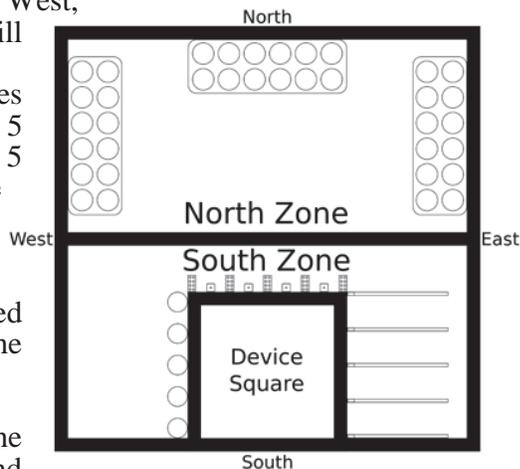


See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Prior to the competition, teams must design, build, document, and test one robotic device to move Scoreable Items.
A TEAM OF UP TO: 2 **IMPOUND:** No **EYE PROTECTION: B** **APPROX. TIME:** 10 min.
2. **EVENT PARAMETERS:** Teams must provide one Device. Teams without proper eye protection must be immediately informed of that and given a chance to obtain eye protection if time allows, otherwise not be allowed to compete and are scored as a no-show. The Supervisor provides the Competition Area and Items.
3. **CONSTRUCTION PARAMETERS:** The Device includes the Arm(s), an optional permanently attached Base, optional detachable passive Arm end effectors (parts that interact with the Items on the Competition Area), remote control box(es) (e.g. radio control; infrared; connections wires, tubes, hoses, etc.), and optional separate power supply.
 - a. The Arm(s) may be attached to a Base. All parts (except the control box(es), separate power supplies, and their connections) must fit inside an imaginary 30.0 cm x 30.0 cm x 100.0 cm high rectangular prism (only during the start). The Device must be attached to the floor only by the force of gravity.
 - b. Multiple commercial kits may be used, but each must have at least one functional modification, defined as a modification such that the lack of it will result in the Device working differently or not working.
 - c. While pneumatics are permitted, storage devices must not start with positive gauge pressure.
 - d. Commercial batteries, not exceeding 14.4 volts as labeled, may be used to energize each of the Device's electrical circuits. Multiple batteries may be connected in series or parallel as long as the expected voltage output across any points does not exceed 14.4 volts as calculated using their labeled voltage. Teams must be able to show the Event Supervisors (ES) the labeled voltage. All energy storage devices must be contained in the Device, power supply, or controller(s). Lead-acid batteries are not allowed.
 - e. **Competitors must go to www.soinc.org to check legal and permitted frequencies for the radio-controlled equipment for surface devices.**
 - f. Students must be able to answer questions regarding the design, construction, and operation of the Device per the Building Policy and **Technical Documentation** in 4.a.-c. See www.soinc.org
4. **TECHNICAL DOCUMENTATION** (must be submitted with the Device at check-in and include):
 - a. **Illustration (photos, drawings, etc.) of the basic structure of the Device with labels that must show:**
 - i. All actuators, numbered for reference in 3.b.i; ii. All energy sources; iii. Controls used to interact with the Device
 - b. **Operating Description: i. Robot reaction to each control input, ii. Tentative/proposed plan of movement (i.e., which Items will be moved, how the Device plans to move each Item)**
 - c. **Written Practice Log: i. Record at least 10 runs, ii. Record at least 3 parameters. The parameters recorded must include score and time and any additional parameter as the third parameter.**
5. **COMPETITION AREA:** The Competition Area is a 75.0 cm x 75.0 cm square marked using the inside edge of tape approx. 2.5 cm wide. The Supervisor must designate each of the 4 sides as North, East, South, and West. See www.soinc.org for an expanded view of Competition Area.
 - a. The inside edge of tape is used to mark a 30.0 cm x 30.0 cm square (the "Device Square") inside of, centered on, and sharing the South edge of the Competition Area.
 - b. The Competition Area is divided into equally sized North and South Zones defined by a piece of tape connecting the midpoints of the East and West edges of the Competition Area.
 - c. The Goal Cartons are 3 egg cartons (2 x 6 egg slots) with all covers and flaps removed. The unsecured Goals are placed facing up, centered, and lengthwise along the West, North, and East inside edges of the North Zone. Each carton will have 2 egg slots randomly and clearly labeled with a "B".
 - d. Scoreable items will be evenly spaced, touching the outside edges of the Device Square tape: 5 ping pong balls on the west side, 5 Lego bricks (standard 2 stud x 4 stud size) on the north side, and 5 unsharpened #2 pencils on the east side. A 2 stud end of the Lego bricks and the eraser end of each pencil will be pointing perpendicularly away from the edges of the Device Square tape.
 - e. 4 standard 16mm dice with the "1" dot facing up are centered between the Lego bricks touching the north outer edge of the Device Square.
6. **COMPETITION:**
 - a. At check-in, the Event Supervisor will inspect and measure the Device, select 6 items from the Technical Documentation, and have the competitors point them out on their Device.



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- b. Teams will have 3 minutes of Preparation Time to set up and test their Device in the Competition Area.
 - c. Before starting the competition, the Device must be in the Device Square in the ready to run configuration.
 - d. Prior to the run, the Event Supervisor must verify that the timekeepers and competitors are ready. It is suggested that 3 Timers be used with the middle time recorded as the Run Time. The Event Supervisor will then count aloud “1, 2, 3, Go”. Teams will be given up to 3 minutes, starting from the word “Go”, to complete the task of moving the Scoreable Items.
 - e. **The Device may move Goal Cartons anywhere inside or outside the Competition Area after Competition Time begins.**
 - f. Scoreable Items and Goal Cartons must not be damaged and must remain usable for other teams (e.g. Ping pong ball cannot be physically changed, mass remains the same, structural integrity remains intact, surface texture remains the same, etc.)
 - g. The run must stop (and the time recorded to the precision of the Timers) when any of the following occur (none of these actions will move the team to a lower tier):
 - i. 3 minutes has elapsed from the word “Go”
 - ii. The competitors say “Science”
 - iii. The competitors contact the Competition Area a second time after being warned once
 - iv. The competitors impart energy directly into the arm, base, Goal Cartons, or Scoreable Items.
 - v. Any end effectors are moved by anything besides stored energy in the Device
 - vi. Any part of the Device (except for end effectors and connections to control boxes) touching the Device Square surface in the ready to run configuration exits the Device Square
 - vii. The Arm(s) become detached from the optional Base (not including optionally detachable passive end effectors).
 - h. All objects must be scored based on where they were at the end of the run when time is stopped.
 - i. Teams who wish to file an appeal must leave their Technical Documentation and Device with the ES.
7. **SCORING: At the end of the competition, points will be awarded based on the number and types of objects that are in the specified scoring areas.** High score wins.
- a. If an Item is moved by the control box(es) connections or touches the surface outside of the Competition Area, even if it is under the control of the Device, that Item is out of play and will not attain any points. The Goal Cartons may touch the surface outside the Competition Area.
 - b. Teams must receive the following points for each Item completely supported by Goal Cartons at the end of the Competition Time. Any Item supported by multiple Goal Cartons will not receive any points. The Goal Cartons containing the Items may be anywhere (even outside the Competition Area) as long as they are upright as when the Competition Time started.

	<u>West Goal Carton</u>	<u>North Goal Carton</u>	<u>East Goal Carton</u>
Pencil	4	3	3
Lego	3	4	3
Ping Pong	3	3	4

- c. 2 additional points for each Goal Carton slot labeled “B” containing a Ping-Pong ball.
- d. At the end of the run, 1 point is awarded for every Item and dice completely within the area defined by vertically extending the lines defining the North Zone.
- e. 6 points for each die sitting flat completely within the Competition Area that has an even number facing upwards at the end of the Competition Time.
- f. The maximum number of points possible is 103.
- g. For each item incorrectly identified in 6.a., the final score will be multiplied by 0.98.
- h. Teams with incomplete Technical Documentation will have their final score multiplied by 0.95. Teams with no Technical Documentation will have their final score multiplied by 0.80.
- i. Ties are broken by 1) Greatest number of dice with the number six facing up; 2) Greatest number of Items fully supported by Goal Cartons; 3) Shortest Competition Time.
- j. Tiers:
 - i. Tier 1: Devices that meet all requirements.
 - ii. Tier 2: Devices with Competition violations.
 - iii. Tier 3: Devices that fail to meet a spec. under “Construction Parameters”.
 - iv. Participation Points only: Devices that violate the frequency rules; that have no capability, by design or construction, to score points via moving objects; or are unable to compete.

Recommended Resources: All resources including the **Robot Arm DVD (RAD)** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

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