

# Description

- Self-propelled
- Air-levitated
- Up to 2 battery powered motors
  - One propeller each
- Levitate and move vehicle down track
- Test on knowledge of classic mechanics and related topics

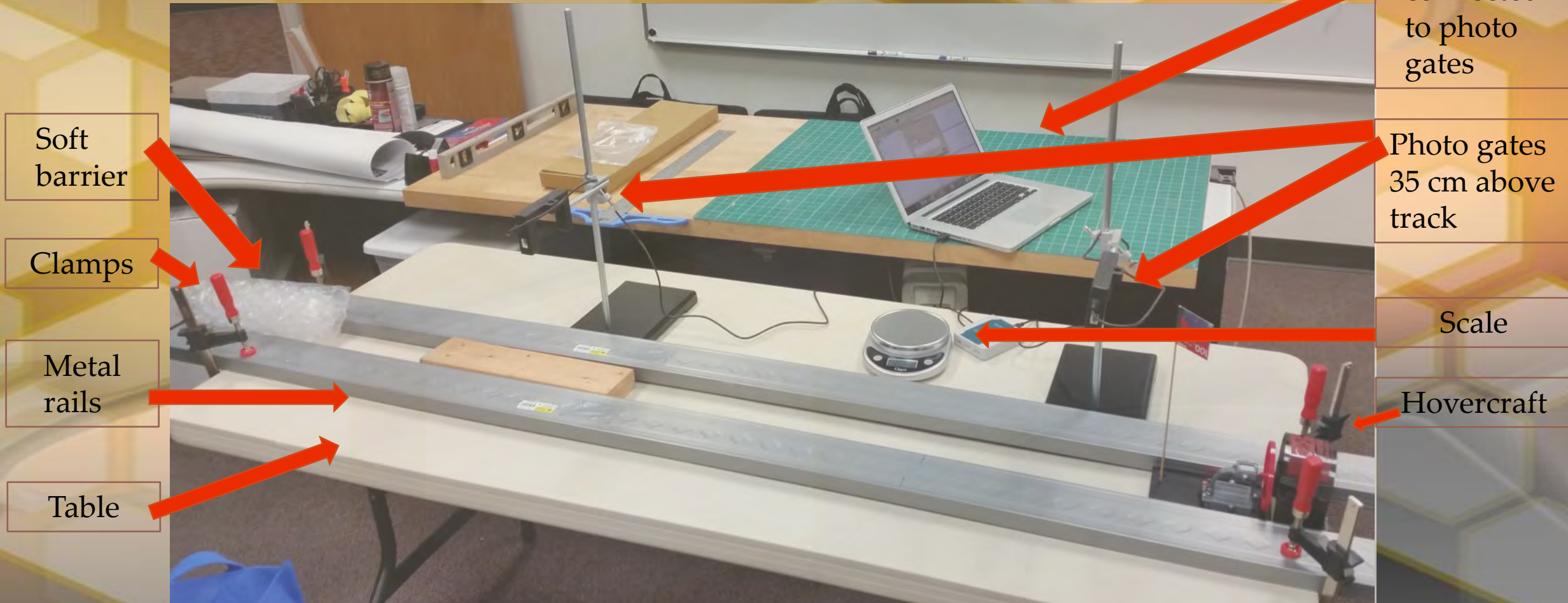
# PARAMETERS

- 3 inch ring binder permitted
- Writing utensils and calculator(s)
- Vehicle in a box (both labeled with team name and tournament specific number (**IMPOUNDED**))
- Eye protection B
- Tools and supplies need not be impounded

# THE TRACK

- **SUPPLIED BY EVENT SUPERVISOR**
- 8' long beams
- 30.0 mm high
- Cushioned barrier to stop vehicle at least 10.0 cm from finish line
- Small wood block to hold vehicle
- Base surface > 215.0 cm
- 60.0 to 95.0 cm base surface (standard 8' table)
- Gap of  $20 \pm 0.5$  cm between beams
- Start line marked at least 35.0 cm from track edge
- Finish line at other end

# THE TRACK



# CONSTRUCTION

- 15.0 – 30.0 cm long (including inflated skirts)
- Less than 20.0 cm tall (with propellers in motion when non-levitated)
- No more than 2,000.0 g
- No more than two motors (one propeller each)
  - Propeller shielding with holes  $< \frac{1}{4}$  in
- Entire vehicle width (including propellers) must not exceed 19.5 cm
- $\frac{1}{4}$  in dowel, vertically attached within 5.0 cm of front edge
  - Top is between 30.0 and 35.0 above the lowest vehicle surface

# CONSTRUCTION CONT'D

- Batteries must not exceed 9.0 V as labeled
- Brushless motors and integrated circuits not permitted
- Competitors may be asked to demonstrate levitation
- Must have switch to permit safe starting
- A stopping system to shut off the motor is recommended
- Competitors must be able to answer questions regarding the design, construction, and operation of the vehicle

# WRITTEN TEST

- Metric units with appropriate significant figures
- Minimum of 20 minutes
- Multiple choice, true-false, completion, or calculation
- At least 5 questions from each of the following areas



# TOPICS

- Newton's laws of motion
  - Inertia, force, impulse, action-reaction
- Kinematics
  - Projectile velocity, speed, acceleration, position
- Kinetic Energy
  - Calculation, momentum, non-relativistic
- Air cushioned vehicles and applications
  - History, design, capabilities

# VEHICLE TESTING

- Track length
  - Between 100.0 and 195.0 cm (Div. C)
  - $130 \pm 0.5$  cm
- Target time between 5.0 and 25.0 s
  - Div. C – exact length and time must be announced
- Specs must be checked during impound or right before run
  - May also check after a run (e.g., to re-measure mass)
- Teams must be notified if vehicle not in specs
- 8 minutes to adjust or repair
  - 5 failed or 2 successful runs
  - Must be warned at 7 minutes

# VEHICLE TESTING

- Prior to run, competitors must demonstrate a safe starting and stopping process
  - Without turning on motor
  - This happens within allotted 8 minutes
- To begin a run, competitors place vehicle on track
  - ES must place block on track to keep the vehicle from moving
- When ready, competitors turn on vehicle and indicate readiness
  - Now they cannot touch vehicle until after passing finish line or ES declares a failed run
- Students give a 3, 2, 1, Launch and ES must remove block

# VEHICLE TESTING CONT'D

- Timing
  - Starts when dowel crosses the Start Line
  - Ends when dowel crosses the Finish Line
- ESs encouraged to use photogates and at least one back-up manual (human) timer
- If only manual timers
  - 3 are recommended
  - Middle value of the 3 timers is official time
- Time recorded in seconds to the precision of the device
- A run must be counted if it has started before the 8 minutes have elapsed

# MORE VEHICLE TESTING

- Failed runs
  - Vehicle does not meet specs when timing for that run starts
  - Vehicle does not move for 3 seconds at any time
  - Fails to cross finish line within 3 times the target time
  - Any part of the vehicle falls off
- After failed run, teams must be allowed to repair and re-run if time remains of their 8 minutes.
  - For a maximum of 5 failed runs.
  - Teams filing an appeal regarding Part II must leave their vehicle
- **Supervisor must verify with the team the correct recording of Part II data on the team scoresheet.**

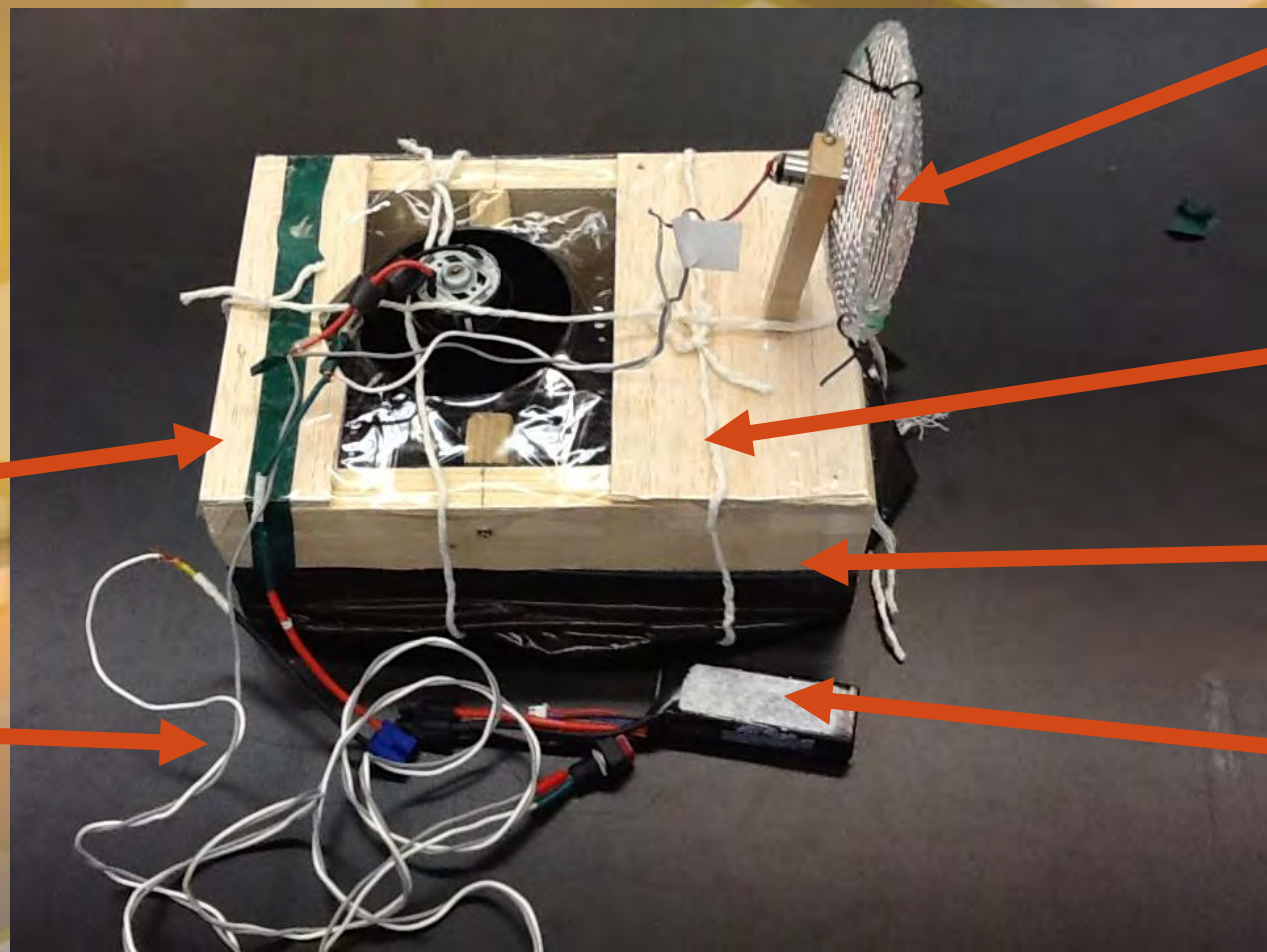
# SCORING

- Mass Score (MS) = (mass of vehicle/mass of heaviest successful vehicle) x 25 points
- Time Score (TS) = ((1-(abs (run time – target time) – run time)) x 25 pts
  - Smallest possible TS is 0
- Teams with no successful runs or are disqualified for unsafe operation receive a TS and MS of 0
  - Must still be allowed to compete in Part I
- Mass of the vehicle must be multiplied by 0.7 when calculating the MS if
  - Any construction violations are corrected during the Part II testing
  - Not impounded

# SCORING CONT'D

- The TS for a successful run must be multiplied by 0.9 when calculating the Final Score if
  - The team violates any of the rules in the COMPETITION during the run
- Rules violations during failed runs do not result in this penalty
- Exam Score (ES) + (Part I score / Highest Part I score for all teams) x 50 points
- Final Score (FS) = MS + best run TS + ES.
  - Maximum possible FS is 100 points. High score wins

# IDEAS (AND LESSONS LEARNED)



This craft masses 1.223 kg

Tether with switch is not legal

This pusher prop not strong enough

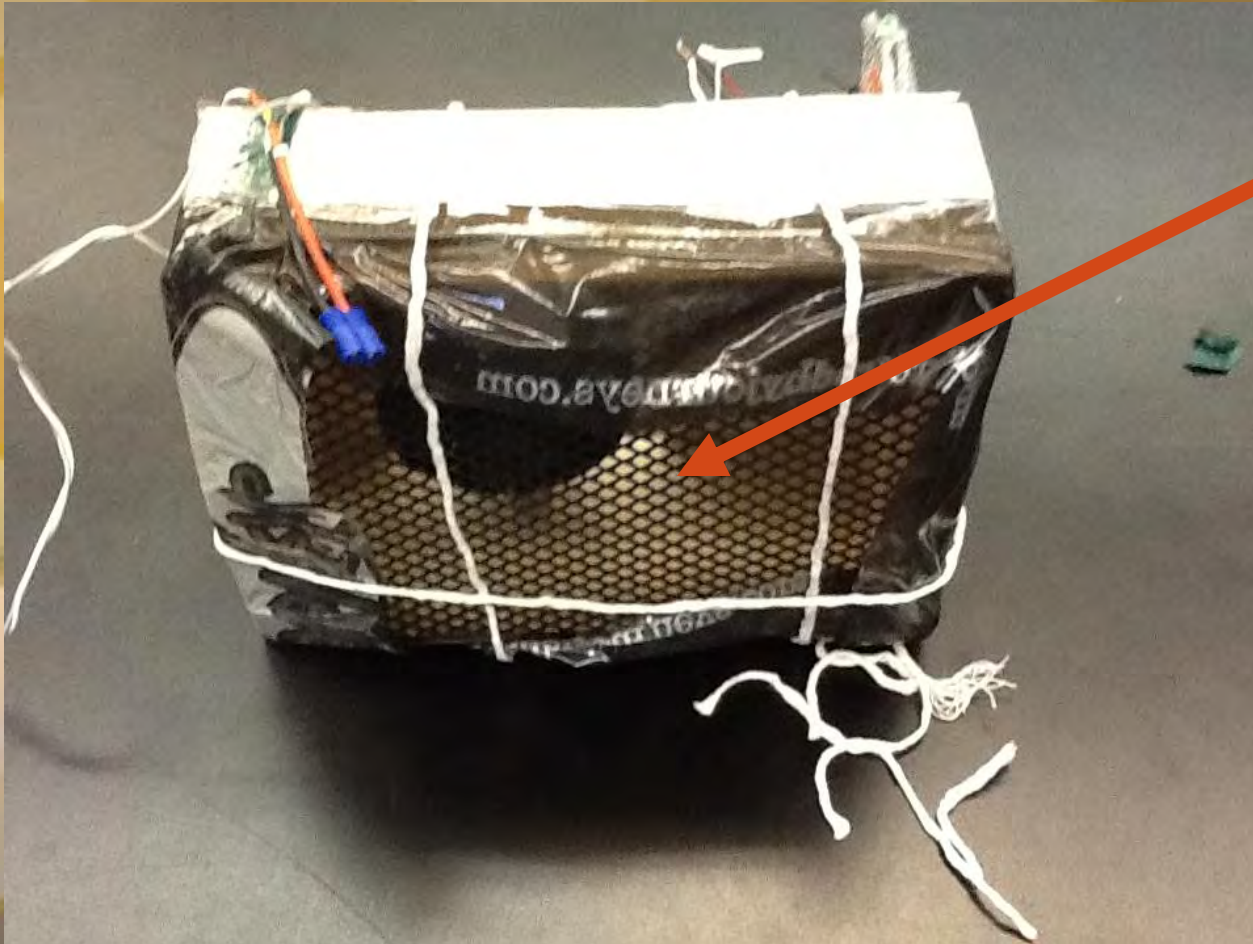
String was an attempt to keep skirt from blowing out

Skirt material must be strong enough to not blow out

Label torn off battery – can't use in competition



# MORE IDEAS ...



Protective  
Screening

# ANOTHER IDEA



Shrink wrap