JUNKYARD CHALLENGE

1. **DESCRIPTION:** Teams must construct a device on-site to solve an engineering challenge.

   TEAM OF UP TO: 2 **EYE PROTECTION:** #2 **IMPOUND:** Yes **TIME:** Build 30 min/Test ≤ 2 min.

2. **EVENT PARAMETERS**: Each competitor must bring and correctly wear safety glasses/spectacles with side shields at all times during the competition. Eyewear does not need to be impounded. The Event Supervisor must bring a measuring device and a stopwatch.
   a. **Junk Box**: All materials must be brought in a "junk box" with a lid, with the sum of the widest outside dimensions including the lid (length + width + height) no greater than 95.0 cm. Teams may construct or buy a box which may not be used as part of the device unless specified in the rules. The junk box must be impounded, checked for safety, and measured before the event begins.
   b. **Materials**: Teams may only bring the following items, which must not be preassembled or prepared ahead of time in any way (no limit in size or quantity unless stated). Permitted materials must be removed from original containers if the original container is not on the following list.
      i. Up to 5 standard size, unaltered plastic practice golf balls **(must bring at least 1)**
      ii. Up to 8 standard size, unaltered golf balls **(must bring at least 1)**
      iii. Up to 10 standard size, unaltered tennis balls **(must bring at least 1)**
      iv. Plates (max dimension 10 ½ inch), cups, and bowls made from paper or Styrofoam **(must bring at least 1 cup & 1 plate)**
      v. Paper or soft plastic straws/hollow stir sticks (each length limited to 24 cm)
      vi. Popsicle/craft sticks (approx. 12 cm x 1 cm) and/or toothpicks made of wood
      vii. Spools of any non-metallic string, line, thread, or tape (must not be used to secure to testing surfaces)
      viii. Paper no larger than 8½" x 11" (weight of 20# or less)
      ix. Rubber bands no larger than size #64 (1/4 inch wide)
      x. Any plastic bags ≤ 1 gallon
      xi. Scissors (must only be used as a tool)

3. **THE COMPETITION**:
   a. The supervisor will select and announce the single challenge after impound. At **Regionals** a Category A Challenge must be selected. At **State** a Category B Challenge must be selected. At **National**, either a Category A or Category B Challenge is selected. If possible, the event should be run during 1 time period.
   b. Only competitors are allowed in the competition area and must not leave without permission from the event supervisor.
   c. Based upon the tournament site, teams may have a limited area to build. Testing may have to be in a different area. If devices must be moved, teams have at least 2 minutes to set-up and calibrate their device.
   d. The device must be built on-site by the competitors using only the materials brought in their junk box.
   e. Unless specifically stated in the instructions, devices must be free-standing.
   f. The balls may be used during construction for practice. Competitors place/drop the balls during official testing.
   g. Teams have a maximum of 30 minutes to build and 2 minutes to test. Teams must not modify their device after the construction period has ended unless allowed in the specific challenge rules. Teams that complete construction may be judged early.

4. **CATEGORY A CHALLENGES - GENERAL RULES**:
   a. Prior to construction, the Event Supervisor must declare which type of ball all structures must hold.
   b. A free-standing cup on the structure must be used to hold the ball.
   c. Teams must provide the cup and the designated ball.
   d. Measurements are made after the cup has been placed, prior to ball placement. If the structure significantly deforms during testing, it may be re-measured.
      i. **Challenge A.1 – Bridge**: Build a free-standing bridge with the longest open span that supports a cup and ball in the center of the span for at least 5 seconds. Rankings are determined by the longest open

span between the bases of the bridge measured in mm. Ties are broken by the height in mm to the bottom of the load held.

ii. **Challenge A.2 – Tower**: Build the tallest free-standing tower that supports a cup and ball for at least 5 seconds. Rankings are determined by the greatest height to the bottom of the load measured in mm. Ties are broken by the narrowest base, measured to the outside edge of the supports at the widest span.

iii. **Challenge A.3 – Cantilever**: Build a cantilever that is laid out from the end of a table so that the length of the device projects horizontally from the table top and supports a cup and ball on the top of the cantilever for at least 5 seconds. Only the allowed materials in the junk box may be used as a counterweight to hold down the cantilever. The box and scissors must not be used as part of the counterweight. Rankings are determined by the greatest distance in mm, parallel to the ground, from the table to the closest edge of the cup holding the ball. Cantilevers are allowed to sag but must support the load. The cantilever must make contact only with the top surface of the table. Cable-stayed or similar devices are not permitted. Ties are broken by the shortest length from table edge to the rear of the counterbalance side (non-suspended side) of the cantilever.

5. **CATEGORY B CHALLENGES - GENERAL RULES**:

a. Teams must choose, during construction, from their materials, which single type (& number) of ball(s) to release in their device to earn points: the maximum is 5 plastic golf balls, or 8 standard golf balls, or 10 standard tennis balls.

b. Teams may use their junk box or make a container for the collection container only for the Ramp Challenge (B.1). Teams must use a plate (any size) from their junk box as the target plate for the Catapult (B.2) or the Bouncer (B.3). Teams place the collection container or target plate at a distance of their choice.

c. Competitors may use one hand to hold the base of the Catapult (B.2) or the Bouncer (B.2) to the surface.

d. Teams cannot make adjustments to the location of the target and device once the team has placed them in their chosen testing positions. If the target or device moves, it must be relocated to the original position.

e. At least one ball must reach the target distance or the teams receive only participation points. To receive the distance score (D) the ball does not have to stay in the container for (B.1) or touch the target (B.2 and B.3).

f. Bonus points for all Category B Challenges are determined by multiplying the measured distance by the number of balls successfully completing the task specified in the challenge plus one, $D \times (n+1)$.

g. Teams have 2 minutes to release all chosen balls. Each ball may be released by the team only once.

i. **Challenge B.1 – Elevated Ramp**: Build a free-standing ramp that transports ball(s) from a starting point down to a collection container**.** The ramp must be elevated the entire distance. The ramp must not touch or be connected to the collection container. Competitors must release the ball(s). Rankings are determined by the direct, straight-line distance in mm between the closest successful starting point and the closest edge of the collection container. Bonus points are earned for each ball successfully transported to and remaining in the collection container. Ties are broken in favor of the tallest height of the ramp measured at the highest successful starting point.

ii. **Challenge B.2 – Catapult**: Build a free-standing catapult that launches ball(s) to hit, on first impact, a target plate provided by the team. The device must have a trigger to launch the ball. Competitors must not touch the ball once it has been loaded into the device. Teams may make adjustments to their device between shots but not to its original location. Rankings are determined by the direct, straight-line distance measured in mm from the closest edge of the catapult to the closest edge of the target plate. Bonus points are earned for each ball successfully hitting the target plate. Ties are broken in favor of the shortest (height) catapult.

iii. **Challenge B.3 – Bouncer**: Build a free-standing bouncer that bounces ball(s) from the bouncer to hit, on first impact, a target plate provided by the team. Competitors must drop the ball from above the bouncer. Teams may make adjustments to their device between shots but not to its original location. Rankings are determined by the direct, straight-line distance measured in mm from the closest edge of the bouncer to the closest edge of the target plate. Bonus points are earned for each ball successfully hitting the target plate. Ties are broken in favor of the tallest center point of the bouncing surface.

6. **SCORING:** Team rankings are determined by the highest score as defined by the Challenge parameters.
   a. Teams that violate Event Parameters, Competition, or Challenge rules will be ranked below all other teams without violations. This includes, but is not limited to:
      i. Having a pre-constructed assembly of any kind.
      ii. Using any materials or tools that violate the event parameters.
      iii. Failure to bring a required material.
      iv. The device is not free-standing (unless allowed in a specific challenge rule).
      v. The device fails to meet the minimum requirements for the challenge.
      vi. Failure to impound on time.
   b. Ties are broken by the scoring criteria for the specific challenge.
   c. Any team that impounds a box but fails to attempt to build is considered a "No Show".
   d. Any team that receives outside help or assistance after the event starts must be disqualified.

Recommended Resources: All reference and training resources are available at http://www.soinc.org