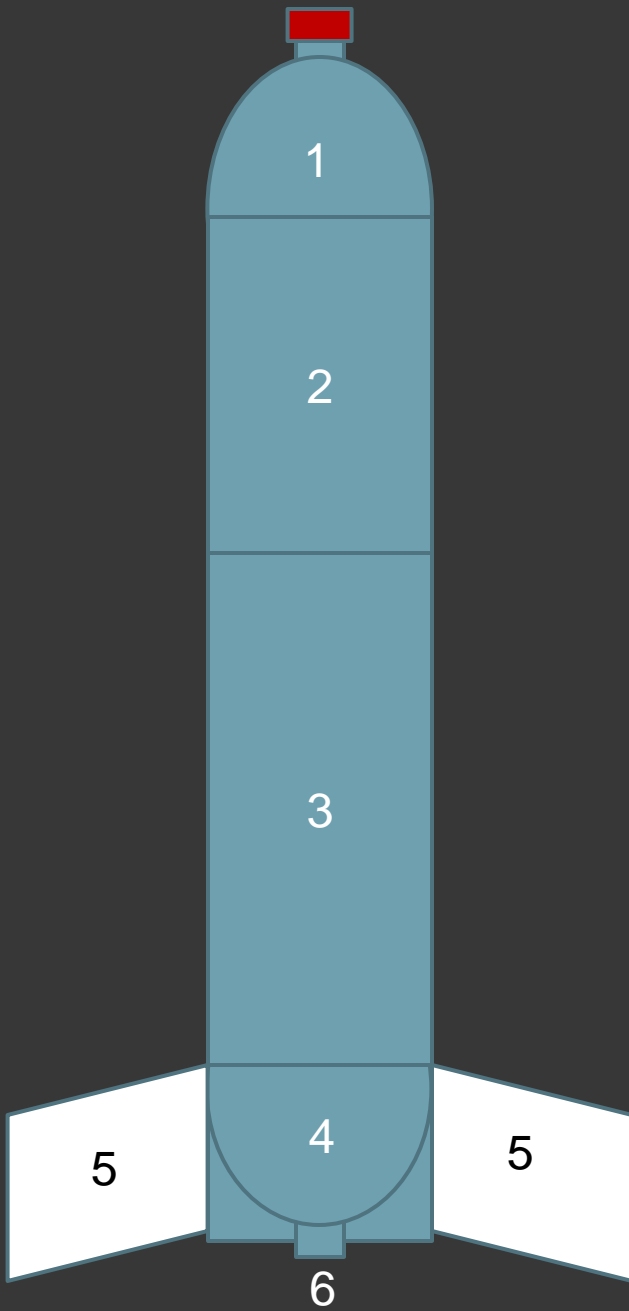


Water & Air Powered Bottle Rocket

NWIC SPACE CENTER



Anatomy of a Rocket

1. Nose Cone
2. Payload Bay
3. Pressure Tank
4. Fin Can
5. Fins
6. Nozzle

Part I – The Airframe



Part I – The Airframe PARTS

You will need 3 bottles that are shaped alike. These can be of any type or size. The important feature is that the neck will fit over a $\frac{1}{2}$ inch PVC pipe.

You will need one bottle cap. This will fit on the nose cone.

Shown here are 2 liter soda bottles.

Note: Bottles that have been left in the sun or a hot car may have shrunken necks and might not fit over the $\frac{1}{2}$ inch PVC pipe. Check each bottle to see if at least one of them fit.



Part I – The Airframe PRESSURE TANK

Choose a bottle whose neck fits over a $\frac{1}{2}$ "
Remove the left-over cap ring on two of the
bottles.

Remove the labels.

If you have the time, remove the label residue.
This will decrease drag as well as make the
rocket look better.

Choose one of the bottles to be the pressure
tank. Set it aside.

The other two will be cut to make sub-
assemblies.



Part I – The Airframe NOSE CONE

Cut the bottom off the bottle that you removed the cap ring from. Use the bottom seam as a guide.

If you make a slit in the bottle's side and insert the top blade of the scissors, it is easier to cut and you can easily see where you are cutting.

Don't worry too much about this first cut. It is quite easy to clean it up after you have separated the two pieces.

This piece will be the nose and payload bay similar to the bottle on the left. Place the bottle cap on this sub-assembly and set it aside.



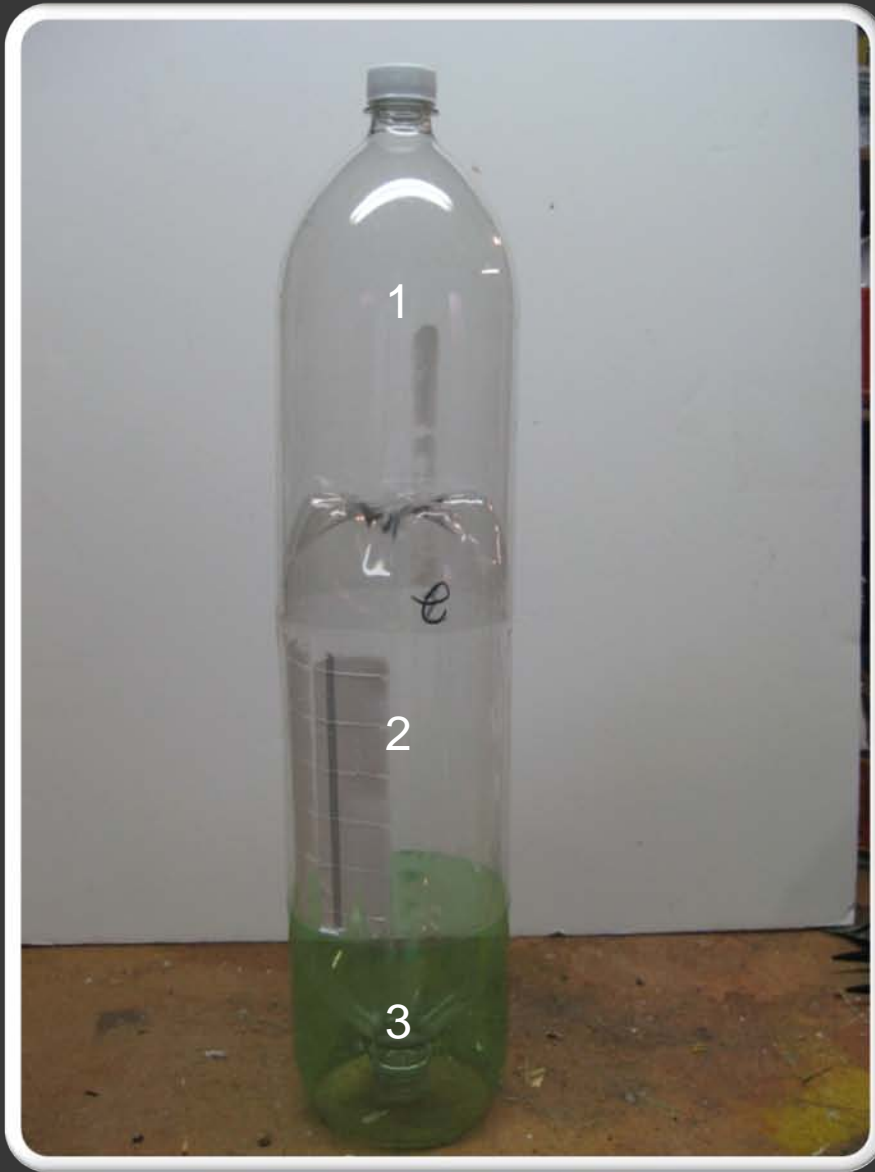
Part I – The Airframe FIN CAN

Cut the cap end from the 3rd bottle. This is for three reasons:

1. This will form a shroud over the rocket nozzle which makes it more aerodynamic,
2. It provides a flatter surface to mount the fins, and,
3. It creates a fin sub-assembly which can be reused if the pressure tank becomes damaged thus saving your fins.

Measure 3-4 inches up from the cut end and remove that piece of the bottle.

You'll then have a piece of bottle that looks similar to the green piece in the picture.



Part I – The Airframe ASSEMBLY

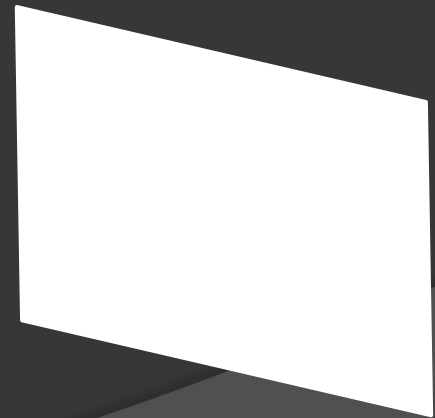
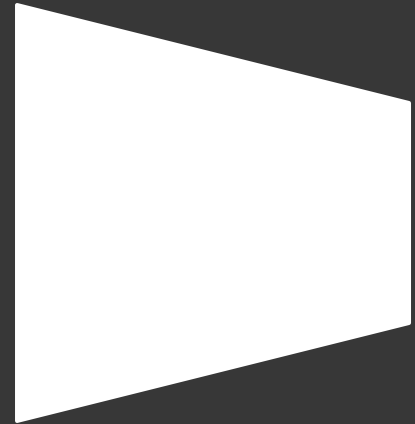
This is the completed airframe:

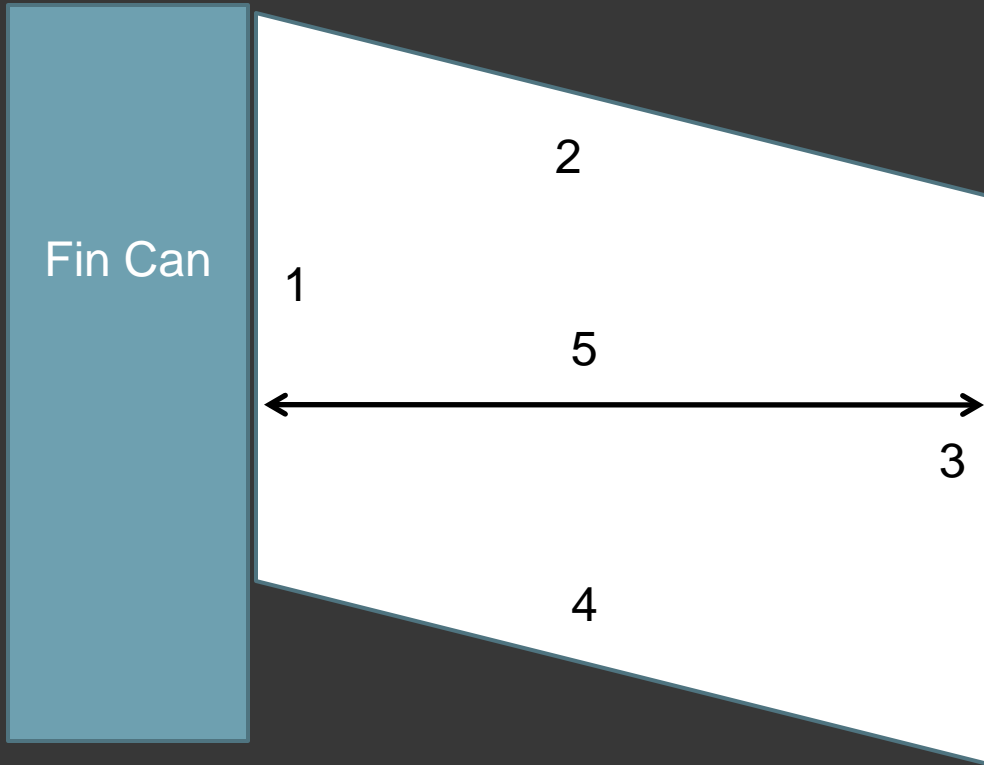
1. The nose/payload section with bottle cap attached
2. The pressure tank
3. The fin can
4. You may want to tape the payload section to the pressure tank. It's an option.
5. Do not tape the fin can until the fins are attached (next section).

Part II – The Fins

1. Fins can be any design that pleases you.
2. Use three, four or more fins. Four fins are easier to place on your rocket. Three fins create less drag. More fins can be fun too.
3. Tape or glue them to the rocket as straight as you can because that makes your rocket fly straighter.
4. You may tape your fins to the fin can using strong tape such as clear packing tape. Duct tape works great too, but is heavier and rougher, which means not as aerodynamic

Some Sample Fin Designs





Part II – The Fins

Fin Anatomy

1. Root Chord
2. Leading Edge
3. Tip Chord
4. Trailing Edge
5. Semi Span



Part II – The Fins

Choose a suitable fin stock. Old election yard signs are light and rigid.

Make 3, 4 or more fins of your own design. The important part is to make the hollow sections parallel to the leading edge of the fin. This adds to the fin's strength.



Part II – The Fins

Drill, burn, or punch holes near the root chord of the fin.

Glue will run into the holes and provide extra holding power to the fin can.

THE HOLES ARE NOT NECESSARY IF YOU ARE GOING TO USE TAPE.

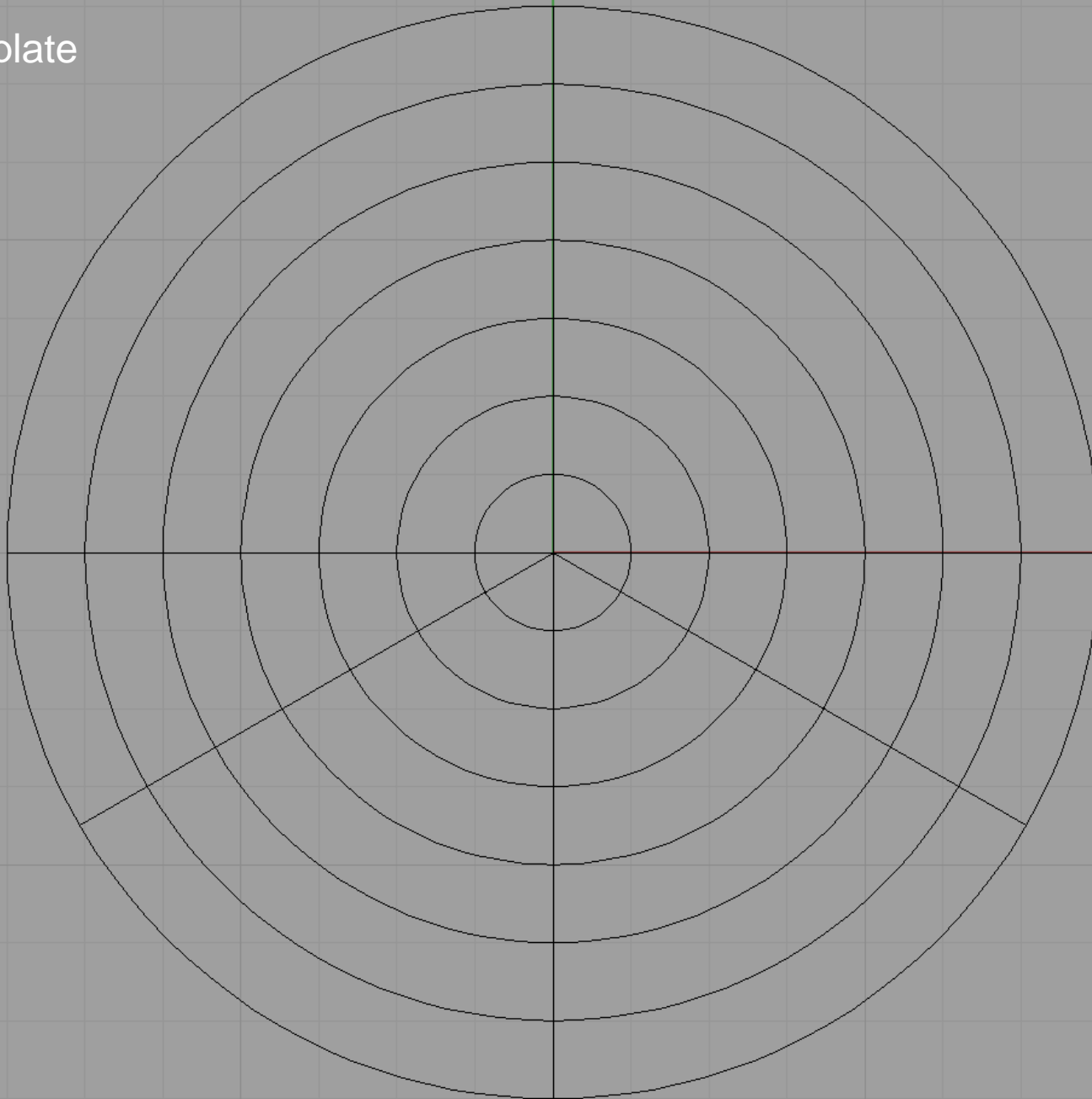
Part III – Attach Fins to the Fin Can

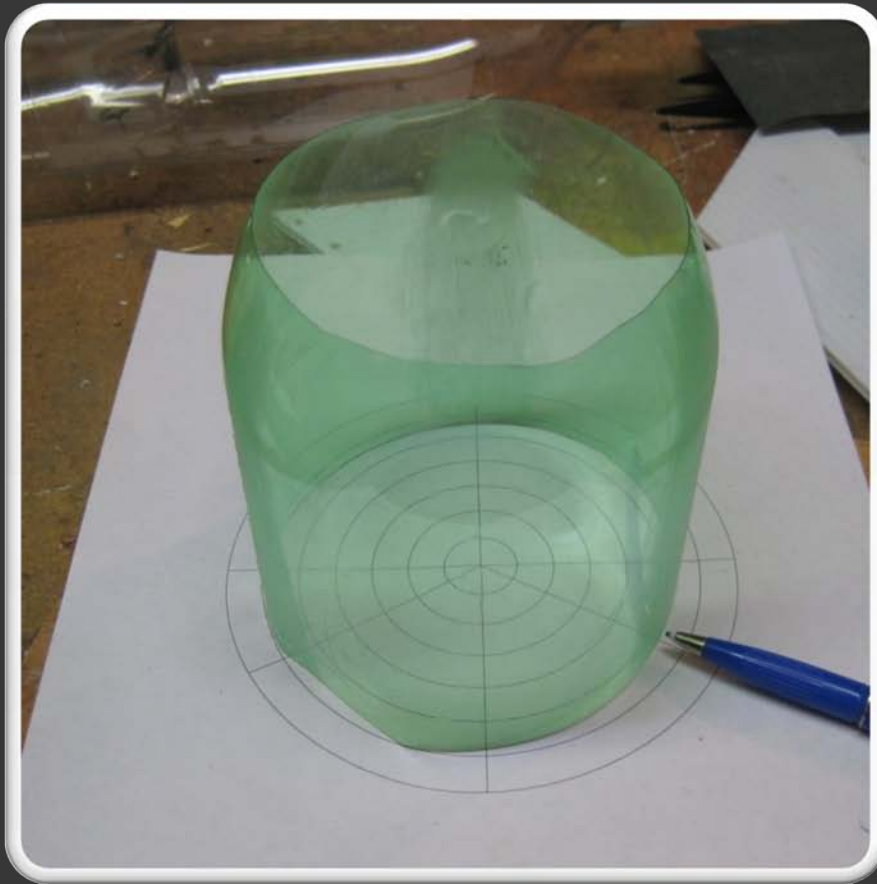
1. You may glue the fins to the fin can using a flexible strong construction adhesive such as PL Premium available from lumber stores, Home Depot, hardware stores, etc.

OR

2. You may tape your fins to the fin can using strong tape such as clear packing tape. Duct tape works great too, but is heavier and rougher, which means not as aerodynamic

Fin Template





Part III – The Fin Can

1. Use your fin template and center your fin can over the template.
2. Mark the fin position for the number of fins you are using.
3. If you want more than four fins, rotate the fin can and make additional marks.



Part III – Glue Fins to the Fin Can

If you are not going to glue the fins to your fin can, skip to [Part III – Tape Fins to the Fin Can](#)

Sand the fin can where the fins are to be glued to the fin can. This will increase the holding power of the glue.



Part III – Glue Fins to the Fin Can

Place the fin can over the pressure tank.

Coat the root chord liberally with the PL Premium glue as well as the fin can where the fin will be attached.

Use masking tape to help hold the fin to the fin can. The tape also makes a smoother fillet where the fin joins the fin can.

You can do all of your fins at one setting, if you are careful. Having a helper makes it much easier to fasten your fins to the fin can!

Place the pressure tank on its bottom and let the PL Premium dry. It takes about 24 hours to really dry.

Part III – Tape Fins to the Fin Can

Tape is a good substitute for glue, especially if you are short of time or are experimenting with fin designs.

A helper is useful when taping your fins because one person can hold the fin and the other can apply the tape.

1. Align the fin straight.
2. Tape both sides of the fin.
3. Tape across the top and the bottom of the fin.

YOU ARE DONE!!