

ROBOT TOUR C (2020 TRIAL) 12/19/19bh

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

A TEAM OF UP TO: 2

IMPOUND: Yes

EVENT TIME: 12 minutes

2. **EVENT PARAMETERS:**

- a. Each team must bring and impound one Robotic Vehicle, a practice log, 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 must contain only one robot program that is the starting program for the robot.
- b. The practice log is the only paper or notes that the competitors may bring into the event area and must be impounded.
- c. Teams may bring tools which do not need to be impounded. Tools may include a stand-alone non-programmable, non-graphing calculator as defined in the calculator policy found on www.soinc.org.

3. **CONSTRUCTION PARAMETERS:**

- a. The autonomous robotic vehicle must be designed and programmed to follow track lines, make decisions at intersections, travel between gates, 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 8 (eight) AA 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 robotic vehicle 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 submitted in a non-metallic container free of any items that might cause 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" round wooden dowel must be attached to the front of the robot. When the robotic vehicle is in the ready-to-run configuration, the dowel must be approximately perpendicular to the floor, extend to within 1.0 cm of the floor, and extend at least 10.0 cm above the floor. The dowel must be the leading part of the Robot at all times and easily accessible by the Event Supervisor. The dowel attachment device may not extend more than 0.5 cm beyond the front of the dowel. 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. 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.
- h. 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. Teams must record the target time, run time, distance from target, and gates, if used, for at least 10 practice runs while varying (and recording) at least one Robot parameter (path taken, gates, ...) for each run.
- b. Logs must be impounded and will be returned when the team is called to compete.

5. **THE COMPETITION:**

- a. The start point, target point, target time, and number of gates to be passed 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 gates 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 30 and 60 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. Participants will be given an Event Time of 12 minutes to perform the following actions. The Event Supervisor will record the total event time used which may affect all scored runs. The Event Time will not include time used by the Event Supervisor for measuring. If a run has started before the 12-minute period has elapsed, it will be allowed to run to completion. The recorded event time must stop at 12 minutes.
 - d. Teams are allowed to make programming changes to achieve the maximum points during their event time.
 - i. If a laptop is the programming unit, then the competitors 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 placed in Tier IV.
 - e. Competitors may not use AC outlet power during their time slot
 - 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. 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. 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 Bonus is awarded for each Gate crossed in any order. Each Gate may only be counted once. The dowel rod and dowel's attachment device must be the first part of the robot to travel across the Gate line.
 - n. 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).
 - o. 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.
 - p. A team filing an appeal must leave their Robot and programming unit/USB in the competition area.
6. **THE TRACK:**
- a. The track area will be on a smooth, level, and hard surface. See website for track diagram PDFs with different printing options. One of these track PDFs must be used as the competition track.
 - b. The track area will be 4 circles with a diameter of 50cm. The circles are arranged 2 by 2 with the tangent points overlapping. The outer perimeter of the circles is connected by 4 straight lines. The track lines are

approximately 1.9cm wide black lines on a white background.

- c. The 12 intersection points are marked by an approximately 2.5 cm wide by 15cm long black line centered and perpendicular to the intersection point.
- d. Event Supervisor will use an approximately 1.9 cm by 1.9 cm pieces of tape to mark the Start and Target Points, with the Start and Target Point marked in the center each piece of tape. The Start Point may be placed at approximately halfway between any two intersection points. The Target Point may be placed at any intersection point.
- e. Gates can be placed at approximately halfway between any two intersection points. A Gate cannot be at the same location as the Start point. The Gate is indicated by a 15cm thin line centered on the track line. The Gate line is marked by a single piece of tape 2.5 cm by 2.5cm at one end with a Gate letter (Ex: “A”, “B”, “R”, ”X”, ...). There must be a gap of 6.0 cm between the Gate tape marker and all track lines.
- f. At the Event Supervisor’s discretion, more than one track may be used. If so, the team may choose which track they use. All runs must be on the same track.

7. SCORING:

- a. The team with the highest Final Score in the lowest tier number wins.
- b. Each team’s Final Score is their highest Run Score with the lowest tier number.
- c. The Run Score for each run = Time Score + Distance Score + Gate Bonus + Penalties.
- d. The Time Score is determined by:
 - i. Run Time less than Target Time: $Time\ Score = 90 - (Target\ Time - Run\ Time) \times 2$
 - ii. Run Time greater or equal to Target Time: $Time\ Score = 90 - (Run\ Time - Target\ Time)$
- e. The Distance Score = Robot Distance x -0.5. 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.
- f. Gate Bonus = 15 points for each gate crossed in any order.
- g. Teams may incur the following Penalties that affect all Run Scores. Penalties do not affect Tier placement
 - i. Recorded Event Time will incur a penalty of -1 point per each 10 seconds beyond 8 minutes.
 - ii. Incomplete Practice Logs will incur a Penalty of -250 points.
 - iii. Teams without impounded Practice Logs will incur a Penalty of -500 points.
- h. Tiers; the Tier with the highest number will be applied when more than one are applicable:
 - i. Tier 1: Runs with no violations.
 - ii. Tier 2: Runs with any competition violations.
 - iii. Tier 3: Runs with any construction violations.
 - iv. Tier 4: Teams that did not impound their Robot during the impound period.
- i. Ties must be broken by this sequence: 1. Higher Time Score on scored run; 2. Lower Robot Distance on scored run. 3. Higher Gates Bonus on scored run. 4. Lower event time used. 5. Next better non-scored run score.

SCORING EXAMPLE: At a competition, the track has 3 Gates (A, B & C). Target Time is 43s. A team’s Robot stopped 21.7 cm from the Target Point with a Run Time of 58.53 sec. Gates “C” and “A” were crossed. The team had a recorded Event Time of 8 minutes and 35 seconds. A valid log was impounded.

Time Score	= 90 - (58.53 – 43)	=	74.47
Distance Score	= 21.7cm x -0.5 pts/cm	=	-10.85
Gate Bonus	= 2 Gates x 15 pts/Gate	=	30.00
Log Penalty	= 0	=	0.00
Event Time Penalty	= -1 x Round Down ((8:35 - 8:00)/10)		
	= -1 x Round Down ((515s - 480s)/10)	=	-3.00
Run Score		=	90.62

Recommended Resources: TBD

