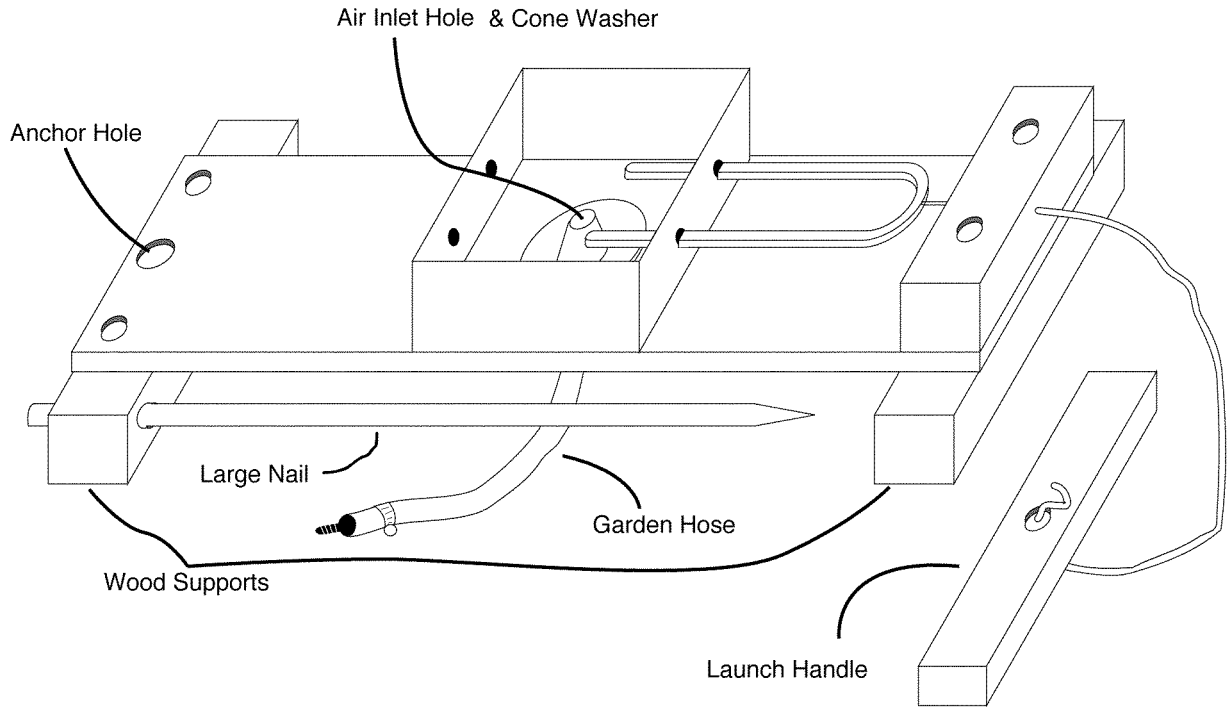
Building the Basic Bottle Rocket Launch Pad



Materials:

-**Formica double-sink countertop cutout.** This can be easily and cheaply obtained from a local company that manufactures and/or installs countertops. Usually this is a throw-away item that is headed to the dumpster. One cutout will make eight 1x4x16 inch base plates for the basic launch pad.

-**1 foot of 3/16" steel Rod** This is used to secure the rocket to the electric box prior to launch and usually comes in three foot rod.

-**1 GM or Ford tire valve stem.** Used on the end of the hose to pressurize the system.
-**1 Large diameter (Ford) valve stem.** Two be used for the alternative launch pad design.
-**1 Four inch square metal electrical box** Use the design that has two holes on each side of the box.

-**2 3x1/4 inch bolts with nuts and washers to** fasten the stop block to the pad.

-**2 2x2x6 inch wooden blocks** to be used for the legs to elevate the pad off of the ground.

-**1 2x3x4 inch wooden block** that stops the U shaped rocket clamp from flying off the launch pad when the rope is pulled.

-**2 One inch wood screws** to fasten the electrical box to the Formica table top.

-2 5/8 inch Large metal washers. These may not be necessary if the pad has a good seal.

-**1 Ten foot length of nylon chord** 1/4 inch diameter to be used to launch the rocket.

-1 1x1x6 inch piece of wood for the handle.

-1 10 inch x 1/2 inch diameter nail to secure the pad to the ground during launch.

-1 5/8 inch inside diameter 4 foot section of garden hose.

-1 1/2 inch diameter PVC 90^{o} elbow attached to the garden hose & pad.

-1 1/2 inch EMT Conduit Strap to hold the elbow and hose to pad.

-2 hose clamps to secure the garden hose to the PVC elbow and the valve stem in the opposite end.

-1 #10 flat 1 inch wood screws to secure the conduit strap & PVC elbow to the pad.

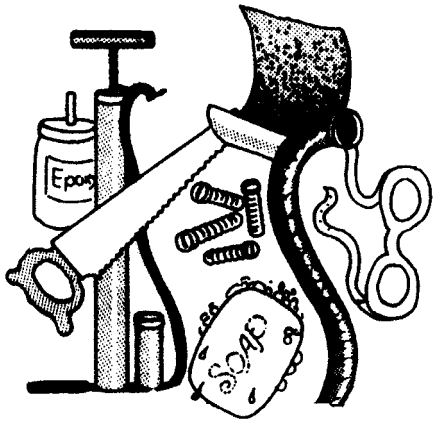
-1 9/16 inside diameter cone slip joint washer to provide the seal between the rocket and the PVC elbow.

Tools:

Saw, flat blade screw driver, Phillips head screw driver, electric drill, 7/32" bit, 5/8" bit, hack saw, 1/4" open end wrench, 1/4 " socket and ratchet. (This list will be greatly expanded if an assembly line approach is used for mass production.)

Assembly:

Assembly will be much easier if you understand how the mechanism works. You will be launching a 2 liter plastic pop bottle that will be placed over the cone washer on the launch pad. The soda pop bottle rocket will have water in it, and air will be supplied by a tire pump. Because the rocket will attempt to take off when it is being pressurized a retaining pin (the 3/16" rod) is needed to secure the rocket to the launch pad until the launch. The rocket is launched by pulling the handle, thus releasing the pin.



Getting Started

1. Using the saw, cut off a 16 inch long x 4 inch wide piece of the Formica to form the launch pad.

2. Drill two 7/32" holes in the electrical box. Many electrical boxes have holes already drilled in them in the appropriate place an all that need be done is “ream” out the opening. The holes should be right above one of the side cut outs. Use a soda pop bottle to determine the distance between the holes. Drill 2 more holes on the opposite side of the box. These holes are used to secure the U-shaped retaining pen made from the 3/16" rod.

3. Drill a 5/8 inch hole in the middle of the Formica table top. The hole should be 7 inches from one end of the Formica table top. Enlarging this opening with dremmel tool drum sanding disk will allow for easier assembly.

4. Using the hack saw cut a 12 inch length of the 3/16" diameter rod. Next, bend the rod into a U shape using a broom handle as a form so that it will have a sliding fit into the holes that were drilled into the electrical box. Tap the U shaped rod with a hammer to make fine adjustments.

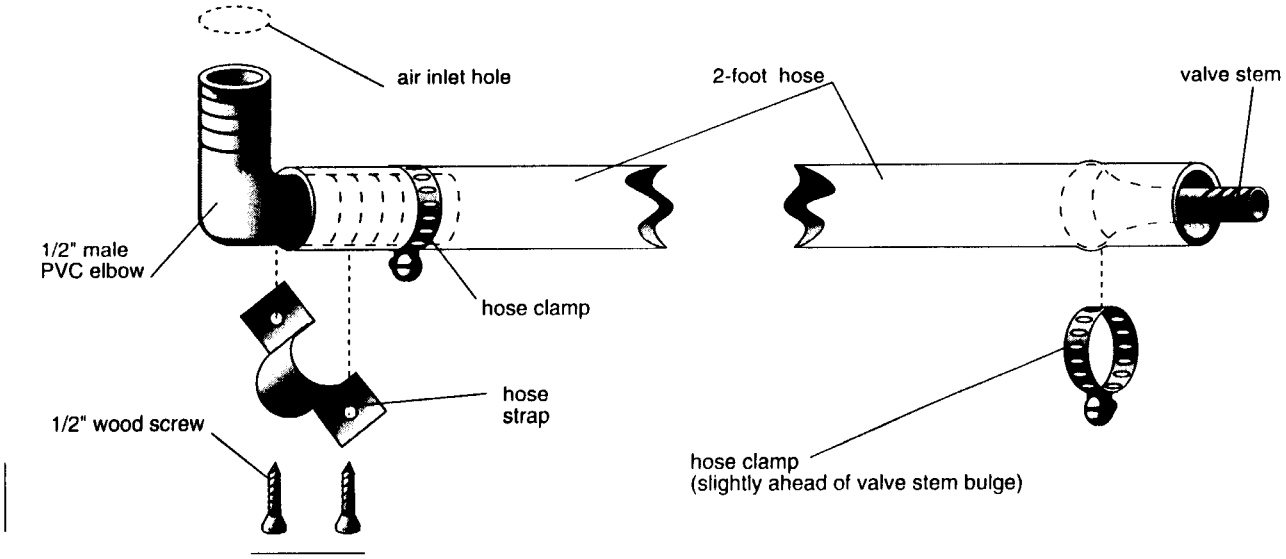
5. Attach the legs to the bottom of the pad using wood screws. (1 inch)
Drill a 1/2 inch hole through one block to store the large nail.

6. Attach the stop block to the top of the Formica as shown in the diagram using the 3 inch long 1/4 inch bolts.

7. Attach the electrical box to the Formica table top so that the hole in the bottom of the box is over the 5/8 inch opening and the reamed out openings on the box for the U rod run the length of the pad. Use wood screws to secure it to the Formica table top.

8. Drill an additional 5/8 inch hole in the opposite end of the pad from the stop block. This angled hole will go all the way through the pad top and the leg support. The large nail is driven in the ground through this hole to secure the pad during launch.

Pressure hose assembly



9. Using soap, lubricate the inside of the ends of the garden hose.

10. Slip the PVC elbow into one end of the garden hose and secure with a hose clamp. (See diagram)

11. Place the large end of the valve stem into the other end of the hose.
Place the hose clamp *slightly ahead* of the valve stem bulge and tighten. (This is essential to stop the valve stem from being blown out of the hose as pressure is added.)

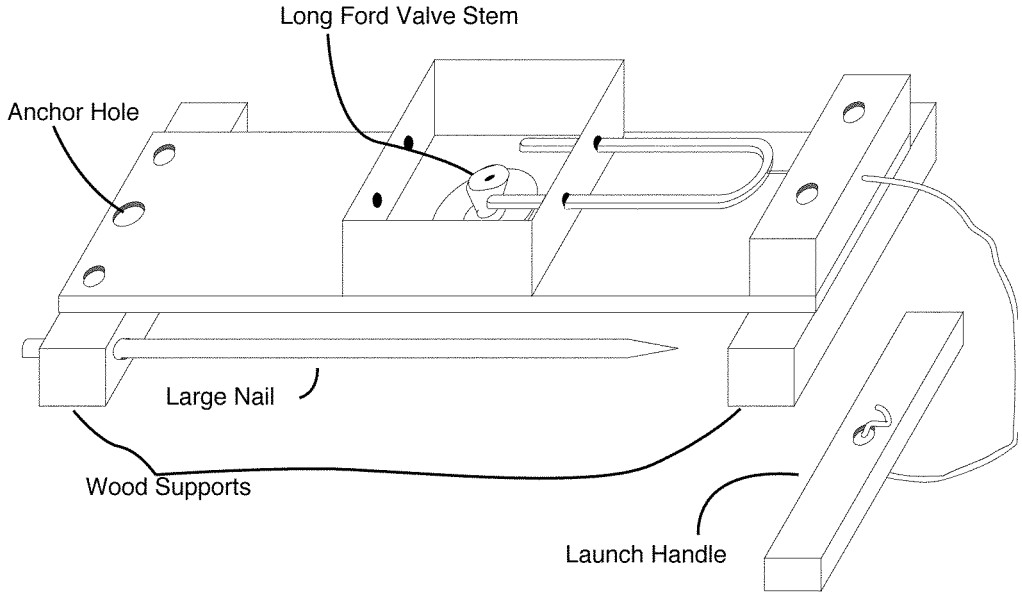
12. Place the PVC elbow through the 5/8-inch air inlet hole in the Formica launch pad and secure the elbow with a 1/2 inch hose strap and the or two wood screws, depending on the strap type.

13. Slip the cone gasket over the end of the PVC pipe.

14. Tie the chord to the handle. (It helps to drill an appropriate sized hole through the middle of the handle first.) Slip the chord through the stop block and tie the other end to the U-shaped retaining rod.

An alternative to the pressure hose assembly.

This system is superior to the PVC elbow/cone gasket assembly in every way with one significant exception. This system seals so efficiently that it requires ***a minimum of 45 to 50 psi to launch.*** This is potentially dangerous in that the pin can be pulled and the pressurized rocket will just sit there. The authors prefer this system. But cautions teachers to be on the alert for students attempting to launch a rocket with too little pressure. A stabilizing rod on the launcher and a straw on the bottle rocket would be a good addition.



Simply place a long Ford tire valve stem in the 5/8 inch hole. Attach the pump to the stem and place the 2-liter pop bottle on the flat end. One or two washers may be placed under the valve stem to raise it thus pushing it farther into the bottle throat forming a better seal.