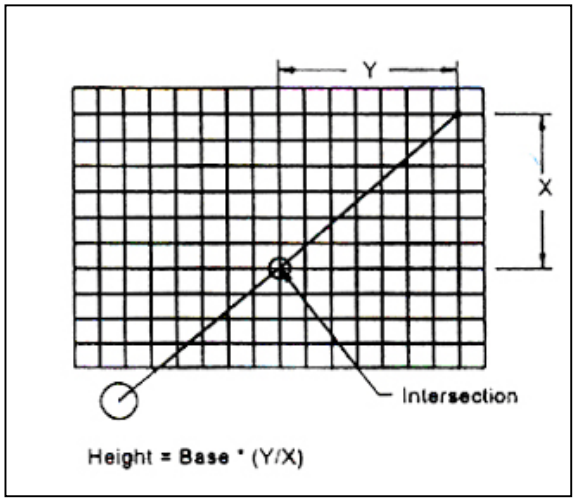
"Whoa! How high did that thing go?" has probably been a question you've asked several times as you watched your rocket soar overhead. There is a Relatively simple method you can use to measure the altitude of your rocket! It is simply a sheet of graph paper mounted on a sheet of cardboard with a plumb line attached to one corner.

Figure 1: Assembling the Altimeter



To assemble the altimeter, paste the altimeter face (found at the end of this manual) to a flat sheet of cardboard that has been cut to the same size. Make sure the top edge of the cardboard is flush with the top edge of the altimeter page. Use a common pin to poke a hole through the cardboard at the top front corner where indicated. Slip one end of the plumb line (thread for this is included) through this hole. ©

Figure 2: Reading the Altimeter



Tape the thread to the cardboard backing where it comes through the hole. Tie weight (large washer) to the free end of the thread as in **Figure 1.** Your altimeter is now ready to use.

Let's start by measuring the height of something you know. First, measure the distance between the object you're measuring and the position you will be standing when you measure its height. This distance is called the "BASE" and should be at least 10 meters. Hold the altimeter card at eye level and sight along its top edge. **Some find it easier to tape or glue a soda straw along the top edge as a sighting tube.** The place where the thread is taped to the cardboard should be away from you. Tip the cardboard upward until the top edge of the cardboard is pointing at the top of the object you're measuring. When the string is hanging freely and no longer swinging, pinch it against the face of the altimeter with your finger, as in **Figure 2.** You can now read the altimeter by finding an intersection on the graph paper that the string crosses.

Read the quantity "Y" from the horizontal axis of the graph paper (this is proportional to the height of the object) and read the quantity "X" from the vertical axis of the graph paper (this is proportional to the distance between you and the object). Using similar triangles, the rocket altitude or "HEIGHT" can be calculated by using the following formula:

HEIGHT = BASE * (Y/X)

Where: HEIGHT = height of the object
BASE = horizontal distance from the object
Y = measured from the altimeter (horizontally)
X = measured from the altimeter (vertically)

Don't forget to add your own height to the calculated height! Actually, you should measure the distance from the string hole down to the ground, and add that to your calculated height. Your most accurate measurements of height, using this device, will be found when your horizontal distance from the object, in value, is close to the actual altitude of the object.

The altitude of the object will have the same units as does the horizontal distance from the object. In other words, if you measured the distance from the launch pad in meters, then your calculations will produce an altitude in meters. If you measured the distance from the launch pad in feet, then the altitude will be in feet.

Note: Altitudes can be easily found using the Arbor Scientific **Altitude Finder** (P4-2250).

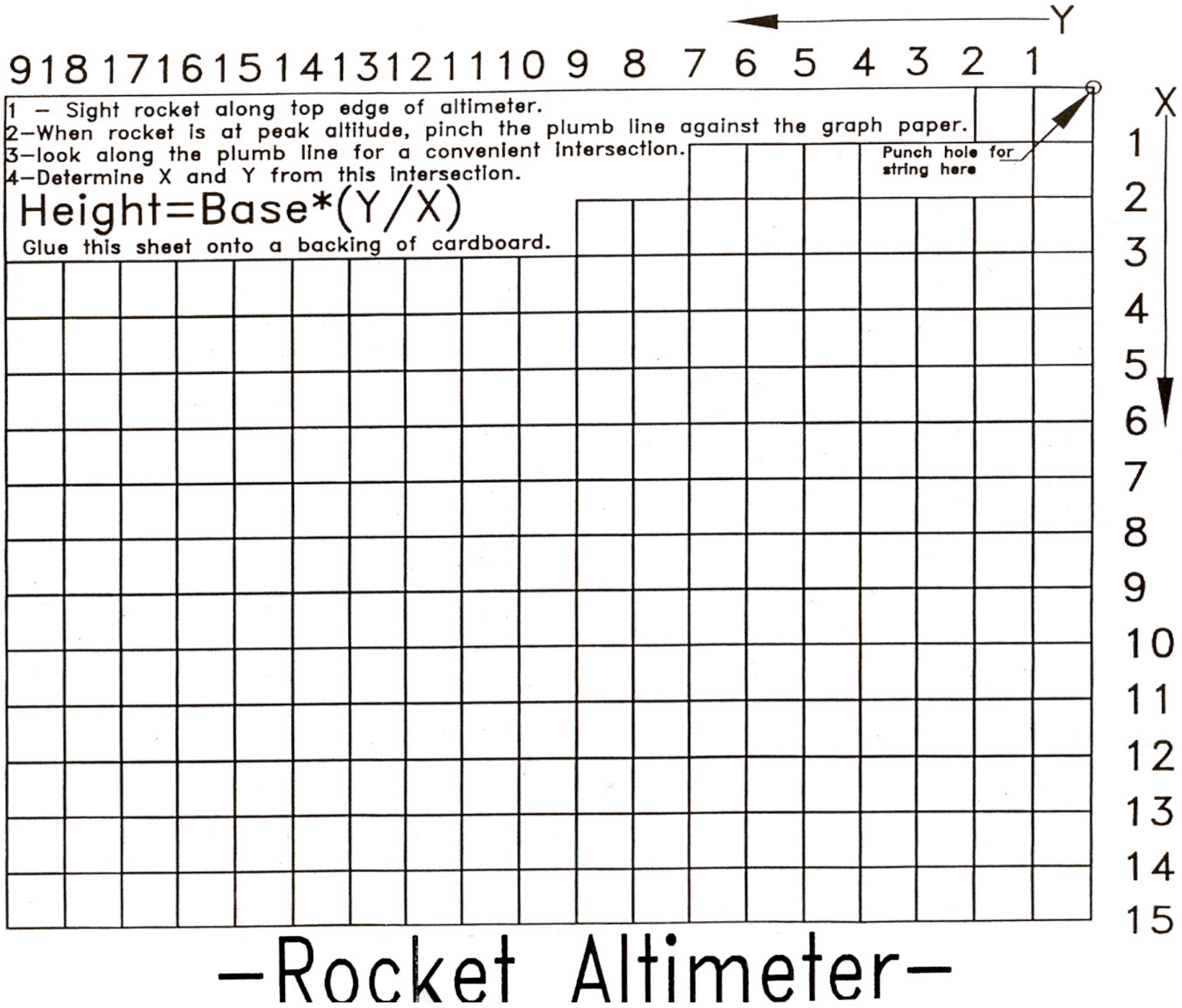
Now that you are able to get accurate measurements of the rocket's altitude, you're ready to do some serious experimenting! Remember – change only one thing at a time; keep everything else constant!

For example, to measure the effect of pressure on the rocket's altitude, use the same rocket, pour the same amount of water into the bottle, and then, for each experiment, pressurize the bottle to different amounts. Record each launch on a data sheet that might look like Table 1.

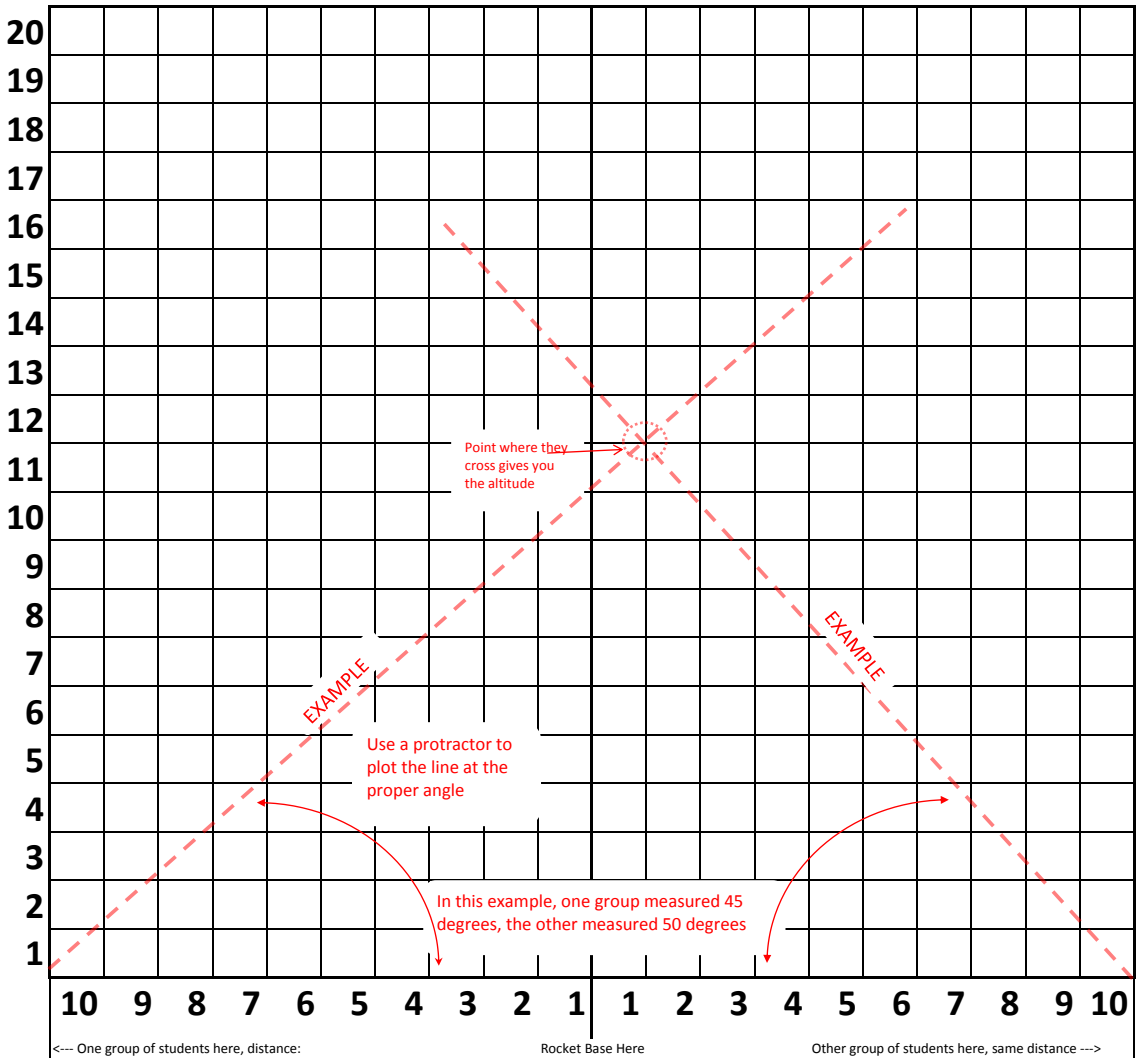
Table 1.

Rocket Launch Data:

Launch #	Water Used Ounces or Grams	Rocket Weight Pounds or Kilograms	Pressure Used PSI or kPa	Altitude Feet or Meters	Time of flight in Seconds
1					
2					
3					
4					
5					



–Rocket Altimeter–



Tip: Use a protractor to plot the angles.
This chart is 20 units X 20 units, so because the rocket base is represented by the middle, each student group will be 10 units away from the base. Divide the distance you students are standing from the base by the 10 units on this cart. So for example, if your students measured from 30 meters, then each unit would be 3 meters (i.e. 30m / 10 units). Using the angle for each student group, you draw a line from each end of the x-axis and note where they cross. This crossing point indicates the altitude of the bottle. Again, if each unit is 3m, and the lines crossed at unit 12, then the altitude is 36m. What is a good distance from the base? This depends on the heights you intend to reach. With the bottle rocket launcher, you will likely be safe using 20-30m. For higher flying rockets, like CO2 rockets, you'll need more distance. Note that this method requires no trigonometry or altitude calculations.