

# Hovercraft

## Division B/C

Georgia Tech Event Workshop Series  
2025-26



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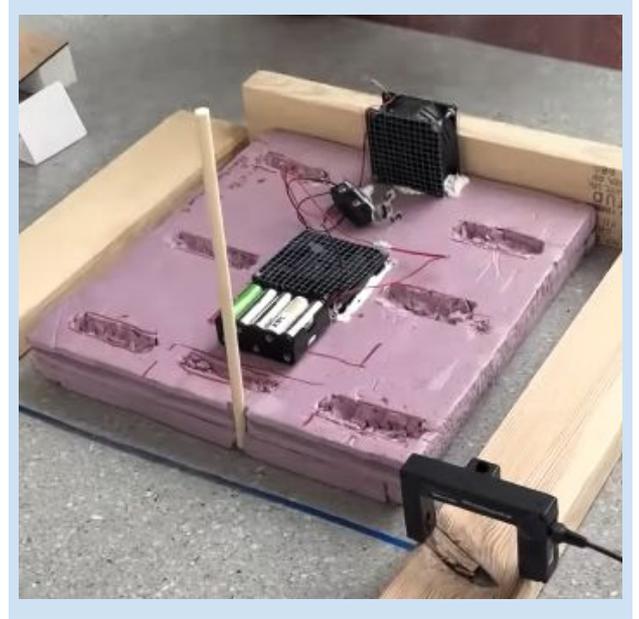
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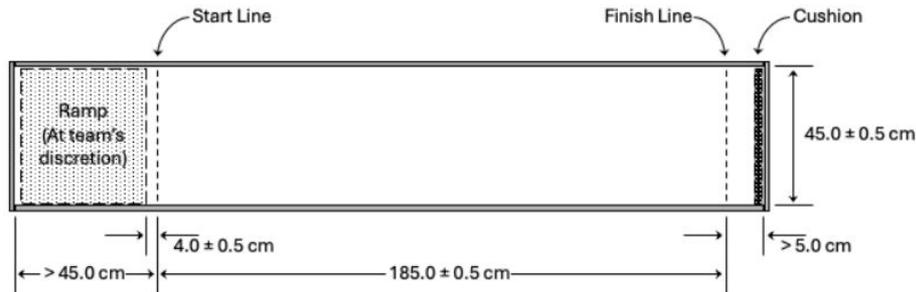
05

**OTHER FREE RESOURCES**



# The Rules Sheet

- Device: a self-propelled air-levitated vehicle that moves down a track
- Goal: to run across the entire track from start to finish, meeting the target time
- Track: 185cm long, 45cm start
- Target Time: 6-26 sec (Div C), 10-20 sec (Div B)
- Bonus: if 25% with TT of first run (Div B and C)



## HOVERCRAFT C

See General Rules, Eye Protection & other Policies on [www.soinc.org](http://www.soinc.org) as they apply to every event.



- DESCRIPTION:** Prior to the competition, participants will design, construct, and calibrate a self-propelled air-levitated vehicle that moves down a track.
  - A TEAM OF UP TO: 2**
  - EYE PROTECTION:** B
  - IMPOUND:** Yes
  - APPROXIMATE TIME:** 10 minutes
  - CALCULATOR:** Class III
- EVENT PARAMETERS:**
  - Each team must impound only one vehicle and any papers/notes needed during the competition time. The vehicle must be impounded with the batteries stored separately and presented to the Event Supervisor for inspection. **No additional papers/notes may be brought into the competition area after impound.**
  - Teams may bring tools, supplies, spare parts, eye protection, and two Class III calculators. These items need not be impounded.
  - Participants must wear eye protection during vehicle setup and operation. Teams without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows.
  - The Event Supervisor will provide the testing materials listed in the TRACK section. Teams should not bring their own track or ramp.
  - Participants must be able to answer questions regarding the design, construction, and operation of the vehicle per the Building Policy found on [www.soinc.org](http://www.soinc.org).
- CONSTRUCTION PARAMETERS:**
  - The vehicle must fit into a  $40.0$  cm  $\times$   $40.0$  cm  $\times$   $40.0$  cm box when levitated in the ready-to-run configuration. Vehicles must not modify or damage the track.
  - The vehicle must levitate on a cushion of air as it moves down the track. Participants may be asked to demonstrate levitation by pushing the vehicle slightly down. If it then rises, it is levitating. Continuous contact of the inflated skirt with the base surface, occasional contact of other vehicle components with the base surface, or any contact with the inside edge of the side rails is permitted.
  - All propellers/impellers, including those under the vehicle, must have shielding that prevents a  $3/8"$  dowel from touching them.
  - Commercial batteries, including rechargeables, not exceeding  $12.0$  V as labeled, may be used to energize each of the vehicle's motors. The label on each battery must be the manufacturer's original and easily viewable by the Event Supervisor. Multiple batteries may be connected together as long as the expected voltage across any two points does not exceed  $12.0$  V, as calculated by their individual labels. The vehicle must not have any other energy sources. Batteries containing lithium or lead are prohibited.
  - All motors must have a switch to permit safe starting and stopping. Relying on inserting batteries or twisting wires together to start is not allowed. If more than one motor is used, they may be combined on the same switch or wired on separate switches.
  - Electrical components shall be limited to batteries, wires, manually-operated switches, resistors, potentiometers, capacitors, and up to two motors (including brushless motors). Integrated circuits (other than those that are an integral part of a commercial motor) are not permitted.
  - For timing and measurement purposes, the vehicle must have a  $1/4"$  or larger wooden dowel vertically attached within  $3.0$  cm of its front edge such that the top end is at least  $20.0$  cm above the track's surface when levitated. The dowel must be placed on the hovercraft so that it will be the first part of the vehicle to break a laser timing beam when the vehicle is traveling forward.
- THE COMPETITION:**
  - Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication until they are finished competing.
  - Vehicles violating rules 3.c., 3.d., or 3.e. or that are otherwise deemed unsafe in construction or operation by the Event Supervisor will not be allowed to run unless brought into compliance. If the team is unable to bring the vehicle into compliance with 3.c., 3.d. and 3.e., the vehicle will not run and will receive a Final Score of zero (0). The Event Supervisor must complete the entire construction check on the vehicle to determine the total number of construction violations (which is used to break ties).
  - Event Supervisors will check the vehicle specifications before the team's testing period. Teams must be notified as soon as possible if a vehicle is out of spec. Teams may modify the vehicle to bring it into compliance during their testing period.

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## HOVERCRAFT C (CONT.)

See General Rules, Eye Protection & other Policies on [www.soinc.org](http://www.soinc.org) as they apply to every event.



- At the start of their testing period, each team will be given a Target Time (TT). The Target Time will be between **6.0-26.0** seconds in intervals of 2.0 seconds for Regionals, 1.0 second for States, and 0.5 seconds for Nationals. The TT will be the same for all teams.
- Teams have a testing period of 8 minutes to adjust and repair their vehicle and make their test runs. Practice runs are not allowed. If a team has 3 incomplete runs, their testing period is over. Once a team has one complete run, the team is allowed only one more run (the Final Run), regardless of the result of that run or whether the team has fewer than 3 incomplete runs.
- An incomplete run occurs if a vehicle fails to move for 3 seconds before crossing the finish line or the dowel fails to cross the finish line within  $(2 \times TT)$  seconds. Teams are not allowed to declare a run as incomplete.
- If the vehicle's dowel does not cross the starting line within 3 seconds of launching, it does not count as a run (either complete or incomplete) and teams may reset. A run will be counted in the scoring as long as it is started before the 8-minute period has elapsed.
- If any part of the vehicle falls off during a run, the team incurs a competition penalty for the run.
- To begin a run, the team will place their vehicle on the track fully behind the start line against a wood

# Design Specifications

- Device: 40cm x 40cm x 40cm
- Up to 2 motors with 2 fans
- All propellers/impellers, including those under the vehicle, must have **shielding** that prevents a 3/8” dowel from touching them.
- Must have a 1/4” or larger wooden **dowel** vertically attached within 3 cm of its front edge with the top end is at least 20.0 cm above the track’s surface when levitated.
- Commercial batteries, including rechargeables, **not exceeding 12.0V** as labeled, may be used to energize each of the vehicle’s motors.
- All motors must have a switch to permit safe starting and stopping. Relying on inserting batteries or twisting wires together to start is not allowed.

# Electrical Components

- Batteries,
  - Wires
  - Manually-operated switches
  - Resistors
  - Potentiometers
  - Capacitors
  - Up to two motors (including brushless motors) are permitted.
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- Integrated circuits (other than those that are an integral part of a commercial motor) are **NOT** permitted (as well as anything not on the above list).



# DIFFICULT TOPICS

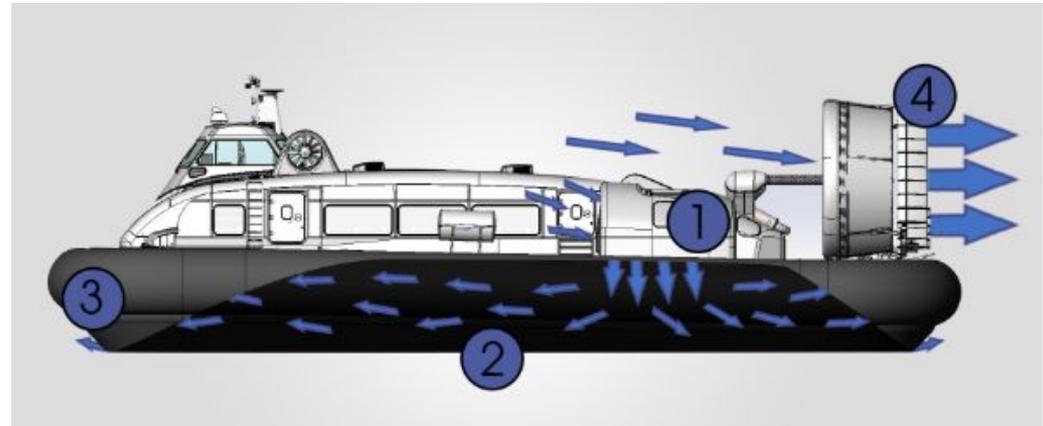
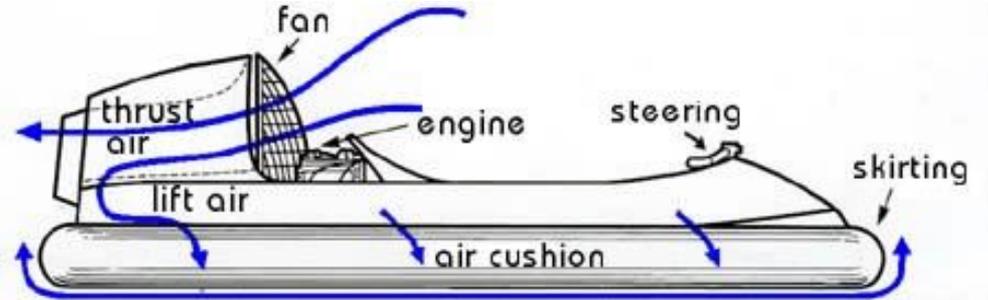
# Topic 1: Design

## FANS/MOTORS

- One fan (distributing the air)
- Two fan (independent)

## SKIRTS:

- Wall Skirt
- Bag Skirt



# Topic 2: Fans

- Lift Force
  - from the fan that blows down
- Thrust Force
  - from the fan that propels the vehicle forward

High static pressure fans - good for moving air through tight spaces

Fans with high CFM - good for moving large quantities of air

Axial Fans - parallel wind direction (thrust)

Centrifugal Fans - perpendicular wind direction (lift)



**Axial Fans**



**Centrifugal Fans**

# Topic 3: Materials

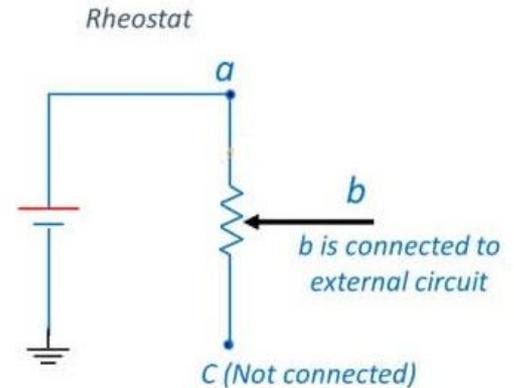
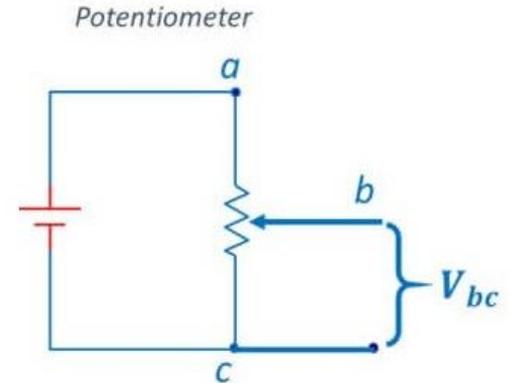
- Fans
  - Axial (thrust)
  - Centrifugal (lift)
- Board
  - Styrofoam
  - 3d Printed
- Skirt
  - Plastic bags
  - Trash bags

What NOT to use:  
Integrated circuits, transistors

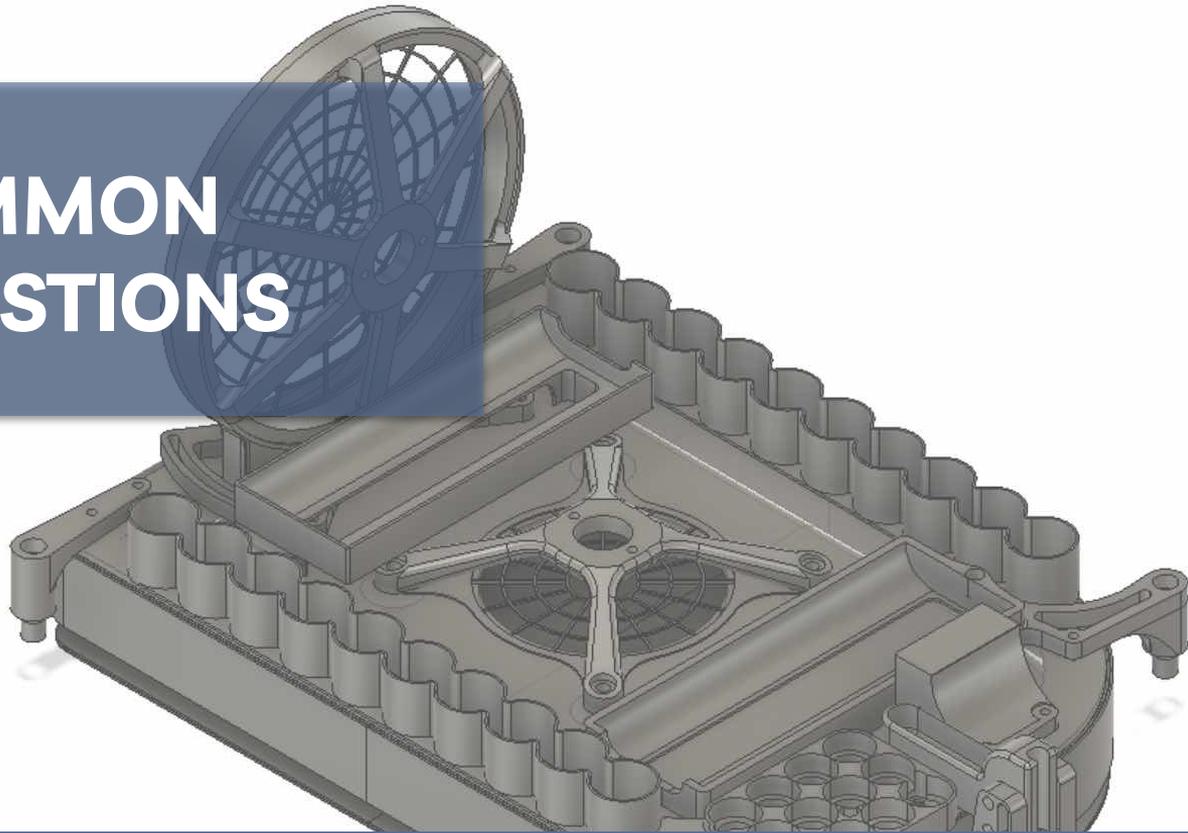
- Motors
- Switches
  - Push buttons
  - Switches
- Calibration devices
  - Variable Resistors
  - Masses

# Topic 4: Circuitry

- Resistors (control speed of fan)
- Potentiometers (voltage control) → Series
  - Rotary
  - Linear
- Rheostats (current control) → Parallel
  - Rotary
  - Sliding



# COMMON QUESTIONS



Common/general questions people have asked me in person or online this year.

# Question 1

- What is the difference between a potentiometer and a rheostat other than how they're connected in the circuit?

Answer: “A potentiometer is designed to control voltage, and a rheostat is designed to control current.”

# Question 2

- Is a better to start off with a wall skirt or a bag skirt?

Answer: “I think it’s better to start off with a bag skirt to pass levitation. Wall skirts are great for future use, but often times wall skirts are sensitive to floor types and are harder to tell if they are truly levitating or not.”

# Question 3

- “Can we use microcontrollers and/or program the vehicle?”

Answer: “No, the rules state that the competitor may not use any integrated circuits (unless they are an integral part of the motor) to control the vehicle.”

# Tips from a Competitor

- Always check shielding!
- Always check dimensions!
- Never test without goggles at home.
- Keep track of where your wires are always, don't short anything.
- Try testing your circuitry separately from the hovercraft with a multimeter first.
- Spend time on your skirt, make sure the balance is good.
- Draw circuit diagrams!
- Test on flat floors (check for incline).

# Additional Resources

## Rules:

### *Div C*

<https://drive.google.com/file/d/14Pz2d5-TZEL2aLHbNzu2iJQLwHwKN6o7/view?usp=sharing>

### *Div B*

<https://drive.google.com/file/d/1ZzFvmV52wORxycqJjibyBZlUKp2xM7Wg/view?usp=sharing>

## FAQS:

<https://www.soinc.org/hovercraft-div-c>  
<https://www.soinc.org/hovercraft-div-b>

**THANKS!**

