Basic Rocket Aerodynamics

# **Rocket Design**

Free rocket design program "Openrocket": http://openrocket.sourceforge.net/features. html

# **Basic aerodynamic principles**

### • Thrust - upward force

- For rockets: more thrust, more lift
- Thrust is generated by the engine
- Drag Resistance to motion through air
  - Cross-sectional area Up, Drag Up
  - Drag acts parallel to the direction of motion through air
- Lift The main stabilizing force
  - Acts perpendicular to direction of motion through air



# Physics

- Center of Gravity-Average location of the rocket's total weight - must be in front of CP
- Center of Pressure-the balance point of all aerodynamic forces on the rocket
- Center of Mass-The balance point of all mass in the rocket



### GO HERE: http://exploration.grc.nasa. gov/education/rocket/rktstab.html

### Cone

- "Breaks" the air around the
- Pointed, round, spike
- Needs to meet flush with th turbulence
- High weight moves center
- Optimal shape depends on speed



# Cone part 2

a needle also be create an artificia at high speeds



# Body

### General rule of thumb

- 10-20:1 length to diameter ratio (aspect ratio)
- Smaller diameter=less drag
- Round, polygonal
- Smoothe prevent turbulence

Helicopter rocket?

Does it have to be round?

http://youtu.be/YLbv9UbqqCs



# fins part 2

A good size to start at is, 2D by 2D by D where D is the Diameter of the rocket body.

Also fins may not be needed if the rocket exhaust can be redirected to stabilize