MOUSETRAP VEHICLE OUT AND BACK

1. **DESCRIPTION:** Teams design, build, and test a vehicle using one or two snap mousetraps as the sole propulsion energy source to push a **plastic cup** out a distance and return to a point behind the starting line as quickly as possible.

   A TEAM OF UP TO: 2 **IMPOUND:** None **EYE PROTECTION:** #5 **APPROX. TIME:** 15 minutes

2. **EVENT PARAMETERS:** Students must bring and correctly wear eye protection while preparing and running their vehicle or they will not be allowed to compete.

3. **CONSTRUCTION PARAMETERS:**
   a. Only one or two unmodified snap mousetraps (with bases less than 6.0 cm x 12.0 cm) must be used as energy sources. An unmodified mousetrap is one that still retains all of its original parts and structural integrity to function as intended. Altering the structural integrity of the mousetrap includes, but is not limited to, welding, bending, and cutting. Items may be added to the mousetrap. **Soldering, taping, tying, gluing, and clamping are allowed. Holes may NOT be made anywhere on the mousetrap.**
   b. All parts of the vehicle must move as a whole; no anchors, tie downs, launching ramps, or other separate pieces are allowed. If any piece falls off during the run, it is considered a construction violation. **The plastic cup is not considered part of the vehicle at any time**.
   c. All of the vehicle's kinetic energy must originate from the unmodified mousetrap**. Items must not be added to the mousetrap to increase the potential energy of the unmodified mousetrap.** Conversion of the mechanical energy of the mousetrap spring is permissible, but any additional sources of kinetic energy must be at their lowest states at the beginning of the run.
   d. Reversing and stopping mechanisms must work automatically. The vehicle must not be tethered or remotely controlled in any way to guide, reverse, or stop it. Recoil is NOT considered reversing.
   e. Electric devices are not permitted.
   f. The vehicle must have a fixed, pointed object, (e.g., pin or toothpick) somewhere on the perimeter of the vehicle chassis that extends down to within 1.0 cm of the track's surface. The point of the fixed object nearest the track surface is used as the reference point for distance measurements.
   g. **The entire vehicle must fit within a 1.0 m x 1.0 m box in ready to start mode only before a run. There is no restriction on the height of the vehicle.**
   h. Competitors must start the vehicle by actuating some sort of trigger using a pencil, pen, dowel or similar device (which is not part of and does not travel with the vehicle). **The trigger must be designed so that the actuation of it is perpendicular (up or down) to the floor. A horizontally activated trigger is a construction violation.**
   i. Sighting devices not using electricity are permitted and may be removed before the vehicle runs.
   j. The wheels and **drive string(s)** are the only vehicle parts permitted to contact the floor at any time.

4. **THE TRACK:**
   a. The competition must be on a straight and level lane with a relatively smooth, hard, low-friction surface.
   b. Event Supervisors must mark the track with tape as follows:
      i. **Start Line**: The edge of the tape closest to the 3 m tape is the Start Line.
      ii. **3 m Line**: A parallel line 3.00 m in FRONT of the Start Line. The edge of the tape closest to the Start Line is the 3 m Line and must be accurate to within 1 mm of 3 m.
      iii. **Minus 4 m Line**: A parallel line 4.00 m BEHIND the Start Line. The edge of the tape closest to the Start Line is the Minus 4 m Line and must be accurate to within 1 mm of 4 m.
      iv. **Lane Boundaries**: Parallel lines 1.00 m apart extending from the 3 m Line to the Minus 4 m Line. The Lane Boundaries may be extended beyond the 3 m and Minus 4 m Lines to help with determining the Lane Bonus.
   c. The center of the Minus 4 m Line must be clearly marked.
   d. Additional space must be provided in all 4 directions of the lane to allow for track over-runs.

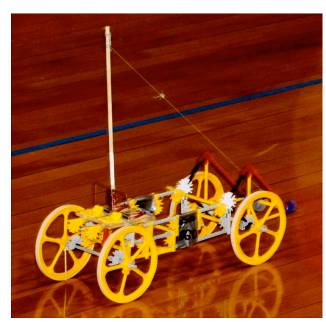
5. **THE COMPETITION:**
   a. **The vehicle must push a 16 oz. disposable plastic cup (provided by the Event Supervisor) to the 3 m Line, leave it there, reverse direction, and stop at the center of the Minus 4 m Line in order to receive the ideal Distance Score**.
   b. **The competitors must place the plastic cup upside down and tangent to the Start Line on the side closest to the 3 m Line. The cup may be placed anywhere along the Start Line as long as it is completely within the Lane Boundaries. The vehicle must be placed so that it is in contact with the cup. The fixed point of the vehicle does not have to be on the Start Line, nor does the entire vehicle have to be behind the Start Line or within the Lane Boundaries**.

c. The competitors must not push or constrain the vehicle during release nor touch their vehicle during a run.
d. The vehicle must be able to remain at the starting position without being touched until triggered. If the vehicle moves any distance after the trigger has been released it is considered a run.
e. Teams have 10 minutes of Event Time to set up, make any adjustments, take measurements, and start two runs. If the second run has started before the 10 minute period has elapsed, it must be allowed to run to completion. Time used by the Event Supervisor for measuring must not count toward the 10 minute Event Time.
f. Run Time starts when the vehicle begins forward motion and ends when the vehicle comes to a complete stop. If a vehicle does not move upon actuation of the switch it does not count as a run and the team may request to set up for another a run, but must not receive extra time.
   i. Run Time is in seconds, recorded to 0.01 seconds.
   ii. If the vehicle does not reverse within 3 seconds after coming to a stop, the run is considered to have ended. In this instance, the Run Time is the time it took the vehicle to start and stop in 1 direction including the 3 seconds. Any action occurring after the vehicle has stopped for 3 seconds must not count as part of the run.
   iii. If the vehicle reverses direction, the Run Time stops once all motion ceases (including recoils).
g. If the time or distance cannot be measured for a vehicle (e.g. a team starts a vehicle before the Event Supervisor is ready or the team picks up the vehicle before it is measured) it is a failed run.
h. **If the cup tips over during a run, measurement is made from where the cup comes to rest.**
i. Once the vehicle starts a run the competitors must move outside the lane, not follow their vehicle, and wait until called by the Event Supervisor to retrieve their vehicle following measurement.
j. Teams who wish to file an appeal must leave their vehicle with the Event Supervisor.

6. **SCORING**:
   a. Run Score: The Run Score is the sum of the Distance Score, Lane Bonus, and Time Score. Negative scores are possible. Lowest score determines the winner.
   b. Distance Score:
      i. The Distance Score is the sum of two distance measurements. 1) The perpendicular distance (point to line) in cm (to the nearest 0.1 cm) from the nearest edge of the cup to the 3 m Line. If the cup is touching the 3 m Line its distance score is 0 cm. 2) The distance (point to point) in cm (nearest 0.1 cm) from the fixed point on the vehicle to the center of the Minus 4 m Line.
      ii. Both distance measurements are absolute value positive measurements. It does NOT matter on which side of the lines the cup and the fixed point come to rest.
      iii. The cup must pass at least 1.5 m or receive 500 points plus the cup distance measurement. The team may elect to not push the cup but receives 300 points as the cup to 3 m Line measurement plus the 500 points for not passing 1.5 m.
      iv. Vehicles not reversing direction receive **1500 points** added to the Distance Score for that run.
   c. Lane Bonus: If the fixed point remains within the Lane Boundaries through the entire run, a -30 point bonus is awarded.
   d. Time Score: Regional, 1 point per second; State, 2 points per second; National, 4 points per second.
   e. Tiers: Teams are ranked using the single run that gives them the best overall rank.
      i. 1st Tier: A run with no violations.
      ii. 2nd Tier: A run with competition violations.
      iii. 3rd Tier: A run with construction violations or both competition and construction violations.
   f. Tiebreakers: 1st: Distance score of the better run. 2nd: The vehicle's other run score.
   g. Teams receive participation points if they have no successful runs.

SCORING EXAMPLE: At a State competition, the run took 20.21 seconds. The cup came to rest 42.4 cm from the 3 m Line. The fixed point was 75.8 cm away from the center of the Minus 4 m Line and remained within the lane boundaries the entire time.

Distance Score	118.2	points (42.4 + 75.8)
Lane Bonus	-30	points
Time Score	40.42	points (40.42 sec. = 20.21 sec. x 2 points/1 sec.)
Run Score	128.62	points



Recommended Resources: All reference and training resources including the **Mousetrap Vehicle (Out & Back) DVD** are available on the Official Science Olympiad Store or Website at http://www.soinc.org