Hovercraft Event Overview

Centerville Coaches' Clinic
October 21-22, 2016

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National Physics Committee Chair

First Things First

New Coaches? – Welcome!
Returning Coaches – Thanks for continued involvement
Purpose of this session:

- NOT to teach you how to compete in the event
- IS to help you guide/coach your students
- NOT reprint every little detail in rules
- IS to provide you with resources

Second Things Second

Do:

- Ask questions
- Share suggestions

Don’t:

- Seek competitive advantage by keeping secrets
- Assume rules are **the same as last year**

General Coaching Tips

Always send max # competitors to event.

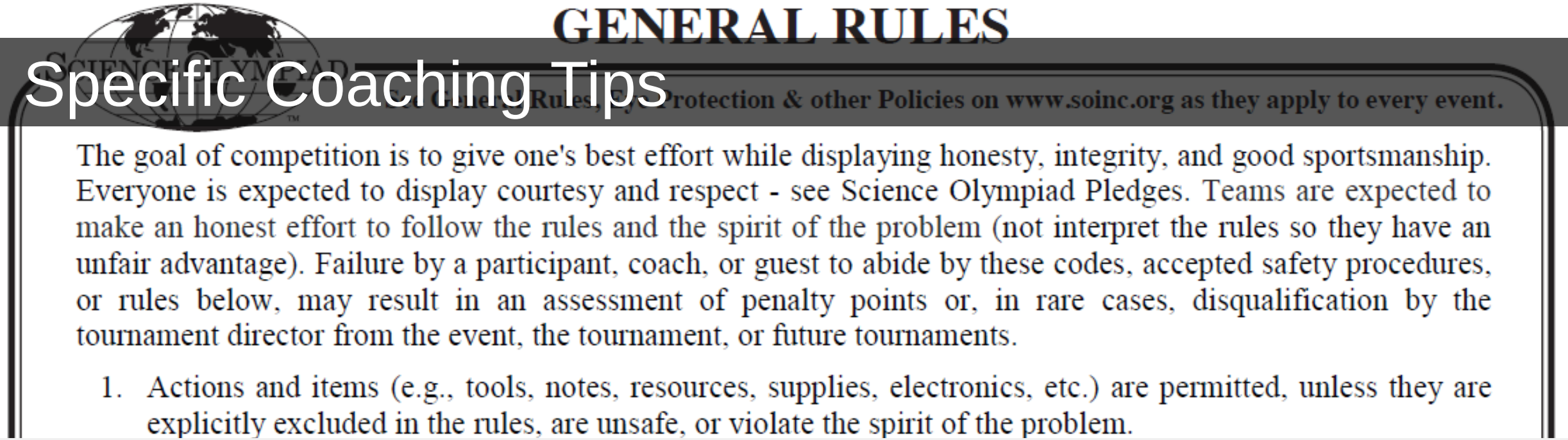
‘Warm bodies’ can:

- Look for general / safety mistakes
- Gain valuable experience in competitive setting
- Help with ‘administrative’ tasks during event

Put extra effort into logistical issues

- Have lots of backup supplies, safety apparatus
- Preplan transportation, food, communications

Specific Coaching Tips



GENERAL RULES

...Rules, ... Protection & other Policies on www.soinc.org as they apply to every event.

The goal of competition is to give one's best effort while displaying honesty, integrity, and good sportsmanship. Everyone is expected to display courtesy and respect - see Science Olympiad Pledges. Teams are expected to make an honest effort to follow the rules and the spirit of the problem (not interpret the rules so they have an unfair advantage). Failure by a participant, coach, or guest to abide by these codes, accepted safety procedures, or rules below, may result in an assessment of penalty points or, in rare cases, disqualification by the tournament director from the event, the tournament, or future tournaments.

1. Actions and items (e.g., tools, notes, resources, supplies, electronics, etc.) are permitted, unless they are explicitly excluded in the rules, are unsafe, or violate the spirit of the problem.

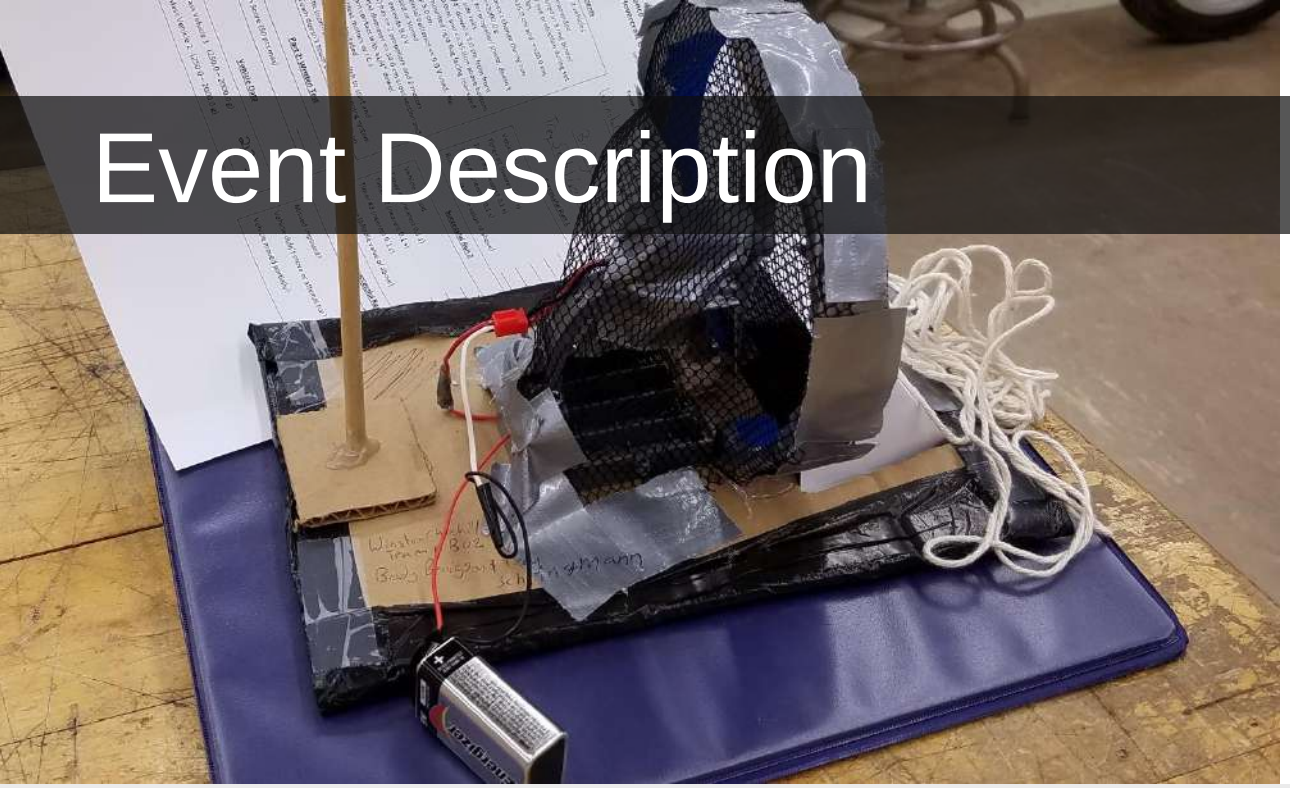
Event supervisors make mistakes sometimes

- Counsel students on appropriate way to point them out
- Document to extent possible
- Don’t be afraid to use the appeals process
- Verify proper recording of device testing data before leaving

Know the General Rules / Spirit of the Problem

Sci. Oly. is as much about the preparation as it is the competition

Event Description



Page 2_____ + Page 3 _____ + Page 4_____ x2 = Total Score _____

SCIENCE OLYMPIAD

Exploring the World of Science

Science Olympiad National Tournament

May 20, 2016
The University of Wisconsin-Stout

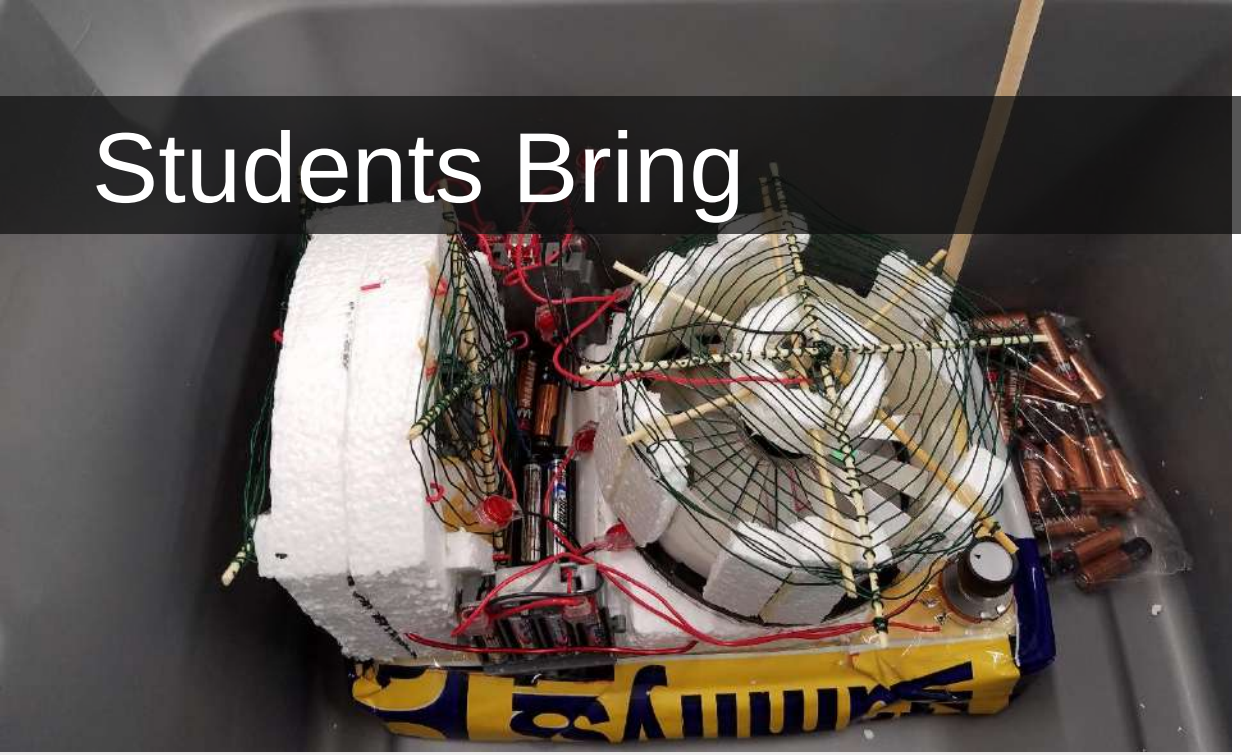
Hovercraft Exam

Instructions:

Construct an air-levitated vehicle &
Test knowledge of classic mechanics

- 50% of score from device testing part
- 50% of score from written test part

Students Bring



CATEGORY A

- Description: Non-impact protection. They provide basic particle protection only
- Corresponding ANSI designation/**required marking: Z87**
- Examples: Safety glasses; Safety spectacles with side shields; and Particle protection goggles (these seal tightly to the face completely around the eyes and have direct vents around the sides, consisting of several small holes or a screen that can be seen through in a straight line)

CATEGORY B

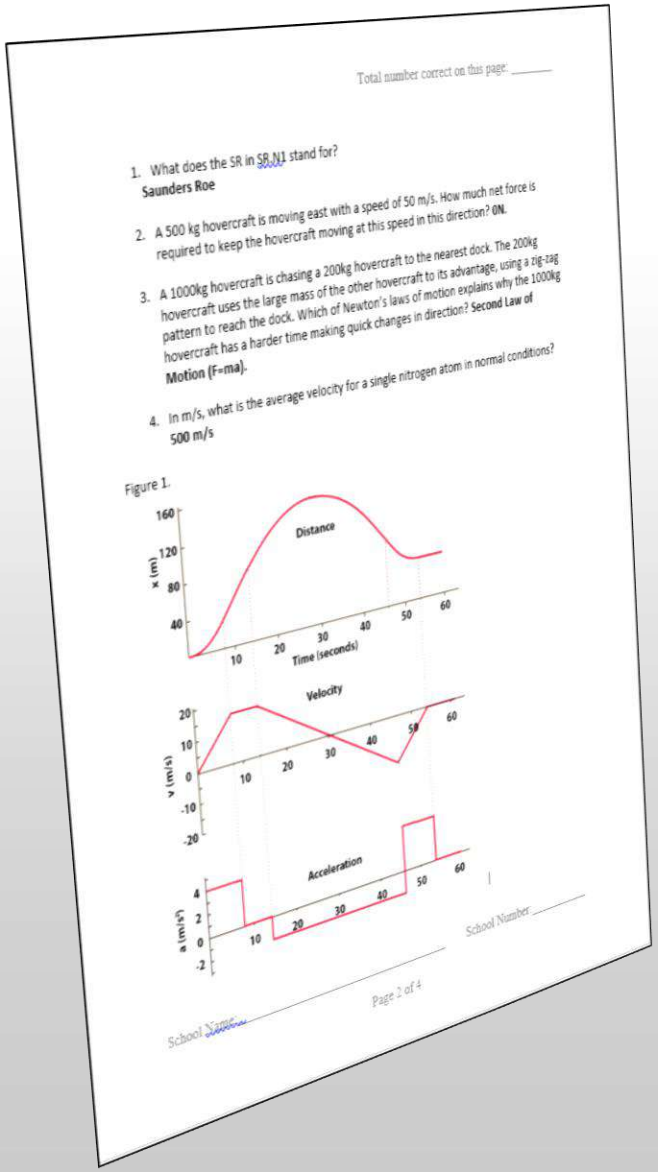
- Description: Impact protection. They provide protection from a high inertia particle hazard (high mass or velocity)
- Corresponding ANSI designation/**required marking: Z87+**
- Example: High impact safety goggles

CATEGORY C

- Description: Indirect vent chemical/splash protection goggles. These seal tightly to the face completely around the eyes and have indirect vents constructed so that liquids do not have a direct path into the eye (or no vents at all). If you are able to see through the vent holes from one side to the other, they are NOT indirect vents
- Corresponding ANSI designation/**required marking: Z87** (followed by D3 is the most modern designation but, it is not a requirement)
- Example: Indirect vent chemical/splash protection goggles

- Vehicle (impounded in a box)
- Any calculators
- Reference materials in 3-ring binder
- Writing utensils
- Tools and supplies
- “B” eye protection

Part I: Written Test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1. What does the SR in SR.N1 stand for?
Saunders Roe

2. A 500 kg hovercraft is moving east with a speed of 50 m/s. How much net force is required to keep the hovercraft moving at this speed in this direction? **0N.**

3. A 1000kg hovercraft is chasing a 200kg hovercraft to the nearest dock. The 200kg hovercraft uses the large mass of the other hovercraft to its advantage, using a zig-zag pattern to reach the dock. Which of Newton's laws of motion explains why the 1000kg hovercraft has a harder time making quick changes in direction? **Second Law of Motion (F=ma).**

4. In m/s, what is the average velocity for a single nitrogen atom in normal conditions? **500 m/s**

Figure 1.

School Name: _____ School Number: _____

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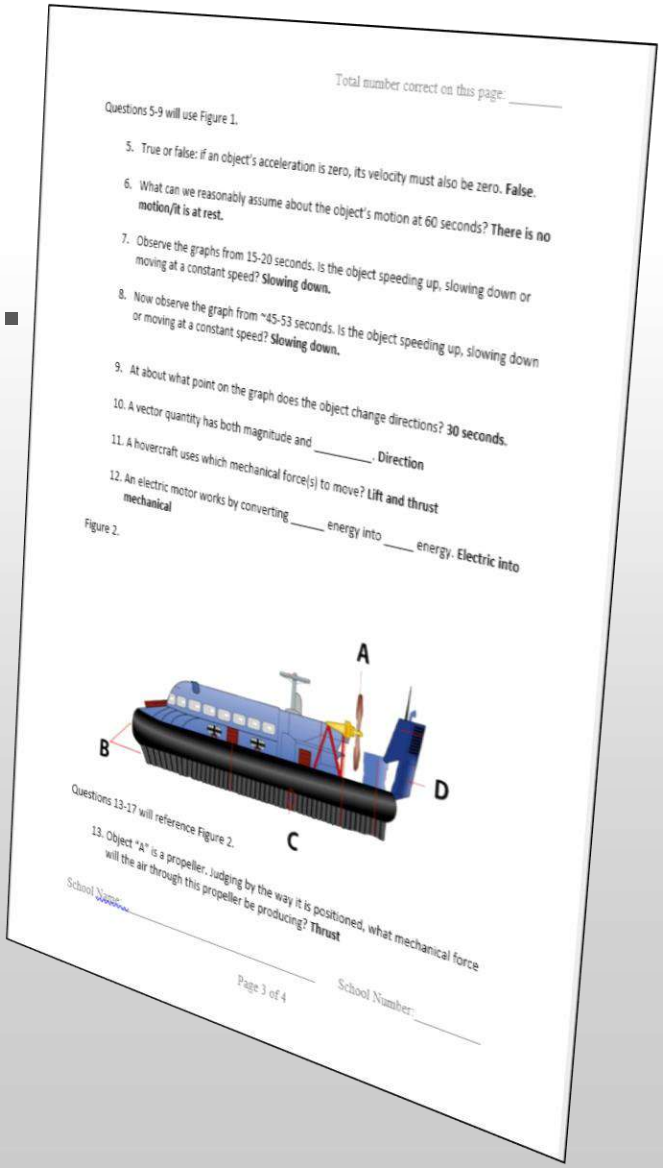
At least 20 mins duration

Use metric units / sig. figs.

5 questions each from:

- Newton's Laws of Motion
- Kinematics
- Kinetic energy
- Air cushioned vehicles

  Fluid mechanics (Div C)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Questions 5-9 will use Figure 1.

5. True or false: if an object's acceleration is zero, its velocity must also be zero. **False.**

6. What can we reasonably assume about the object's motion at 60 seconds? **There is no motion/it is at rest.**

7. Observe the graphs from 15-20 seconds. Is the object speeding up, slowing down or moving at a constant speed? **Slowing down.**

8. Now observe the graph from ~45-53 seconds. Is the object speeding up, slowing down or moving at a constant speed? **Slowing down.**

9. At about what point on the graph does the object change directions? **30 seconds.**

10. A vector quantity has both magnitude and _____. **Direction**

11. A hovercraft uses which mechanical force(s) to move? **Lift and thrust**

12. An electric motor works by converting _____ energy into _____ energy. **Electric into mechanical**

Figure 2.

Questions 13-17 will reference Figure 2.

13. Object "A" is a propeller. Judging by the way it is positioned, what mechanical force will the air through this propeller be producing? **Thrust**

School Name: _____ School Number: _____

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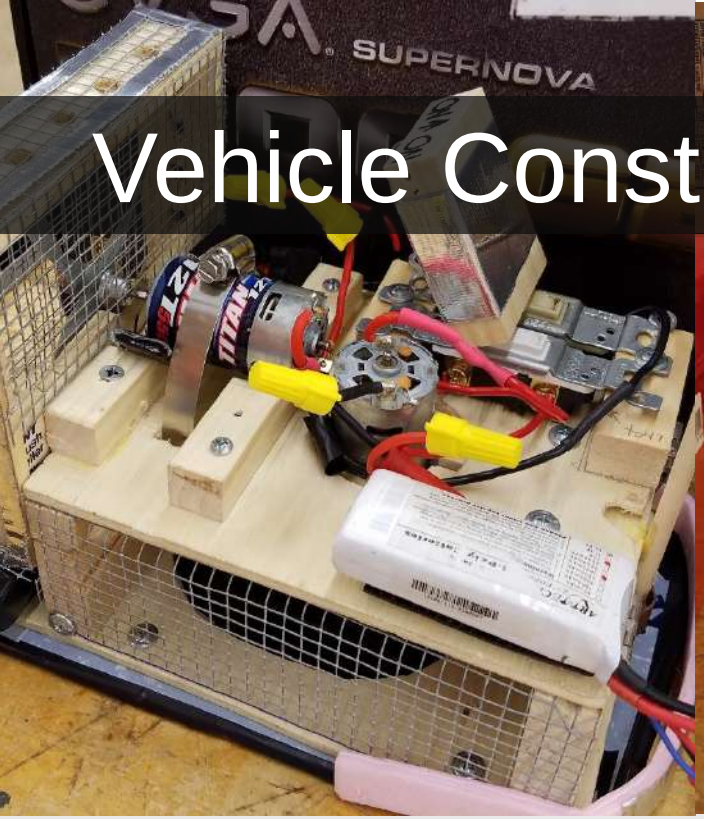
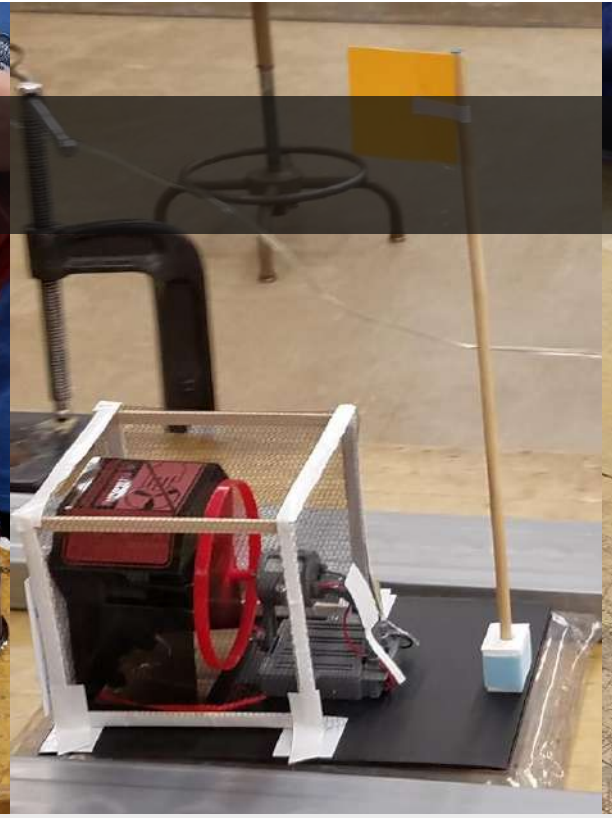
Vehicle Construction





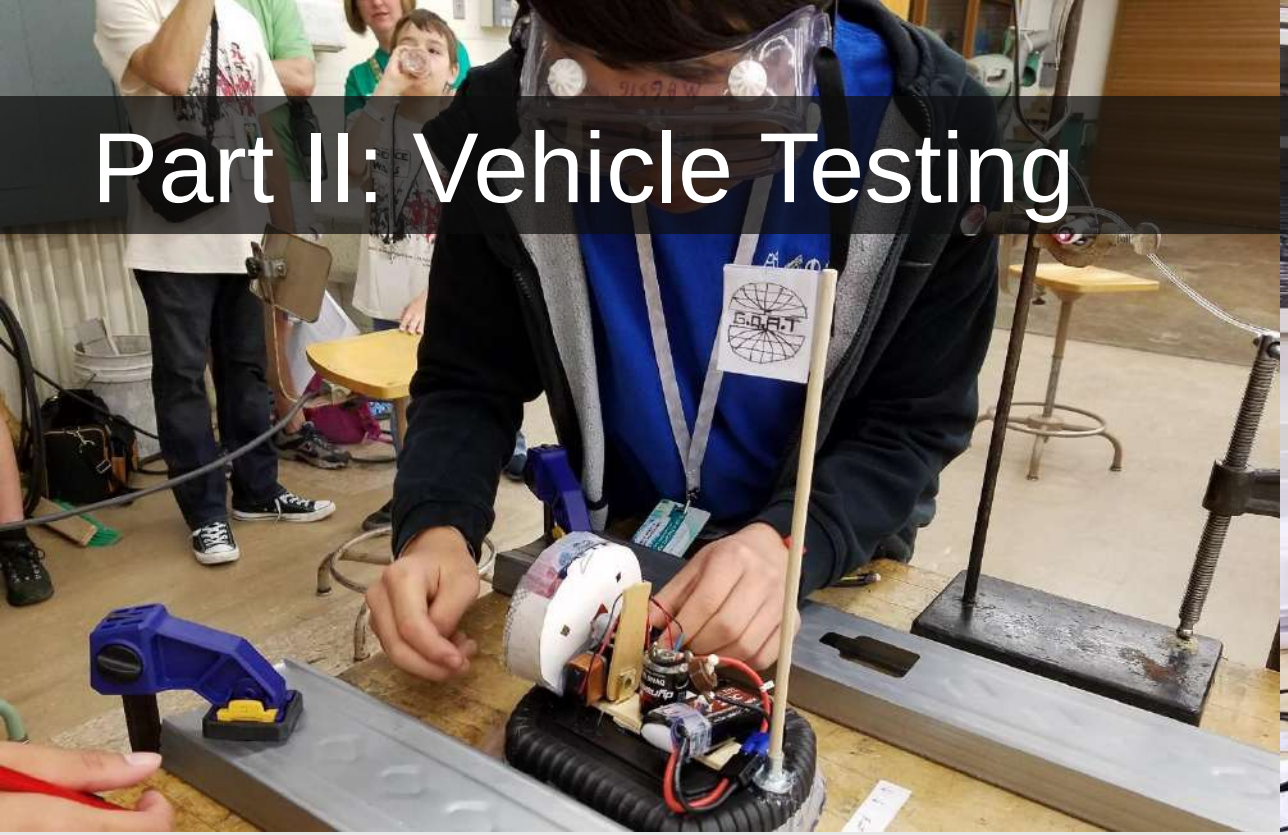
- 1 levitated vehicle per team
- < 30 cm long x 20 cm tall x 19.5 cm wide and 2kg
- <=2 motors / propellers, with shielding
- <= 9V batteries (no ICs / brushless motors) **(EXCEPT – SEE RULES CLARIFICATION!)**

Event Supervisor Provided Track Design

- 1 soft barrier
- 4 bar clamps
- 2 metal 2x4s
- 8 foot table
- 2 photogates
- 2 lasers

See Hovercraft event page for detailed examples

Part II: Vehicle Testing



Objective is to travel down track in target time with max mass

- Track length: 130 cm (Div B) / 100-195 cm (Div C)
- Target time: 5-25 seconds

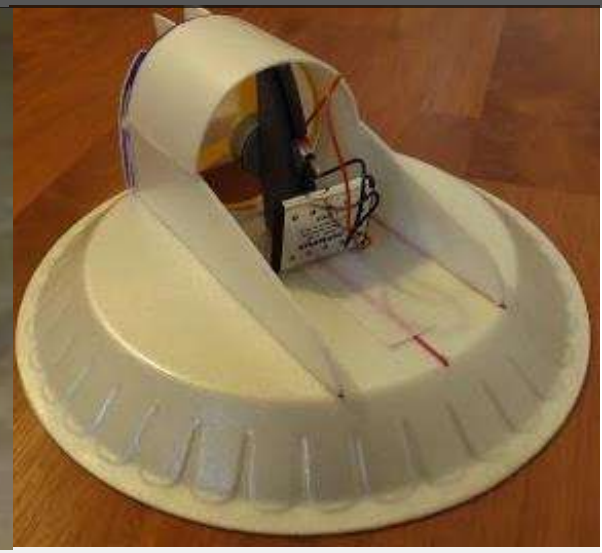
Testing time: 8 mins (for 5 failed or 2 successful runs)

Teams may modify / repair / adjust vehicles between runs

Scoring

- **Mass Score (MS)** = (mass of vehicle / mass of heaviest vehicle of all teams) x 25 pts
- **Time Score (TS)** = (1-(abs (run time – target time) / run time)) x 25 points.
- **Exam Score (ES)**: (Part I score / Highest Part I score for all teams) x 50 points
- **Tie Breakers**: 1st - Best ES; 2nd - Best MS; 3rd – Best other successful run TS;
- **Penalties**: 0.7 or 0.9 multipliers for various violations

Event Tips



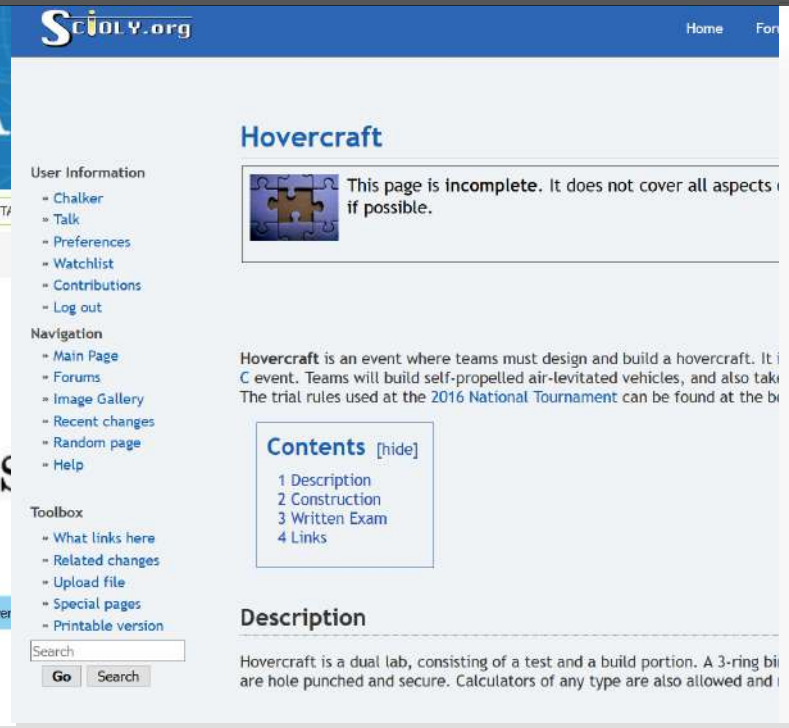
Vehicle Construction:

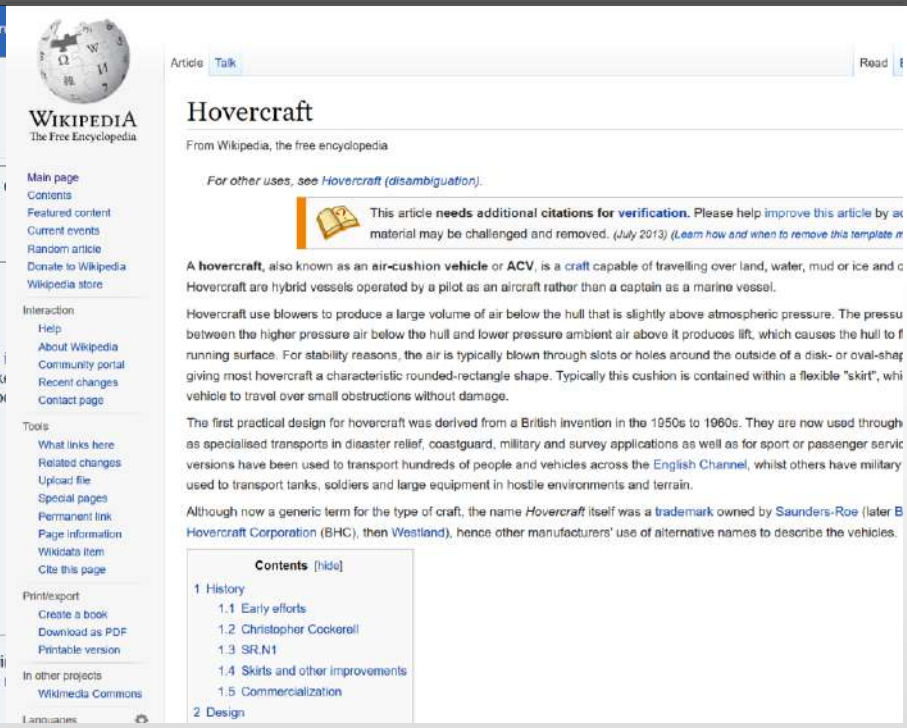
- K.I.S.S principle
- Get components from hardware stores, toy stores, computer stores, etc.
- Minimize effort required to setup and reset vehicle
- Have defined roles for both team members

Written Test:

- Review all questions before starting
- Tackle easy ones first
- Divide up questions between team members and work in parallel

Suggest Resources





- Soinc.org Hovercraft page
- Scioly.org student forums / wiki / test exchange
- Wikipedia (Hovercraft, etc.)
- Physics textbooks – most have chapters on this material

Final Random Thoughts

Moderation in all things!

Regularly check www.soinc.org

- Clarifications
- FAQs
- Policies (Lasers, Safety, Building, etc)

Use free tools if running event / tournament

- Checklists / scoresheets for select events: soinc.org event pages
- Complete tournament scoring system: sourceforge.net/projects/soscoring/
- Scoring best practices: soinc.org/scoring_guidelines

Last Things Last

Invitational tournaments at Wright State Univ.

- Opportunity to have ‘National experience’
- We are always in need of volunteers

Please publicize Science Olympiad and recruit new participants

Keep Science Olympiad mission in mind

- Create an interest and passion for science
- Improve STEM education and workforce skills
- Recognize and celebrate achievements by students and teachers

Questions?