ROBOT TOUR

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

1. **DESCRIPTION:** Teams design, build, program and test one Robotic Vehicle to navigate a track to reach a target in a set amount of time as accurately and efficiently as possible.

   A TEAM OF UP TO: 2 **IMPOUND:** Yes **EVENT TIME:** 18 minutes

2. **EVENT PARAMETERS:**
   a. Each team must bring and impound one Robotic Vehicle (Robot), a Practice Log (if prepared), programming unit (except laptops), and any additional/spare parts.
      i. If the programming unit is a laptop, then a USB Flash Drive must be impounded instead of the laptop. The USB drive, or similar storage device, must contain only one robot program that is the starting program for the Robot.
   b. The Practice Log are the only papers or notes that the competitors may bring into the event area and must be impounded.
   c. Teams may bring tools, which includes a stand-alone non-programmable, non-graphing calculator (Class II), which do not need to be impounded..

3. **CONSTRUCTION PARAMETERS:**
   a. The Robot must be designed and programmed to navigate a track, make decisions, travel to gate zones, and stop at a designated target point on the track without external interactions.
   b. Electrical energy used by the Robot for any purpose, including propulsion, must be stored in a maximum of **6 (six)** AA or AAA 1.2 to 1.5-volt common, commercially available batteries, individually labeled by the manufacturer. Rechargeable batteries are allowed.
   c. 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.
   d. Batteries and Robot are to 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. The robot should be submitted at the same time but physically separate from the batteries. Teams violating any of these conditions will have the opportunity to remedy the situation to the satisfaction of the Event Supervisor should time allow. The Event Supervisor will instruct the teams when to install the batteries and prepare their Robot for its run.
   e. An approximately ¼" to ⅜" wooden dowel must be attached to the front of the Robot. The dowel must be approximately perpendicular to the floor, extend to within 1.0 cm of the track surface, and extend at least 10.0 cm above the floor. The dowel must be easily accessible by the Event Supervisor. No part of the Vehicle can extend beyond the front of the dowel, other than the dowel attachment device. The dowel's front bottom edge will be the Robot's Measurement Point for distance measurements.
   f. The entire Robot in the ready-to-run configuration must fit in any orientation in a 30.0 cm by 30.0 cm space of any height.
   g. Teams may use sensors to provide information about the environment or the Robot's movements. The Robot must remain autonomous and not be remotely controlled
   h. All parts of the Robot must move as a whole; no tethers or other separate pieces are allowed. The only parts allowed to contact the floor during the run are parts already in contact with the floor in the ready-to-run configuration. Pieces falling off during the run constitutes a construction violation.
   i. Participants must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found on www.soinc.org.

4. **PRACTICE LOG: A Practice Log is recommended but not required. The Practice Log must be impounded in order for the team to use it during Setup Time.**

5. **THE TRACK:**
   a. The track area will be a 2 meter by 2-meter square area on a smooth, level, and hard surface. A PDF diagram of the track is available on the Event Page at sonic.org.
   b. The square track area will be marked by 2.5 cm tape lines on the outside. The 2.0 meter dimension is measured inside to inside of the tape lines.
   c. The outside tape lines will be marked every 0.5 m or 50 cm for the imaginary lines within the track area. There are three (3) imaginary lines in both vertical and horizontal directions for a total of six (6) lines. All imaginary lines are perpendicular to the outside tape lines. The imaginary lines will form sixteen (16) square zones (approximately 50 cm x 50 cm) within the track area. It is recommended to use ¼" wide tape to mark all imaginary lines, but not required.

d. The Start Point will be marked on the outer boundary tape line and on the inside edge. The mark will be centered between any imaginary line and/or a perpendicular outer boundary tape line.
e. The Target Point will be in the center of one of the sixteen (16) zones defined by the imaginary lines and outer tape lines. The Target Point will be marked on approximately 2.5 cm x 2.5 cm tape with the Target Point marked at the center of the tape.
f. Eight (8) wooden 2x4 Obstacles are placed on the track lines. The 2x4 can be placed on any imaginary line or outside tape lines. The 2x4s are placed centered between adjacent perpendicular track lines (outside or imaginary). The dimensions of the 2x4 obstacles are 1.5 inches by 3.5 inches by 16 inches long. The location of the 2x4s needs to be marked by the Event Supervisor in case a 2x4 needs to be relocated after a robot makes contact or is temporarily removed for measurements.
g. Bonus Gate Zones will be marked by 2.5cm tape lines. Each Gate Zone is approximately 50 cm by 50 cm square. The tape will be placed on the inside edge of the imaginary lines and/or the outer tape line to form the Gate Zone. The Event Supervisor will select the locations of the Gate Zones after impound. Each Gate Zone will be marked with a letter (Ex: "A", "B", "R", "X", ...).
h. At the Event Supervisor's discretion, more than one track may be used. If so, the team may choose which track they use. All of a team's runs must be on the same track.

6. **THE COMPETITION:**
   a. The Start Point, Target Point, Target Time, and number of Gate Zones along with their locations are chosen by the Event Supervisor (ES) and must not be announced until the impound period is over. The number of Gate Zones will be up to 3 for regionals, up to 4 for states and up to 6 for nationals. The Target Time will be chosen between 50 and 75 seconds.
   b. Only participants and the Event Supervisors will be allowed in the event area. Once participants enter the event area to compete, they must not leave or receive outside assistance, materials, or communication.
   c. Teams are allowed to make programming changes to achieve the maximum points during their Event Time. If a laptop is the programming unit:
      i. Participants must open the single program file from the impounded USB drive in front of the Event Supervisor.
      ii. Teams must only modify the impounded program file during the competition.
      iii. Opening other files or referencing the Internet will result in their Final Score receiving the Not Impounded penalty.
   d. A team's Event Time is a combination of their Setup Time and Track Time. The Event Supervisor will record the total Track Time used which may be used as a tiebreaker.
      i. Teams are given Setup Time to determine the robot's path and make any configuration or programming changes. Teams have a maximum of 10 minutes for setup. All work must take place away from the track. The teams are not permitted to test their Robot's movements on any surface during the Setup Time. Using a software simulation of the robot to verify motions and / or run times is not permitted. Time starts after the completion of the inspections and the competitors are ready to begin the setup process. Competitors will notify the Event Supervisor when ready to move to the track.
      ii. Teams are given a maximum of 8 minutes for their Track Time. All actions described below must take place during their Track Time. The Track Time will not include time used by the Event Supervisor for measuring. If a run has started before the 8-minute period has elapsed, it will be allowed to run to completion. The recorded Track Time will stop at the end of the team's last run.
   e. At the Event Supervisor's discretion Participants may use AC outlet power during their time slot but this may depend on event location.
   f. Teams may have up to 2 successful runs or 3 Failed Runs (whichever comes first). Teams may ask to have the run recorded as a Failed Run and stop the run. Removing a Robot before the end of a run will be recorded as a Failed Run.
   g. In the ready-to-run configuration, the Robot's Measurement Point must be over the Start Point with the Robot in any orientation. If the robot is starting from outside of the Track then the robot's first movement must be to enter the Track area. The Robot must remain at the starting position without being touched.
   h. Teams may adjust their Robot (ex: programming changes, physical modifications, ...) during their event time. The Event Supervisor may re-verify that the Robot meets specifications prior to each run.
   i. Teams must run their Robot on the track provided by the Event Supervisor. Running the Robot on any surface other than the event track will result in the team's next run being recorded as a failed run for each occurrence.

j. Participants may clean the track during their event time, but the track must remain undamaged and dry at all times. No wet and/or tacky substances may be applied to the track, wheels, or treads.
k. Teams must start the Robot using any part of an unsharpened #2 pencil with an unused eraser, supplied by the Event Supervisor, in any motion to actuate a trigger. They may not touch the Robot to start it, hold it while actuating the trigger, or "push" the Robot to get it started. Once they start a run, the participants must not touch their Robot and must wait until notified by the Event Supervisor to retrieve their Robot.
l. Run Time starts when the robot begins to move and ends when the Robot comes to a complete stop; recoils are considered part of the Run Time. If the robot does not move within 3 seconds after coming to a stop, the run is considered to have ended; the 3 seconds are not included in the Run Time. Any action occurring after that time does not count as part of the run. Movement is defined by the Robot's measurement point changing location on the track. The Event Supervisor is encouraged to use three timers. The middle time of the 3 timers must be the official Run Time. The Run Time must be recorded in seconds to the precision of the timing devices.
m. A Gate Zone Bonus is awarded for each Gate Zone entered in any order. Each Gate Zone may only be counted once. The front side of the Robot with the dowel rod must be the first side of the robot to travel into the Gate Zone. Traveling backwards or sideways will not count as entering the Gate Zone.
n. A Contact Penalty is awarded for making contact with any of the 2x4 Obstacles during a team's run. This penalty can only occur once. Teams may choose before moving to the track area to compete without the 2x4 Obstacles for a penalty less than the Contact Penalty. All runs must be attempted with or without the 2x4 Obstacles. Teams cannot change their decision once their Track Time begins.
o. A Stalling Penalty will be awarded for delaying movement actions at the end of a run with the intent to improve only the Time Score. Possible delaying actions can include but not limited to: repeating a single or multiple movements, moving in small circles, or other motions designed to improve the Time Score only. The end of the run is defined as occurring in the 50cm by 50cm Target Point square or an adjacent 50cm by 50cm square. An Event Supervisor may request the last run to be repeated to verify the presence of delaying movements. This repeat run will not count toward the team's Track Time or used for scoring.
p. A Failed Run occurs for any run that:
    i. Does not finish within twice the target time
    ii. The Robot exits the track area as determined by all Robot floor contact points being completely outside of the track's outer perimeter lines.
    iii. If the time and/or distance cannot be measured for a Robot (e.g., it starts before the Event Supervisor is ready, the participants pick it up before it is measured).
q. If the Robot does not move upon actuation of the trigger, it does not count as a run and the team may set up for another run.
r. A team filing an appeal must leave their Robot and programming unit/USB in the competition area.

7. **SCORING:**
    a. Each team's Final Score is their lowest Run Score plus any Final Score Penalties. Low score wins.
    b. The Run Score for each run
        i. Non-Failed Run = Time Score + Distance Score + Gate Bonus + Run Penalties.
        ii. Failed Run = 750 points + Run Penalties
    c. The Time Score is determined by:
        i. Run Time less than Target Time: Time Score = 100 + (Target Time - Run Time) x 2
        ii. Run Time greater or equal to Target Time: Time Score = 100 + (Run Time - Target Time)
    d. The Distance Score = Robot Distance x 1 point/cm. The Robot Distance is the point-to-point distance from the Measurement Point to the Target Point in centimeters measured to the nearest 0.1 cm.
    e. Gate Bonus for each run = -15 points for each Gate Zone entered in any order.

f. Run Penalties:
   i. Contact Penalty: 50 points added to each Run Score that has 1 or more contacts with the 2x4 Obstacles.
   ii. No 2x4 Obstacle Penalty: 35 points added to all Run Scores when a team chooses to run without the 2x4 Obstacles.
   iii. Stalling Penalty: 20 points added to each Run Score with delaying movement actions.
   iv. Competition Violation: 150 points added to each Run Score that has 1 or more Competition Violations.
   v. Construction Violation: 300 points added to each Run Score that has 1 or more Construction Violations.

g. Final Score Penalties:
   i. Robot's movements tested during Setup Time: 200 points added to the team's Final Score.
   ii. Robot Not Impounded: 5000 points added to the team's Final Score.

h. Ties must be broken by this sequence:
   i. Lower Time Score on scored run;
   ii. Lower Robot Distance on scored run.
   iii. Higher number of Gate Zones entered on scored run.
   iv. Lower Track Time used.
   v. Next better non-scored run score.

8. **SCORING EXAMPLE:** At a competition, the track has 3 Gates (A, B & C). Target Time is 53s. A team's Robot stopped 21.7 cm from the Target Point with a Run Time of 68.53 sec. Gate Zones "C" and "A" were entered. The team had a recorded Track Time of 7 minutes and 35 seconds.

Time Score	= 100 + (68.53 – 53)	=	115.53
Distance Score	= 21.7cm x 1.0 pts/cm	=	21.7
Gate Bonus	= 2 Gates x -15 pts/Gate	=	-30.00
Run Score		=	107.23

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

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