

# Air Rocket

by Create It Lab (CreateItLab.org)



An easily assembled, fun toy that demonstrates aerodynamic principles.

This document includes a list of materials required, assembly instructions, and a discussion of the principles involved.



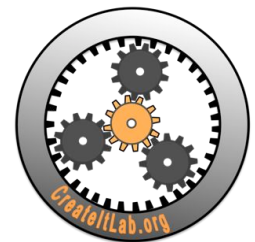
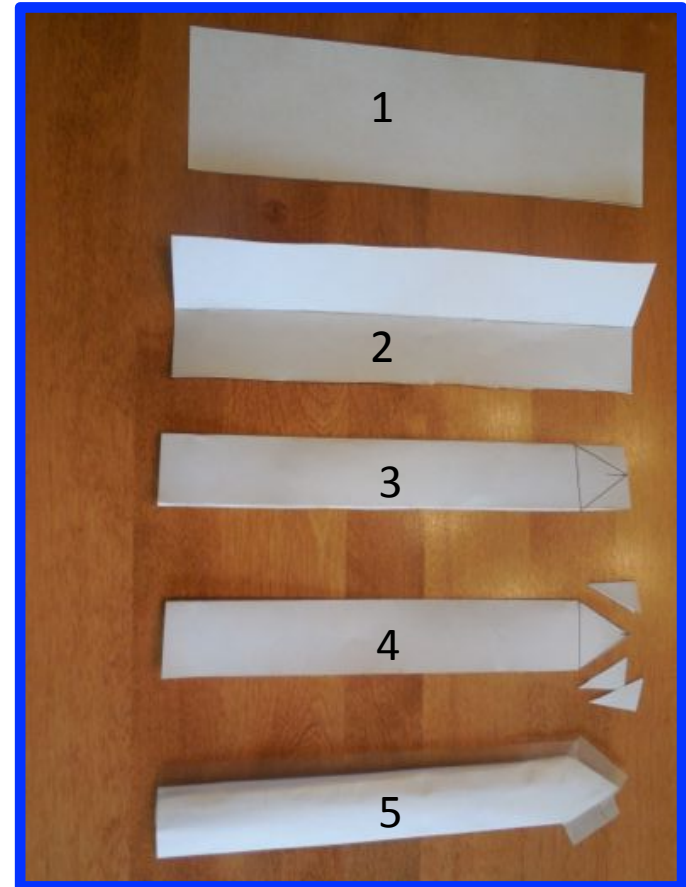
# Materials & Tools

- Scissors
- Tape
- Ruler
- Paper
- Foot Pump & Launch Stand  
Alternate: Bicycle pump



# Assembly 1

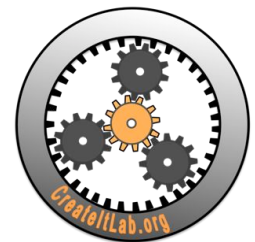
1. Cut paper into strips with widths slightly larger than the circumference of the launch tubes
2. Fold strips in half in the long direction.
3. At one end of the strip, mark the center point.
4. From center point, cut at an angle (~30 deg.) twice to create an arrow shape. This will act as a nose cone.
5. Tape together the long edge and both edges of the nose cone
6. Trim the tape edges



# Operation

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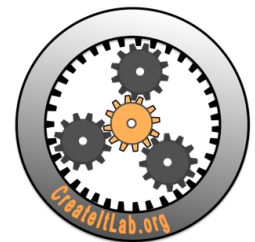
- Connect foot pump to launch stand
- Place rocket onto launch tube
- Stomp onto foot pump



# Assembly/Operation 2

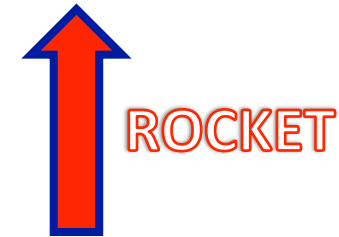
Alternative to foot pump/launch stand

- Use tire pump instead of foot pump
- Tape end of tire pump hose to some solid vertical item (such as a baluster or chair) if stand is not available
- Leave enough hose exposed to insert into rocket
- Place Rocket onto hose
- Push hard

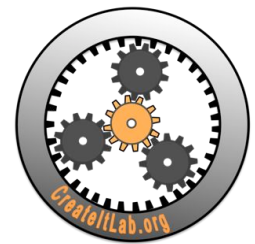


# Paper Rocket Propulsion - 1

Escaping air creates an equal and opposite force on the glider called thrust, propelling the rocket upward.



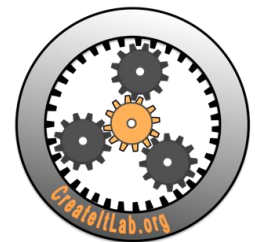
Pressure from stomping on the pump creates a force that pushes the air downward between the rocket and the launch tube.



# Paper Rocket Propulsion - 2

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- Stomping on the foot pump creates an increase in air pressure inside the launch tube.
- The increased pressure is reduced by pushing the rocket higher on the launch tube; thus increasing the volume of the system.
- For large sudden increases in air pressure, the volume increase must also be large and sudden.
- Thus the rocket is rapidly pushed up the launch tube, gaining momentum until pushed off the launch tube.
- After the rocket leaves the tube, the pressure is released and the launching thrust becomes zero



# Paper Rocket Forces



Drag = Gravity plus  
Air Resistance

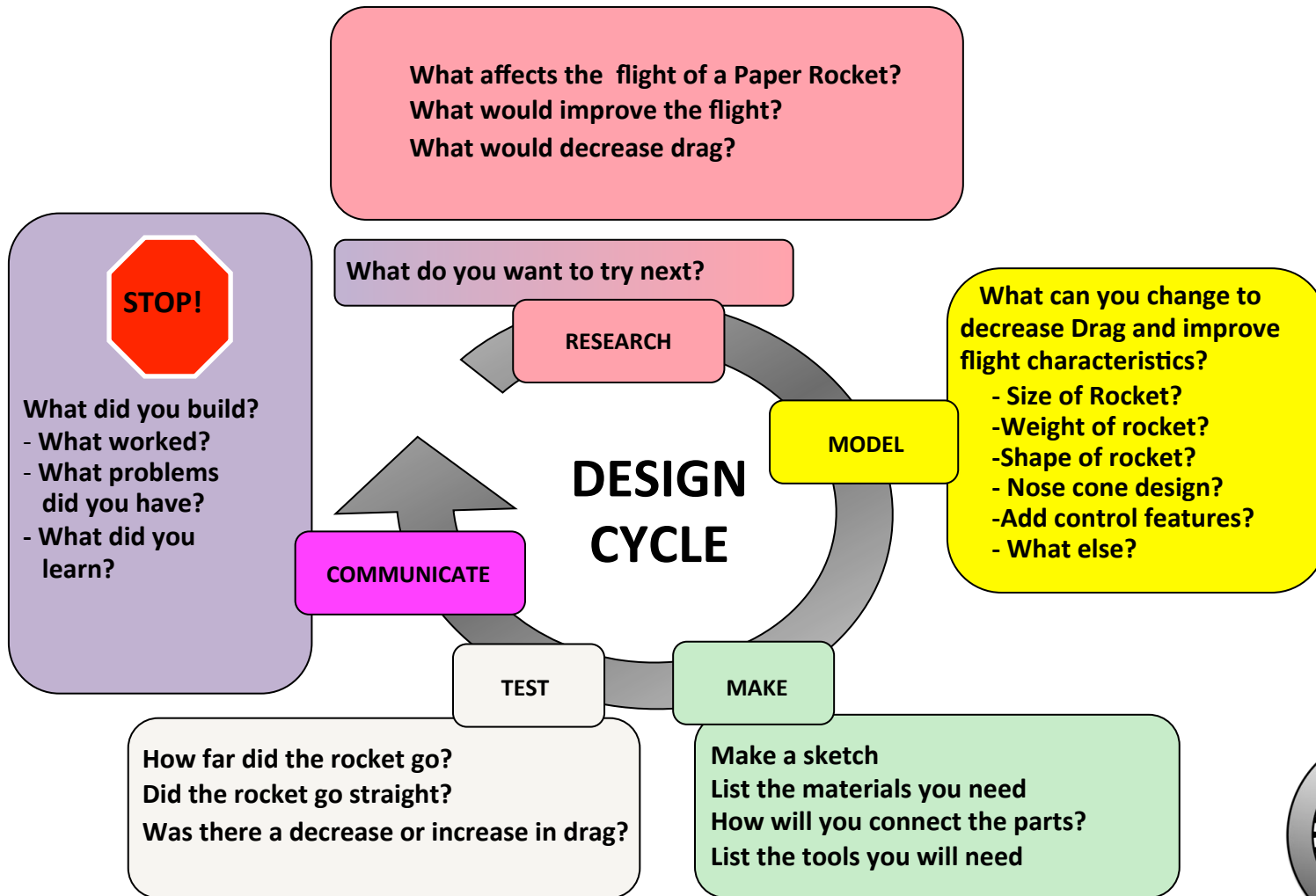
- After the rocket leaves the tube, the pressure is released and the launching thrust drops to zero.
- Then the only forces pushing on the rocket are gravity and air resistance





# PAPER ROCKET MOTION

MAKE A BETTER PAPER ROCKET! JUST FOLLOW THE DESIGN CYCLE!



# Paper Rocket Questions

- What do other rockets have that might improve your rocket?
- How can the stability of the rocket be improved?
- How does weight affect the flight?
- How does weight, length or their ratio affect flight?
- Does the diameter of the rocket nozzle affect the flight?

