



1. **DESCRIPTION:** Teams must design, build, and test one Vehicle that uses non-metallic, elastic material as its sole means of propulsion to travel a distance as quickly and accurately as possible.

A TEAM OF UP TO: 2 **IMPOUND:** Yes **EYE PROTECTION:** B **APPROX. TIME:** 12 minutes

2. **EVENT PARAMETERS:**

- a. Each team must bring and impound one Vehicle, alignment devices (if used), a Practice and Design Log, and additional/spare parts. The Vehicle must be impounded in its lowest potential energy state.
- b. Teams may bring a stand-alone calculator of any type and non-electronic tools which do not need to be impounded.
- c. All participants must properly wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without eye protection will not be allowed to compete and will receive participation points.
- d. 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. All energy used to propel the Vehicle must be stored in non-metallic, elastic material(s). They may be left unattached until just prior to the run. Pre-loaded energy storage devices may be used to operate other Vehicle functions (e.g., braking system) as long as they do not provide energy to propel the Vehicle.
- b. Electronic components and electric devices are not permitted except for calculators.
- c. The distance from the front of the front wheel(s) to the back of the back wheel(s) must not be $> 70.0\text{cm}$.
- d. The Vehicle width must not exceed 30.0 cm at any point.
- e. The Vehicle must have, attached to the front end, **approximately $\frac{1}{4}"$ to $\frac{3}{8}"$** wooden dowel approximately perpendicular to the floor so as to be the foremost part of the Vehicle at all times during its run.
 - i. The dowel must extend to at least 20 cm above the Track's surface to interrupt the photogates or timing lasers, if used - see 5.d.
 - ii. The dowel must also extend to within 1.0 cm of the Track's surface so that its front bottom edge will be the Vehicle's Measurement Point for distance measurements.
 - iii. **A paper flag for the timing system must be attached to the trailing side of the dowel with the paper's center height at $17.0\text{cm} \pm 1.0\text{ cm}$. The paper size must be 5.0 cm by $5.0\text{ cm} \pm 1.0\text{ cm}$. The paper may be any color and decorated.**
- f. No part of the Vehicle including the wheels can extend beyond the front of the dowel, other than the dowel attachment device.
- g. Participants must design the activation trigger so that its actuation is perpendicular (vertical) to the floor. The Vehicle must be able to remain at the starting position without being touched until triggered. The stopping mechanism must work automatically. The Vehicle must not be remotely controlled or tethered.
- h. 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, drive string(s), elastics from 3.a., 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.

4. **PRACTICE LOG:**

- a. Teams can submit a Practice Log along with their Vehicle **for a bonus**. To receive the bonus, log must meet the following requirements:
 - i. Recorded data covering **5** or more parameters (**4** required and at least 1 additional) for 10 or more test runs prior to the competition.
 - ii. The required parameters are Target Distance, Vehicle Distance from Target, Time, and **Bonus Can Distance**.
 - iii. The additional **5th** parameter (e.g., # of axle turns for braking, alignment angle, or other adjustment to enable the Vehicle to score better) is chosen by the Team.
 - iv. The **team name** must appear on the practice log
 - v. Log was impounded with Vehicle
- b. All numerical values should be labeled with standard units (e.g., SI or English) appropriate to the dimension being measured or be considered incomplete. SI units should be the default standard.
- c. The practice log will be returned to teams after inspection.



5. THE TRACK:

- a. The Track will be on a smooth, level, and hard surface. Refer to soinc.org for a diagram of the Track.
- b. The Event Supervisors must mark the track as follows:
 - i. Start Point - an approximately 5 cm x 2.5 cm tape with the Start Point marked at the center of the tape.
 - ii. **0.50 m Timing Line** - a line of 2.5 cm tape, approximately **1.0 m long**, to be placed perpendicular to and centered on the imaginary Center Line. The edge of the line closest to the Start Point must be **0.50 m** from the Start Point.
 - iii. **7.00 m Timing Line** - a line of 2.5 cm tape, approximately **1.0 m long**, to be placed perpendicular to and centered on the imaginary Center Line. The edge of the line closest to the Start Point must be **7.00 m** from the Start Point.
 - iv. Target Point - an approximately 5 cm x 2.5 cm tape with the Target Point marked at the center of the tape. **When possible, at least 1.0 m beyond the Target Point should be available for a Vehicle to travel past.**
 - v. **Bonus Line - 2.5 cm tape placed halfway between the Start Point and the Target Point extending perpendicular from an imaginary center line 1.0 m to the left when facing the Target Point. The edge of the line closest to the Start Point defines the line.**
- c. The exact Target Distance from the Start Point to the Target Point will be between 8.00 m and **12.00 m**. At Regionals/Invitationals the interval will be 0.50m, for States 0.20 m, and for National 0.05 m. The exact distance will be chosen by the Event Supervisor and announced after the impound period is over.
- d. **The Event Supervisor will use two empty cans with diameters 7.0 - 8.0 cm, height at least 10.5 cm positioned standing upright with their centers on the Bonus Line to create an obstacle for the teams. The outer can is placed by the Event Supervisor so that its rightmost edge is 1.0m from the imagery center line. The cans will be removed if the team does not want to attempt the Bonus for a specific run.**
- e. A photogate timing system is highly recommended. See www.soinc.org for information. If used, the system will be installed at the Timing Lines with the beams at a height of 17.0 ± 2.0 cm **and a minimum gap of 2.0 m across the track**. At least one manual timer should be used as a backup. If photogates are not being used, three timekeepers should be utilized with the middle time used as the official Run Time - lasers are recommended to be placed at the Timing Lines so the time keepers only have to watch for the flash of light as the dowel cuts through the laser beam.
- f. At the Event Supervisor's discretion, more than one Track may be used. If so, the team may choose which Track they want to use but must use the same Track for both runs.

6. THE COMPETITION:

- a. Only participants and the Event Supervisors will be allowed in the impound and track areas. Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication until they are finished competing and have left the event area.
- b. Teams have 8 minutes of Event Time to set up and start up to 2 runs. Vehicles in the ready-to-run configuration before the end of the Event Time will be allowed to complete a run. **The 8-minute Event Time is paused for all measurements conducted by the Event Supervisor(s) or volunteer(s) assigned to the event.**
- c. Electric tools must not be used except for the calculator in 2.b.
- d. In the ready-to-run configuration, the Vehicle's Measurement Point must be over the Start Point.
- e. Teams may adjust their Vehicle (e.g., change its elastic materials, distance, aiming) within their Event Time, though the Event Supervisor may re-verify that the Vehicle meets specifications prior to each run. Timing is paused during any measurements made by the Event Supervisor. Timing resumes once the participants pick up their Vehicle or begin making their own measurements.
- f. Teams may use their own non-electronic measuring devices to verify the Track dimensions during their Event Time.
- g. Only non-electric/non-electronic sighting/aiming devices are permitted. If placed on the Track, they must be removed before each run. If placed on the Vehicle, they may be removed at the team's discretion.
- h. Teams must not roll the Vehicle on the floor of the Track on the day of the event without tournament permission. If permitted, only participants may be present.
- i. Substances applied to the Vehicle must be approved by the Event Supervisor prior to use and must not damage or leave residue on the floor, Track and/or event area. Teams may clean the Track during their Event Time, but it must remain dry.



- j. Teams may earn the Bonus by having their vehicle navigate between the two cans located on the Bonus Line of the track. Prior to each run the participants place the inner can at a distance of their choice between 0.0 cm and 100.0 cm from the outside can on the Bonus Line. The Event Supervisor will then record the inner distance between the two cans along the Bonus Line. All parts of the Vehicle must travel between the two cans to earn the Bonus. A Vehicle moving either of the cans will not receive the Bonus. Moving is defined by the distance between cans or the location of either can changing.
 - k. Teams must start the Vehicle using any part of an unsharpened #2 pencil with an unused eraser, supplied by the Event Supervisor, in a motion approximately perpendicular to the floor, to actuate a trigger. They may not touch the Vehicle to start it, hold it while actuating the trigger, or “push” the Vehicle to get it started. Once they start a run, teams must not follow their Vehicle and must wait until called by the Event Supervisor to retrieve their Vehicle.
 - l. If the Vehicle does not move upon actuation of the trigger, it does not count as a run. The team may continue to work on their device in order to attempt 2 runs within the Event Time.
 - m. A Failed Run can occur if the Vehicle starts before the Event Supervisor is ready, if its distance cannot be measured (e.g., the participants pick it up before it is measured), or if the team pushes the Vehicle down the track, **or the Vehicle travels the wrong direction from the Start Point, or the Vehicle moves but does not go at least 0.50 m.** Construction and/or Competition Violations must still be recorded for Failed Runs. A team having only one successful run during the 8-minute Event Time will be assessed a Failed Run for a 2nd run score. If the Vehicle does not move during the Event Time, the team will be assessed 2 Failed Runs.
 - n. If the Vehicle passes the **0.50 m** Line but stops before the **7.00 m** Line, it is considered a Competition Violation. The Event Supervisor records the run measurement.
 - o. The Event Supervisor will review with teams the data recorded on their scoresheet.
 - p. Teams filing an appeal must leave their Vehicle and Practice Log in the event area.
7. **SCORING:**
- a. Each team’s Final Score is the better of the 2 Run Scores plus any Final Score Penalties. Low score wins.
 - b. Run Score = **100** + Distance Score + Time Score + **Can Bonus** + **Log Bonus** + Run Penalties.
 - c. Time Score = Run Time x 2
 - d. Run Time begins when the dowel of the Vehicle reaches the **0.50 m** Timing Line and ends when it passes the **7.00 m** Timing Line. The Run Time must be recorded in seconds to the precision of the timing device used. The Run Time will be recorded as 0.00 seconds for Failed Runs or if the Vehicle passes the **0.50 m** Line but stops before the **7.00 m** Line.
 - e. Distance Score: The Distance Score is the distance from the Vehicle’s Measurement Point to the Target Point in centimeters measured to the nearest 0.1 cm. This is a point-to-point measurement. The Distance Score for a Failed Run is **2000 points**.
 - f. **Can Bonus = -0.5 x (110 - inside distance between the cans to the nearest 0.1 cm).**
 - g. **Log Bonus = -40 for a Practice Log meeting the requirements of 4.a.**
 - h. Run Penalties:
 - i. Competition Violation: 150 points added to the Run Score per violation
 - ii. Construction Violation: 300 points added to the Run Score per violation
 - iii. Failed Runs can be assessed violations.
 - i. Final Score Penalties:
 - i. Vehicle Not Impounded: 5000 points added to the team’s Final Score.
 - j. Two or more teams tied with 2 Failed Run scores, without Competition or Construction Violations, will remain scored as ties. Other ties are possible.
 - k. Tiebreakers in order:
 - i. Better Vehicle Distance of the scored run
 - ii. Shortest Run Time of better scored run
 - iii. **Better Can Bonus of the scored run**
 - iv. Better Vehicle Distance of the non-scored run



8. SCORING EXAMPLE:

A Vehicle has 2 runs in the allotted time.

- In the 1st run, the Vehicle stopped 67.6 cm from the Target Point with a Run Time of 5.27 seconds **and without cans.**
- In the 2nd run, the Vehicle stopped 27.6 cm from the Target Point with a Run Time of 7.34 seconds **and Can Distance of 50.0 cm.**
- The team's Practice Log is complete.

Base Score	= 100	=	100.00
Distance Score	= 67.6 cm x 1.0 pts/cm	=	67.60
Time Score	= 5.27 x 2	=	10.54
Can Bonus	= No Cans	=	0.00
Log Bonus	= -40	=	-40.00
1st Run Score		=	138.14

Base Score	= 100	=	100.00
Distance Score	= 27.6 cm x 1.0 pts/cm	=	27.60
Time Score	= 7.34 x 2	=	14.68
Can Bonus	= -0.5 x (110.0 - 50.0)	=	-30.00
Log Bonus	= -40	=	-40.00
2nd Run Score		=	72.28

Final Score = 2nd Run Score (Better Score) = 72.28 pts

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries a variety of resources to purchase for this event; other resources are on the Event Pages at soinc.org