



# ROBO-CROSS

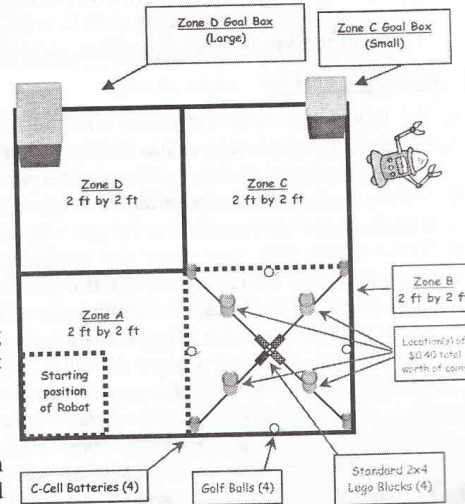
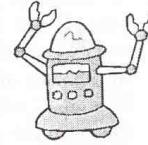
Read the General Rules in the manuals and on [www.soinc.org](http://www.soinc.org) as they apply to every event.

- DESCRIPTION:** The object of this event is to design and build a robot capable of performing certain tasks on a prescribed playing field.

**A TEAM OF UP TO:** 2      **IMPOUND:** Yes      **APPROXIMATE TIME:** 5 Minutes/Team

## 2. MATERIALS:

- Each team may enter only one robot that must be **designed and built** prior to the competition.
- The robot may be controlled remotely by radio control, infrared, or by a control box with wires leading to the robot. Batteries used in the controller shall be as stipulated by the manufacturer without modification. Controllers constructed by the competitors shall be powered by **commercial** batteries not exceeding a combined voltage of 9.6 volts.
- At the start of the competition, all portions of the robot (including the antenna if applicable) with the exception of the wires connecting it to the student control box(es), must fit into a qualifying cube with inside dimensions of 30 cm x 30 cm x 30 cm. **The walls and lid of the qualifying cube may not be used to hold any portion of the robot within the qualifying dimension.**
- All robot motion may be powered only by electrical, elastic or gravitational energy. These forms of energy may not be converted to other forms such as hydraulics, pneumatics, and fluidics to power the robot.
- Each robot circuit must be energized by one or more commercial batteries which do not exceed 9.6 volts. If multiple batteries are used, they may be connected in series or parallel as long as the voltage output does not exceed 9.6 volts. The voltage stated on commercial batteries will be accepted.
- Each robot function (such as drive train, arm, etc.) may have its own independent circuit, source of electrical energy, and control mechanism.
- The robot must have a legible team name on it.
- Only commercial radio control equipment intended for unlicensed remote control vehicle operation may be used. For example, transmitters whose operational frequencies are in the 75 MHz band (75.41 through 75.99 MHz), 27 MHz band (26.995 through 27.255 MHz), 49 MHz band (49.8302 through 49.890), or the 2.4GHz Band (including Bluetooth). Robots may not use equipment that requires a license to operate.**



## 3. PLAYING FIELD

- The playing field for the event shall be constructed on a piece of ¼ inch thick Masonite® (tempered hardboard) 4 feet by 4 feet, placed on the floor, smooth side up. Students may not step or stand on the playing field.
- The perimeter of the playing field will have a border of commercial 1" x 2" (nominal, ¾" x 1½" actual) wood, attached to the top surface of the field with the 2" dimension placed vertical.



## ROBO-CROSS (CONT.)

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- c. The playing field will be equally divided into square zones labeled A, B, C, and D counterclockwise. Zone D will have a border of commercial 11/16" quarter round molding separating it from Zone A and two 11/16" quarter round moldings forming a half cylinder separating it from Zone C.
- d. The other interior boundaries will be drawn with a fine tipped marker.
- e. Zone A will contain the starting position for the robot.
- f. Zone B will contain all of the scoreable items at the start of the competition.
- g. All materials for the event, including the playing field, qualifying cube, goals (**plastic containers**), golf balls, C-cell batteries, **2 yellow Legos, 2 blue Legos, and United States coins totaling \$0.40 value** will be provided by the event supervisor.
- h. At the start of the competition, the event supervisor will place the following objects in Zone B: 4 golf balls, 4 C-cell batteries (**standing on negative end**), and the 4 Lego blocks (standard 4x2 size), as shown in the playing field diagram. **The colored Lego blocks will be placed alternating around the center of zone B. United States coins totaling \$0.40 value will be placed in one to four stacks at the midpoints of the diagonals in Zone B. The event coordinator at each competition will determine the denominations and arrangement of the coins. The arrangement will be announced between impound and the start of the first team competing and will remain the same throughout the competition.**
- i. **The large goal box placed in Zone D will be an empty, approximately 10 cm x 10 cm x 12 cm, 1 quart plastic container with no top, bottom intact, and no label. The goal box will be placed on its side in the outside corner of zone D with the open top facing zone A (see playing field diagram). The wall thickness of the container including any lip will be less than or equal to 2 mm.**
- j. **The small goal box placed in Zone C will be an empty, approximately 10 cm x 10 cm x 8 cm, 1 1/2 pint plastic container with no top, bottom intact, and no label. The goal box will be placed on its side in the outside corner of zone C with the open top facing zone B (see playing field diagram). The wall thickness of the container including any lip will be less than or equal to 2 mm.**



#### 4. COMPETITION:

- a. All robots and control systems must be impounded before the start of the competition and will be released after the last team has finished competing. Robots and controls entered by teams that have filed an appeal may be retained by the event supervisor until the appeal process is completed.
- b. Before starting the competition, students will place their robot in the designated starting position in the outside corner of Zone A.
- c. The students will then place the qualifying cube over the robot. **A removable lid and/or visual inspection will be used to ensure the robot height is within the specification.** If the robot does not fit in the cube, the students will be allowed to compete but their robot will be ranked behind all of the other robots that qualify. After this point, students may not touch their robot until their run is completed.
- d. The students will then remove the cube. After the qualifying cube is removed, **no part of the robot may change in size or shape or move until the competition begins.**
- e. The competition will start by the judge verifying that the students are ready and then counting aloud "1, 2, 3, go". Teams will be allowed three minutes, starting with the word "Go", to complete the task of moving the scoreable items into scoring areas.
- f. The competition will stop (and the score will be determined at that point) when any of the following occur:
  - i. Three minutes have elapsed from the word "Go".
  - ii. The team says "Stop".
  - iii. **Any part of the robot or either goal touches the floor outside of the playing field.**
  - iv. The team touches the robot.
  - v. The robot is physically moved by the wires connecting it to a control box.
  - vi. A team member steps on the playing field.
- g. The robot may move the goals, but the goals must remain inside the playing field in any zone.



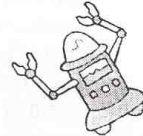
## ROBO-CROSS (CONT.)

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- h. If the control wires move a scoreable item, it will be out of play and may not be used to attain any points.
- i. Miscellaneous robot parts, or the entire robot, may end up in one of the goals without penalty.
- j. At the end of the competition, all controllers must be set on the floor immediately, and the event supervisor will allow 10 seconds for the robot to "come to rest" with the power off to determine if any parts are touching the ground outside of the playing field.

### 5. SCORING:

- a. At the end of the competition, points will be awarded based on the number and types of items that were moved into scoring areas.
- b. If the robot (parts touching the ground), at the end of the competition, is completely in:
  - i. Zone B, the team will receive 5 points.
  - ii. Zone C, the team will receive 10 points.
  - iii. Zone D or the Goal(s), the team will receive 20 points.
  - iv. If a portion of the robot is left in another zone the score received for the robot will be the lesser of the scores for each zone.
- c. Teams will receive the following points for each item moved into the following areas:



| <u>Item</u>        | <u>Quantity</u> | <u>Points in Zone C</u> | <u>Points in Zone D</u> | <u>Points in Small Goal</u> | <u>Points in Large Goal</u> |
|--------------------|-----------------|-------------------------|-------------------------|-----------------------------|-----------------------------|
| Golf Balls         | 4               | 5                       | 10                      | 5                           | 20                          |
| C-cell batteries   | 4               | 6                       | 12                      | 6                           | 24                          |
| Yellow Lego blocks | 2               | 8                       | 8                       | 24                          | 8                           |
| Blue Lego blocks   | 2               | 8                       | 8                       | 8                           | 24                          |
| Coins              | \$0.40 total    | value in cents          | value in cents          | 3 times the value in cents  | value in cents              |

**Note:** Each item may be awarded points for only one of the above areas.

- i. A scoreable item that touches the floor outside of the playing field at any time, even if it is under the control of the robot, is out of play and may not be used to attain points.
  - ii. The robot or any scoreable item on the line or straddling 2 zones will receive the lesser score.
  - iii. If any part of a goal touches the floor outside of the playing field, the scoreable items within that goal will have no point value.
  - iv. A scoreable item is considered in the goal if a part of the item is within the goal box and the item is in contact only with the goal box or other items contained therein. All other items will be scored based on the zone they are in.
- d. Maximum score is 412.
  - e. The team with the most points will be the winner. In the case of a tie, the team that completed the task in the shortest length of time will receive the more favorable score value. If teams still have identical scores, the tie will be broken by massing the robot and batteries. The robot and its batteries with the least mass will receive the more favorable score value (ranking).
  - f. Robots that fail to meet any of the specifications under "Materials" will be allowed to compete but will be ranked behind those that meet specifications. Robots that violate the frequency rules (see 2h) will not be allowed to compete and will receive participation point(s) only.

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