Electric Vehicle

Division C

Georgia Tech Event Workshop Series
2024-25

Science Olympiad at Georgia Tech®

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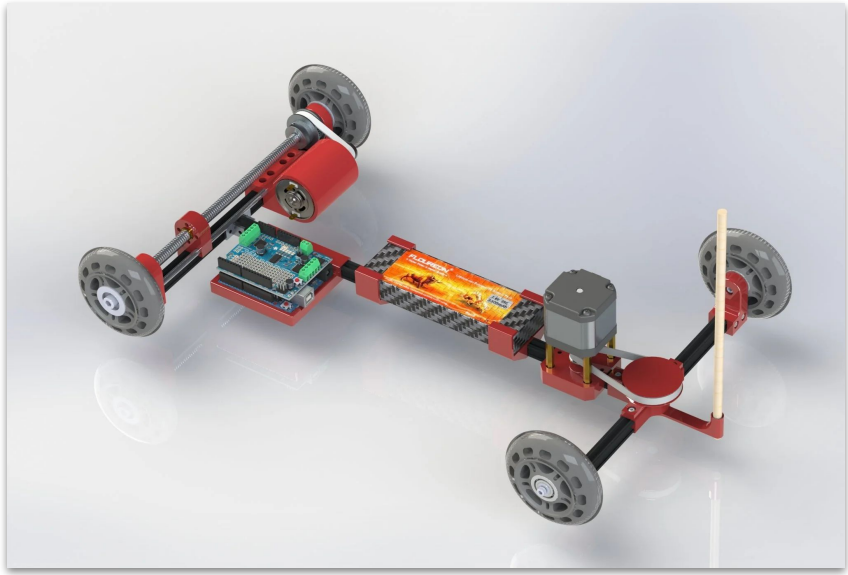
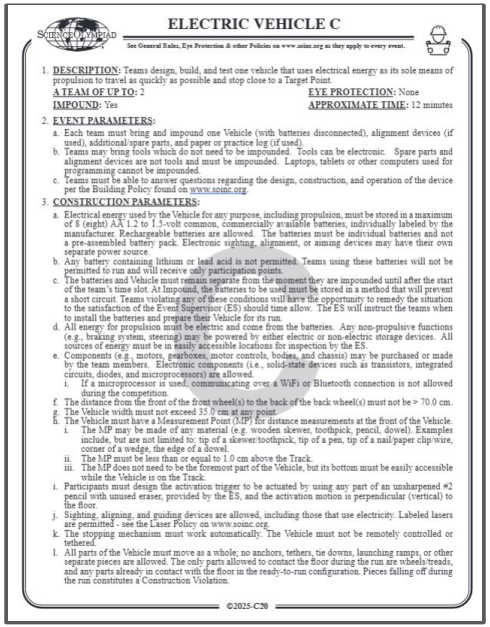


The Rules Sheet

- Build an electric vehicle that autonomously goes from the start point to the target point as fast as possible
- The target point will be located between 7-10m from the start point.
- Scoring is as follows:
  - Total Score = Distance Score + Time Score + Run Penalties
  - *Distance Score → 2.0pts/cm x distance(cm)*
  - *Time Score → run-time(s)*
  - *Run Penalties*



ELECTRIC VEHICLE C

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

1. **DESCRIPTION:** Teams design, build, and test one vehicle that uses electrical energy as its sole means of propulsion to travel as quickly as possible and stop close to a Target Point.
   A TEAM OF UP TO: 2 **EYE PROTECTION:** None
   IMPOUND: Yes **APPROXIMATE TIME:** 12 minutes
2. **EVENT PARAMETERS:**
   a. Each team must bring and impound one Vehicle (with batteries disconnected), alignment devices (if used), additional/spare parts, and paper or practice log (if used).
   b. Teams may bring tools which do not need to be impounded. Tools can be electronic. Spare parts and alignment devices are not tools and must be impounded. Laptops, tablets or other computers used for programming cannot be impounded.
   c. Teams must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org.
3. **CONSTRUCTION PARAMETERS:**
   a. Electrical energy used by the Vehicle for any purpose, including propulsion, must be stored in a maximum of 8 (eight) AA 1.2 to 1.5-volt common, commercially available batteries, individually labeled by the manufacturer. Rechargeable batteries are allowed. The batteries must be individual batteries and not a pre-assembled battery pack. Electronic sighting, alignment, or aiming devices may have their own separate power source.
   b. Any battery containing lithium or lead acid is not permitted. Teams using these batteries will not be permitted to run and will receive only participation points.
   c. The batteries and Vehicle must remain separate from the moment they are impounded until after the start of the team's time slot. At Impound, the batteries to be used must be stored in a method that will prevent a short circuit. Teams violating any of these conditions will have the opportunity to remedy the situation to the satisfaction of the Event Supervisor (ES) should time allow. The ES will instruct the teams when to install the batteries and prepare their Vehicle for its run.
   d. All energy for propulsion must be electric and come from the batteries. Any non-propulsive functions (e.g., braking system, steering) may be powered by either electric or non-electric storage devices. All sources of energy must be in easily accessible locations for inspection by the ES.
   e. Components (e.g., motors, gearboxes, motor controls, bodies, and chassis) may be purchased or made by the team members. Electronic components (i.e., solid-state devices such as transistors, integrated circuits, diodes, and microprocessors) are allowed.
      i. If a microprocessor is used, communicating over a WiFi or Bluetooth connection is not allowed during the competition.
   f. The distance from the front of the front wheel(s) to the back of the back wheel(s) must not be > 70.0 cm.
   g. The Vehicle width must not exceed 35.0 cm at any point.
   h. The Vehicle must have a Measurement Point (MP) for distance measurements at the front of the Vehicle.
      i. The MP may be made of any material (e.g. wooden skewer, toothpick, pencil, dowel). Examples include, but are not limited to: tip of a skewer/toothpick, tip of a pen, tip of a nail/paper clip/wire, corner of a wedge, the edge of a dowel.
      ii. The MP must be less than or equal to 1.0 cm above the Track.
      iii. The MP does not need to be the foremost part of the Vehicle, but its bottom must be easily accessible while the Vehicle is on the Track.
   i. Participants must design the activation trigger to be actuated by using any part of an unsharpened #2 pencil with unused eraser, provided by the ES, and the activation motion is perpendicular (vertical) to the floor.
   j. Sighting, aligning, and guiding devices are allowed, including those that use electricity. Labeled lasers are permitted - see the Laser Policy on www.soinc.org.
   k. The stopping mechanism must work automatically. The Vehicle must not be remotely controlled or tethered.
   l. All parts of the Vehicle must move as a whole; no anchors, tethers, tie downs, launching ramps, or other separate pieces are allowed. The only parts allowed to contact the floor during the run are wheels/treads, and any parts already in contact with the floor in the ready-to-run configuration. Pieces falling off during the run constitutes a Construction Violation.


DIFFICULT
TOPICS

Topic 1: Movement

- Electronics
  - Controller
    - Arduino, Lego Mindstorms, Raspberry Pi
  - Motor
    - Lego EV3, TT Motor
- Distance Measurement
  - Wheel Rotations
  - Motor Time On
  - Detect Target Point

Topic 2: Wheel Rotations

- One rotation of the wheel makes the car travel the circumference of the wheel
  - $d = (\omega) \times (2\pi) \times (r)$
    - $d \rightarrow$ Distance Traveled
    - $\omega \rightarrow$ Wheel Rotations
    - $R \rightarrow$ Wheel Radius
    - $\pi \rightarrow$ Pi
  - $\omega = (d) / (2\pi \times r)$

Tips from a Veteran

- Slippery Tires will result in a shorter distance travelled
  - Use rubber wheels or wrap rubber bands around plastic wheels
  - Heavier vehicle can also help
- For time to distance, old batteries will result in a shorter travel distance
  - Use rechargeable batteries at full charge for testing and the competition
- Have an easy to access measurement point
- Alignment is very important, make sure you have a calibration tool

Additional Resources

Resource 1

Resource 2

Resource 3

Resource 4

THANKS!