

# Electric Vehicle C

## National SO resources:

**Event Objective:** Students must build a vehicle that uses electrical energy as its propulsion to travel as quickly as possible and stop as close as possible to a Target Point.

The Target Point is between 9.00 and 12.00 m and is selected by the event supervisor and announced after the impound window has closed.

The options for the Target Point are as follows:

*Invitationals/Regionals:* 9.00 m, 9.50 m, 10.00 m, 10.50 m, 11.00 m, 11.50 m, 12.00 m

*State:* 9.00 m, 9.10 m, 9.20 m, 9.30 m, 9.40 m, 9.50 m, 9.60 m, 9.70 m, 9.80 m, 9.90 m, 10.00 m, 10.10 m, 10.20 m, 10.30 m, 10.40 m, 10.50 m, 10.60 m, 10.70 m, 10.80 m, 10.90 m, 11.00 m, 11.10 m, 11.20 m, 11.30 m, 11.40 m, 11.50 m, 11.60 m, 11.70 m, 11.80 m, 11.90 m, 12.00 m.

## Equipment Needs:

- (2) Tape Measure, units in meters, at least 12.0 meters long
- (2) Meter sticks
- (2) Rulers, including metric units
- (1) Stickers to be placed under pointer after each run to simplify distance measurement
- (4) Stopwatches if one track is used, (8) stopwatches if two tracks are used
- (1) Laptop with scoring/ranking scoresheet
- (1) Standard 2.5 cm (1 inch) tape, preferably blue painters tape
- (4) Clipboards for event supervisor to use during the competition
- (2) Weighted cans (diameter 7 cm-8 cm, height > 10.5 cm) - one track, (4) cans - two tracks
- (5) Unused, unsharpened #2 pencils for starting electric vehicles
- (1) Photogate system PER track (2) if two tracks (not needed but preferably)
  - (2) Lasers per track, pen lasers work great
  - (2) Stands for lasers
  - (2) Photogate sensors OR backstops for lasers if photogates are not used per track

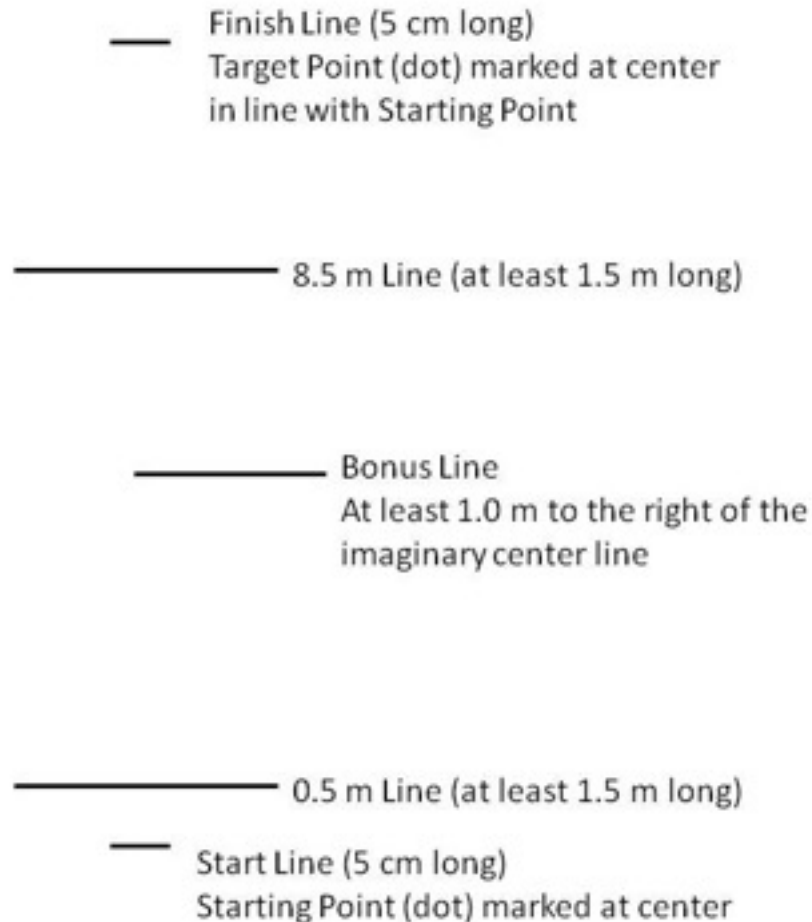
## Number of Volunteers Needed:

- (1) Impound table/greeter
- (1) Timer for 8 minute event timer & official measurer (Lane Boss) (per track)
- (3) Timers if photogate system is not used, if photogate(s) used, need (1) backup timer (per track)
  - For the state tournament you will be provided names and contact info for your volunteers and YESS team. It is required that you contact them prior to the tournament to relay any event-specific information.

## Prior to the Event:

- Read and re-read the event rules
- Get in contact with tournament director to learn more about competition area and try to ensure a flat, consistent floor with enough space for track(s) and impound area.
- Get a copy of the official scoring/check-in worksheet on the national website: [www.-soinc.org](http://www.soinc.org)
- Print off enough check in worksheets from the national website to have one sheet per team, plus a few extra sheets. If you have time, put the names of the teams on the top of the sheets (one team per sheet) and, if you have the times that each team will compete, put the team's competition time also on the top of the sheet.
- Put the team names into the scoring spreadsheet from the national website to save time on competition day.
- Create fake results to test the scoring spreadsheets, including Run Time (in seconds to the nearest 0.1 second), Distance (in cm to the nearest 0.1 cm), Bonus (in cm to the nearest 0.1 cm), and Penalty (250, 500, 1000, 5000, or 10000 points). Ensure that you know how to properly use the scoring spreadsheet and correct results are created by manually calculating the scores.
- Review event penalties:
  - Written Log Violations (check at impound preferably)
    - Incomplete log - 250 point penalty
      - Less than 10 runs
      - Less than 3 parameters
      - Not having distance or time as parameters
    - No Log - 500 point penalty
  - Construction Violations (5000 point penalty per run, max of 15000 point penalty)
    - Battery voltage greater than 9 V according to labels
    - Battery not commercially available or labeled
    - Lead acid battery used
    - Vehicle size over limit
    - Dowel less than 2.0 cm from front of vehicle
    - Dowel less than 20.0 cm above ground at top
    - Dowel greater than 1.0 cm above ground
    - Vehicle is propelled by energy other than electricity
  - Competition Violation (1000 points on that run only, max of 4000 point penalty)
    - \*At invitational tournaments consider giving teams a warning before assessing penalty\*
      - Not starting vehicle on starting point
      - Not using unsharpened #2 pencil with unused eraser to start vehicle
      - Using an AC outlet during the 8 minute competition time
      - Team rolling vehicle on floor near track without approval prior to or during competition
      - Pieces falling from the vehicle during the run
      - Vehicle damaging floor or leaving substances on floor after the run
      - Vehicle propelled backwards at any time during the run

- Students pick up vehicle before being instructed by the supervisor
- Vehicle remotely controlled or tethered
- Impound Violation (student does not impound vehicle before window closes) (10000 point penalty on each run)
- If using photogates, test the system to ensure it works. If not using photogates, ensure all necessary equipment is lined up and ready to use on competition day.
- Print off a few extra copies of the rules to take to the competition as reference.
- Understand how to set up the track the day of competition. A diagram is provided below:



### Scoring of Individual Teams: Low Score Wins

- Each run is scored separately. Team earns the lowest score of the two runs.
- Distance from target is measured to the nearest 0.1 cm. Each point is 1.0 cm off.
- Time is measured from 0.5 m to 8.5 m to the nearest 0.1 sec. Each point is 1.0 seconds.
- Bonus is calculated according to the following formula:

$$B = (110 - \text{Distance between cans in cm}) \times 0.2$$

- Penalties are assessed to an individual run (as applicable)
- Run Score = Distance Score + Time Score + Penalties - Bonus
- Scoring Example #1: Vehicle is 52.5 cm off, run time 7.4 seconds, no bonus, incomplete logs

$$\text{Score} = 52.5 + 7.4 - 0 + 250 = 309.9$$

- Scoring Example #2: Vehicle is 5.8 cm off, run time 5.1 seconds, can distance = 70 cm, no penalties

$$\text{Score} = 5.8 + 5.1 - (110 - 70) * 0.2 + 0 = 2.9$$

### Day of the Competition:

- Arrive early and allow enough time to prepare track, check in table and impound area. Plan that space may not be assigned, floor may be uneven or problematic, or tables may not be available.
- Make sure the space for the track(s) is as FLAT as possible with as consistent of floor surface as possible.
- Start by taping off a segment of your competition area for the impounding of student devices. This area must be taped off to prevent spectators and non-competing students from entering the area and ensure the security of the student devices. This area must be large enough to handle all student devices but not too close to the track(s) to avoid any possible accidents (stepping on vehicles, etc.)
- Set up one or two tracks. If you have more than six teams per time slot signed up you are encouraged to set up two tracks that are as close to identical as possible. All tape marks except for the bonus line and the finish line can be put down on the floor before impound. Immediately after impound, put the bonus line and finish lines on the floor and put up a sign with the distance to the target point.
- Set up and test lasers at 0.5 m and 8.5 m locations. For safety reasons, try and have lasers point to the wall where students or spectators cannot look into the lasers. If a wall is not available, consider walling off the area. If possible, avoid having spectators behind the target point as some teams may use lasers for alignment and some vehicles may not have breaking mechanisms. Make sure to allow as much space beyond the target point as possible.
- Set up check-in table. After impound post Target Point distance. Consider posting simple instruction sheet for students to follow.
- Set up a construction check-in station preferably on check-in table if room space allows. Consider asking students questions during check-in to verify that they built and understand the device. It is recommended to add (or subtract) about 1% of dimensions to account for minor differences in measuring devices, but remind students to not build devices so close to the limits in the future.

### Impounding of Devices:

- Assign at least one individual to impound. It is critical that students avoid stepping on or damaging other devices when checking in OR when retrieving devices for competition
- Have students line up for check-in, first come, first served. Students needing to fix or change their device need to exit the line and go to the end. Anybody in line at the end of the impound window is allowed to impound their device with no penalty, but the students must be IN LINE at the end of the impound window.

## Competition:

- Stage students ready to go just outside of the competition area
- Lane Boss has clipboard with team checklist and records times, distances, and penalties
- Lane Boss reads the following script to each team, usually as they walk them along the track to show them everything.

*When you tell me you are ready, you can enter the test area and you will have a total of eight minutes to complete two runs. The eight minute timer will begin after I have finished with these instructions.*

*Any run starting in your eight minute time allotment will count as a valid run. I will pause the eight minute countdown timer when your first run is completed for the judges to collect data on your run.*

*The target distance for today is XX meters. Will you be using the bonus cans for your run? If you will be using the bonus cans for your run, we will place the outer can on the bonus tape one meter from the track center and you may set the inner can at your desired distance when you enter the test area after the eight minute timer starts. You may also move your bonus can or elect to not use it at all for your second run. The eight minute timer will be paused while I measure the distance between the cans.*

*Here is the starting point (point directly to the tape on the floor). The front bottom edge of your dowel must be positioned directly over the starting point prior to your run.*

*Here is the Target Point (point directly to the tape on the floor after walking the team down the track).*

*When you are ready to start your run, say "READY" and wait for the supervisor to say "Supervisors Ready" to make sure we are ready to time.*

*When your vehicle has stopped, I will stop the eight minute timer and we will measure your results. Stay in the start area until a supervisor tells you to come and pick up your vehicle.*

*When you touch your vehicle to retrieve it, we will restart the eight minute timer.*

*At any time you may ask the eight minute timing person how much time is remaining.*

*Do you have any questions?*

- After the team has finished their two runs or the eight minute window has closed, report the raw score to the team. Do not report ranks or any other teams scores to students, coaches, or spectators.

## Scoring at End of Day:

- After the last team has finished, copy the scores from the spreadsheet to the scorecard given to you by tournament administrators at the beginning of the day.
- Take all team score sheets, your spreadsheet, and the scorecard to scoring to finish event scoring.