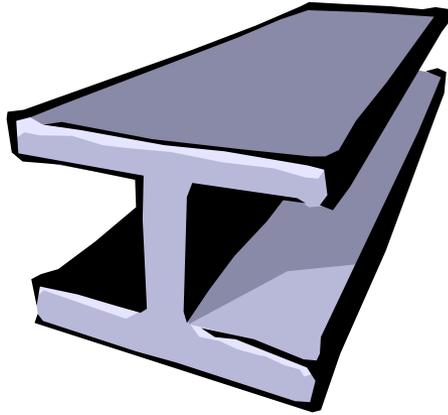


# Fun making Pinewood Derby Cars





Let's have some fun and build a  
Pinewood Derby car



# Things that can make a difference: "the easy way"

- Weight



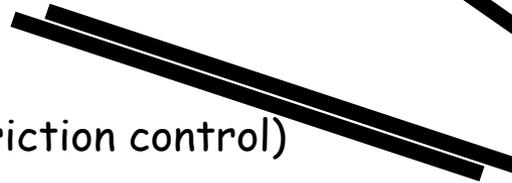
- Axles



- Wheels



- Graphite (friction control)



- Aerodynamics



# Weight: A WINNING difference

- Weight
  - The limit is 5.0 oz: Be as close to 5.0 as possible
  - Consensus: center of gravity should be about 60-70% of the way back.
  - Put weight on top or back (or drill holes), not the bottom (dragging problem)
  - What wins: weight on top, on top and back, or drilled in



# Axles make a Substantial difference

From this



To this



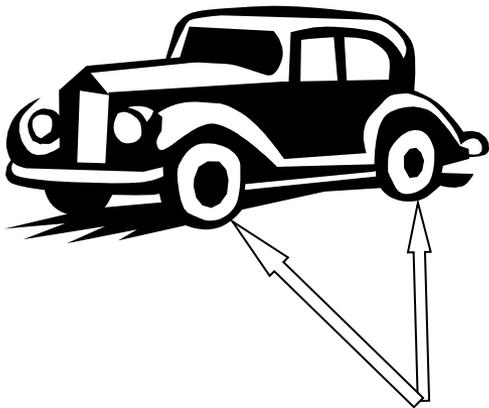
Axles (aka the brads)

- If the axle slots are not straight, get new ones cut!
- Glue the axles in place
- Removing the burrs is necessary because they 'grab':  
Use 220 or finer sandpaper (if you can feel them keep sanding)
- This is easy if you put the axle in a variable speed drill and turning it slowly while carefully holding sandpaper with gloves on over the rougher parts.
- When smooth, you can also rub graphite into the axle.

# Wheels make a difference

## Wheels

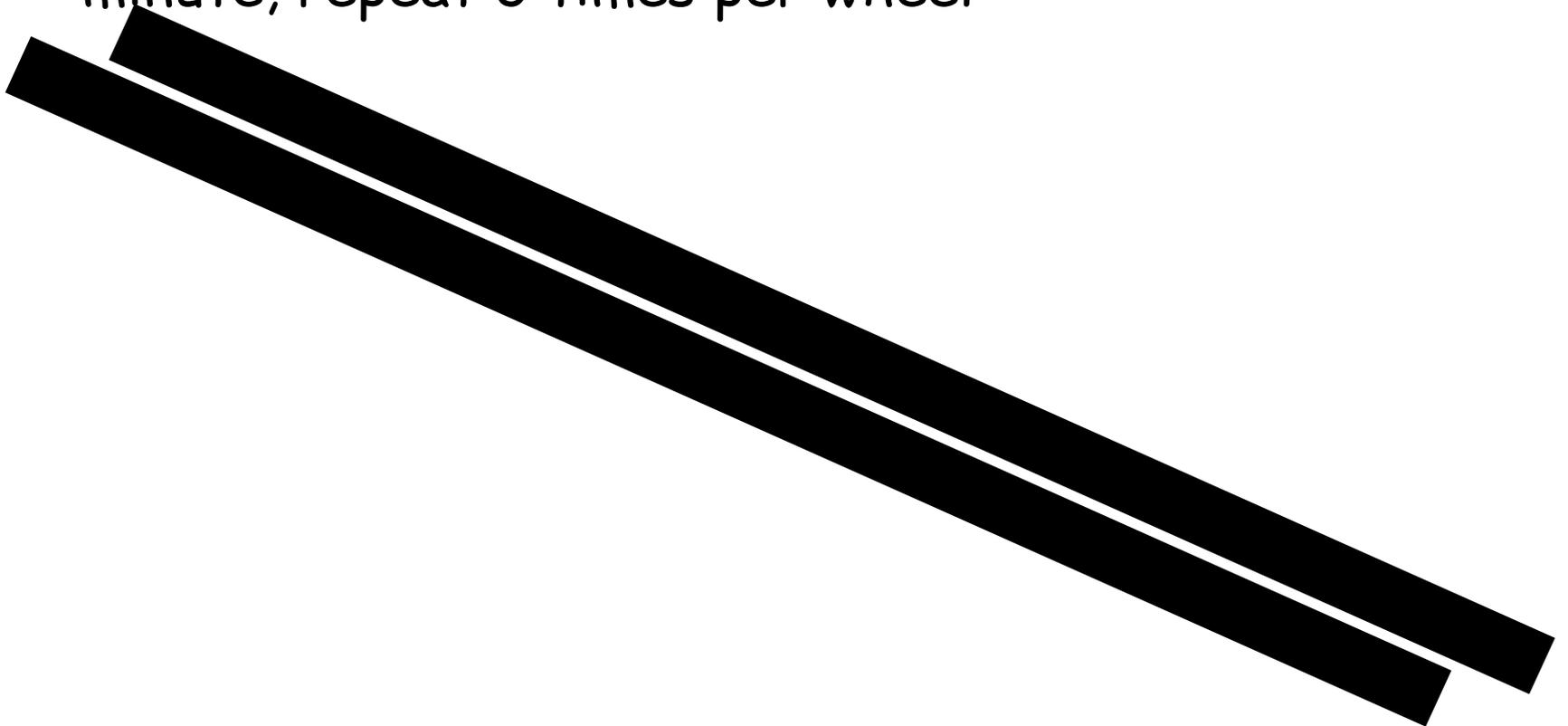
- The wheels you use must be straight (on the sides) and round (sometimes you might find a deformed wheel)
- You must use the "official" wheels supplied
- "Light sanding" to smooth, and round
- Don't paint the wheels (it slows the car at the start)



# Graphite / Friction Reduction make a difference in most races

## Graphite

- The only legal lubricant (graphite is a powder)
- "Squirt" it on each end of each wheel, spin it for 1 minute, repeat 3 times per wheel

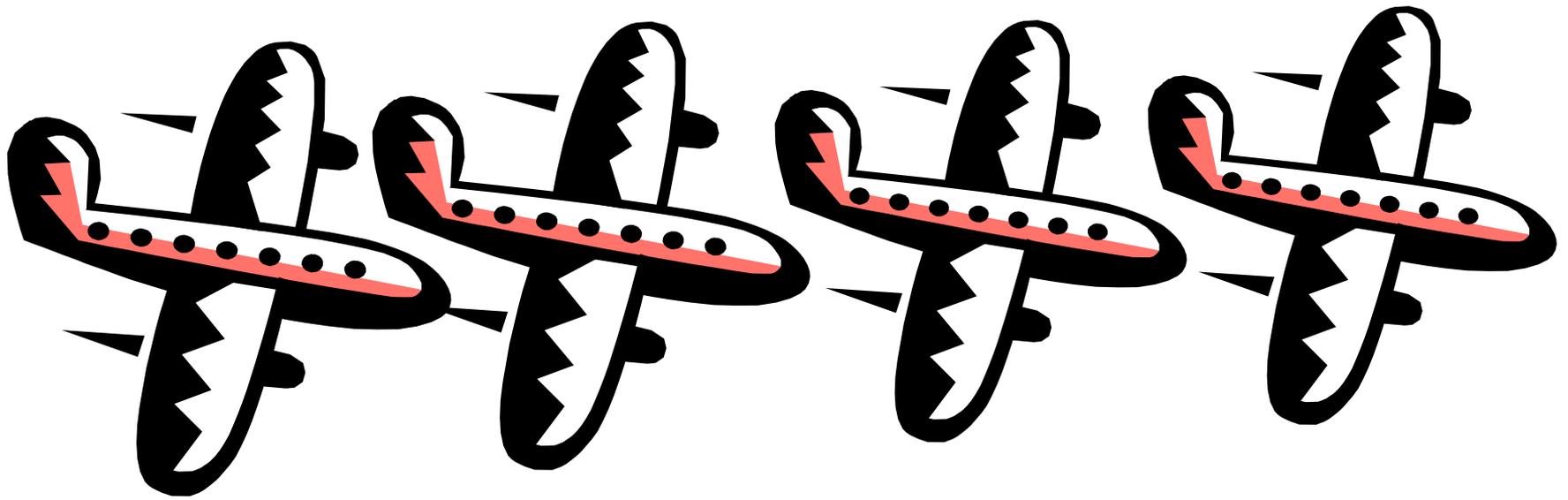


# Aerodynamics make a difference in close races

## Aerodynamics

- Anything except a flat front
- Easiest to cut on a jig saw, coping saw or table saw

Studies show that Scout blood on the pine block slows the car down!!! Be careful!

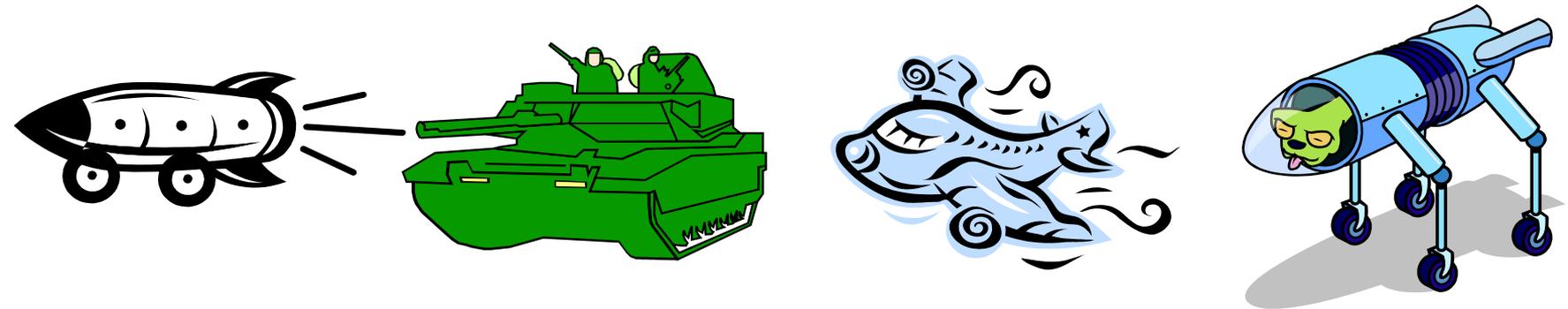


# Things that are just fun

Paint it! Add a character or something you!

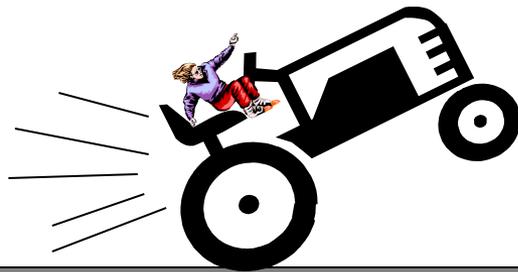
Make a theme for your car

- Rocket car, Pokemon, Lego, Batman, or pick something else



# Things to do just before your race (just before you turn your car in)

- Put graphite on each wheel, and spin it again gently
- Make sure all the wheels are aligned and axles "solidly in place" (you did glue them???)
- Have fun!
- Have fun!



If you're really really competitive and want to go to District, Council, State and on, then...



You'll need a  
slightly  
different  
Approach



Hint: It helps if your Mom / Dad has a PhD in Applied Mechanics and Classical Energy Transfer...



# Disclaimer!

You probably won't have as much fun if  
your Mom builds the car...

Some require that you built the car.

P.S. Don't take it so seriously! Besides, you're  
Mom's not supposed to build the car for you,

**YOU ARE!**

**Have FUN!**

# Things scouts (or their moms) “may have done” to win district, council, state, then...



## Kits

- They mowed lots of lawns so they could buy 20 kits to optimize the selection of wheels and axles.

## Axles

- They trued the axles on a precision lathe to the limits of a micrometer.



# Things scouts (or their moms) did to win district, then council, then...

## Wheels

- They understand “Moment of Inertia” of a thin disk/cylinder, and how to apply this knowledge to ‘lightly sanding’ the wheels, even ‘lightly sanding’ all wheel surfaces with a precision lathe.
- They know wheels produced 15 years ago had lower moments of inertia, and have acquired 4 unused ‘old’ wheels.
- They figured out how to “plate” graphite on plastic wheels.
- They also know that 3 wheels, perfectly balanced, have 25% less friction than 4 wheels.

# Things scouts (or their moms) did to win district, then council, then...

- Weight

- The weight limit is 5 oz. The scales used are accurate to 5.00 oz. According to the National Bureau of Standards, their car weights exactly 5.00499999 oz.



- In practice, Physics says this difference yields a 3 millisecond advantage, just enough to win by 1/16” on a light sensor finish line.
- They know that maximizing lead weight (in optimum locations) and minimizing wood weight is a key.

# Things scouts (or their moms) did to win district, then council, then...

- Aerodynamics / Shape / Placement
  - At this level of competition, razor thin vs. thin is worth about 2 milliseconds at the finish line



- The shape of front of the car, and how it sits on the start gate and how it crosses the finish line can easily provide
  - (Hint: How can you give your car more potential energy at the start gate, all others things being the same)
  - (Hint: What shape on the front of the car hits the sensor first?)
- No/ very low frontal area is better than a big frontal area. (she appreciates lower Reynolds numbers)

# Things scouts (or their moms) did to win district, then council, then...

- Books

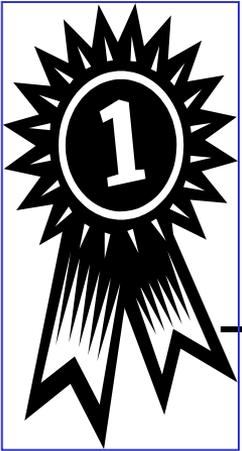
- There are some books and pamphlets available online and elsewhere that tell you how to build a winning car.

- Some are very good, Some are very expensive
- Few will give you much more information for as good a price!

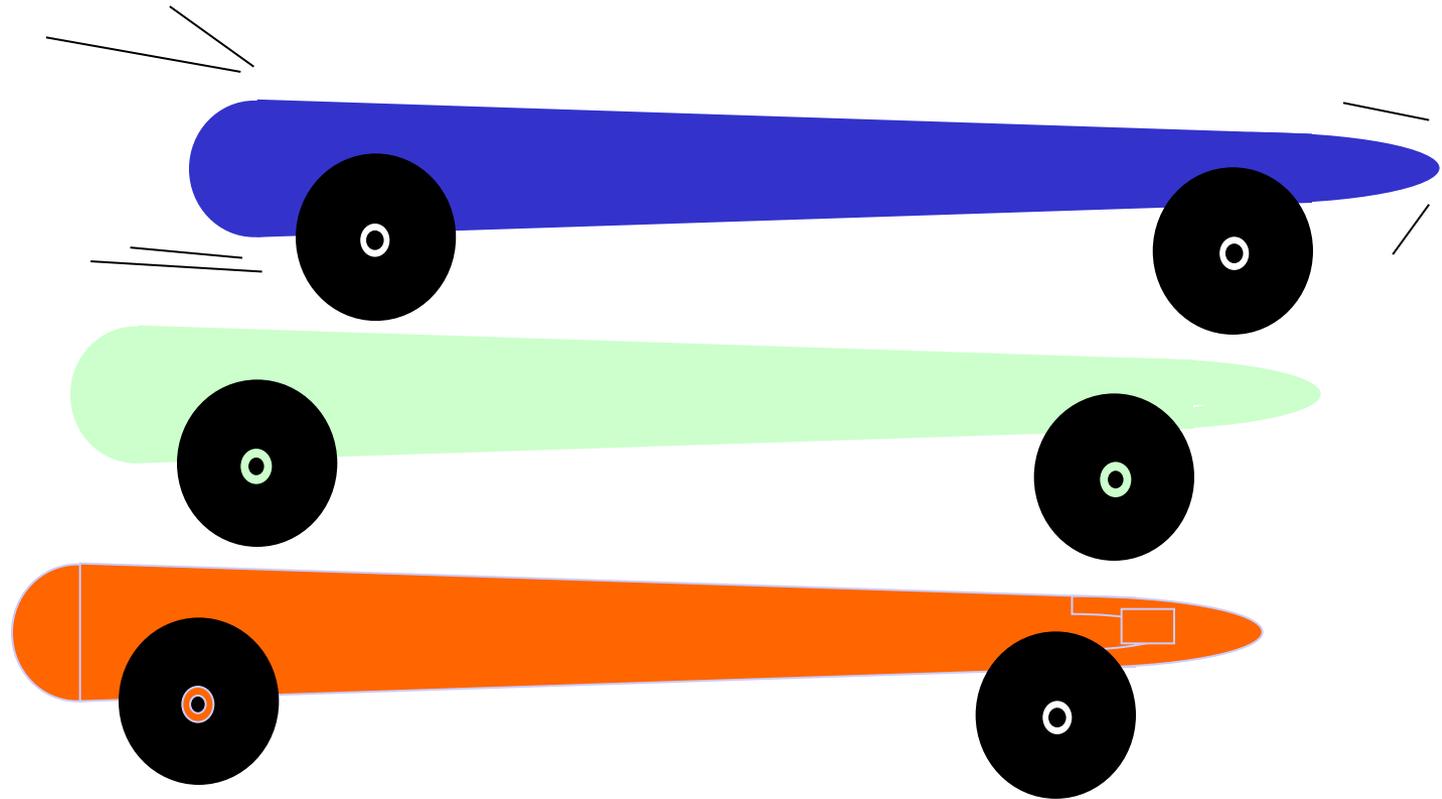
– Race in the race who built it!

- If you built it, then you get to race it in the Cubs race 😊

- If your mom or dad built it they race in the adults race 😞



Don't take it so seriously!



Most of all, Have fun!!!!

Questions, Comments, or want this presented to your Pack?

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