vi. **Push or pull an object with a mass ≥ 500 g at least 10 vertical cm up an inclined plane with an IMA ≥ 2 before the object initiates the next action**.
vii. Use a pulley system with an ideal mechanical advantage (IMA) of at least **3** to lift an object with a mass ≥ 500 g at least 10 vertical cm before the object initiates the next action.
viii. Use the mechanical advantage of all 3 classes of levers in sequence to initiate the next action.
ix. **Use gravity to clearly rotate a screw at least two full rotations so that it operates as a screw converting rotational force into linear force and moves an object at least 2 cm before that object initiates the next action. The screw must be marked so its rotational movement is clearly visible**.
x. Launch an unmodified US quarter out of the top boundary of the device, so that it falls back into the device and initiates the next action. When the device is in the ready to run position, the quarter must be heads up. After the quarter is launched out of the device, lands back in, **and initiates** the next action the quarter must be tails up.
xi. **Use electricity to directly or indirectly break a string or fishing line so that the breaking of the line initiates the next action.**
xii. **Remove a magnet from a surface so that a magnetic object falls due to the removal of the magnetic force. That object must initiate the next action.**

c. **Final Action** (250 points) – **The device must raise a perfectly square platform that is between 5.0-10.0 cm on each side, a vertical distance of at least 20.0 cm before it becomes the highest point of the device. The platform must be a single surface that is hard, non-tacky, and smooth with no lip on any of its edges. On the platform must be a freestanding, upright standard 9V battery which is not attached to the platform or any other part of the device. The action is complete when the top surface of the platform and the battery are above the entire device and movement stops. Only the battery can be supported by the platform and this action may not count as the timer.**
d. **Two** Action Sequence Lists (ASLs) must be submitted to the Event Supervisor at impound. The ASLs must be legible, neat, and an accurate documentation of each intended scorable and non-scorable action of the device's operation. Scorable and non-scorable actions must be numbered and documented in the ASLs and correspondingly labeled in the device. Scoring will be based only on the Scorable Actions listed in the ASLs. Example ASLs may be found on the event page at soinc.org.
e. The Target Operation Time is 60.0 seconds at Regionals/Invitationals, 61.0 to 90.0 seconds at State, and 91.0 to 120.0 seconds at Nationals. For State/Nationals the time will be announced at setup and will be the same for all teams.
f. Timing and scoring begin when a participant **drops the Ping-Pong ball into the device**. Timing stops when **the platform stops moving** or when 180.0 seconds elapse, whichever comes first. **If the device stops after 3 touches or the platform never stops moving, the time will be scored as 180.0 seconds**.
g. Participants must designate **a timer,** an action taking over **10.0** seconds that does not use electricity or springs for power, **to be eligible for bonus points**.
i. **A 1-point bonus will be awarded for every full second the timer operates before the Target Operation Time. The timer must run for at least 30 seconds to earn points. The timer may run past the Target Operation Time but will not receive points for the duration after the Target Operation Time.**
ii. The timer must successfully start the next Scorable Action for any bonus points to count.
iii. For State/National tournaments, the team must demonstrate how this timer is adjusted to account for the increased length of Target Operation Time for the bonus points to count.
h. If the device stops, jams, or fails, the participants will be allowed to "**touch**/adjust" the device up to three times to continue operation. **A single "touch" may consist of multiple touches and ends once the device runs again on its own**. Obvious stalling will result in disqualification.
i. If a participant completes a scorable action or makes an adjustment that leads directly to the completion of the action, then that action will not count for points, even if it is part of the Final Action.
j. If an action starts out of ASL order, all actions skipped in the listed sequence, even if completed, earn zero pts.
k. The supervisor will review with teams the data recorded on the scoresheet.

5. **SCORING:**
a. High score wins.

b. Award 25 points for each of the following: (100 points maximum):
   i. The ASLs are submitted on time at device impound.
   ii. The ASLs use the format specified on www.soinc.org.
   iii. The ASLs are 100% accurate of intended scorable and non-scorable actions.
   iv. The scorable & non-scorable actions within the device are labeled as in the ASLs.
c. Award 50 points for each of the following:
   i. Participants use no more than 30 minutes to set up their device.
   ii. The first time each action in **4.b.** is successfully completed as described.
d. Award 100 points for completing the Start Action.
e. Award 250 points for completing the Final Action **if the battery is freestanding and untouched at the end of the run. If the battery tips on a side, but still remains on the platform, only award 150 points if all other requirements are met. If the battery falls off the platform, no Final Action points will be awarded.**
f. Award 2 points for each full second (rounded down) of operation up to the Target Operation Time.
g. Award 1 point per full second that a non-electrical or non-spring timer runs before the Target Operation Time if all conditions are met and the next action is initiated by the timer.
h. Award 0.1 point for each 0.1 cm that the device dimensions are under 60.0 cm in each axis. The maximum score awarded will be 90 points.
i. Award 75 points for a device that has no touches.
j. Teams receive only participation points for impounding a device but not competing, unsafe devices, or devices that are remotely timed/controlled.

6. **PENALTIES:**
   a. Deduct 1 point for each full second (rounded down) that the device operates past the Target Operation Time up to 180.0 seconds (whichever occurs first).
   b. Deduct 25 points:
      i. for each dimension of the device that exceeds 60.0 cm, **excluding the Final Action**
      ii. **if the top and 2 vertical walls are not open or transparent**
      iii. for each **touch/adjust up to 3 times. If the device stops after the third touch, it will not be allowed to be touched/adjusted and the time will be scored as 180.0 seconds.**
   c. Deduct 50 points for the first solid or liquid that leaves the measured dimensions of the device, **excluding 4.b.x. and the Final Action**
   d. Deduct 150 points for each:
      i. electrical or spring timing action in the device that takes longer than 10.0 seconds, except raising the Final Action platform
      ii. **action where electricity is used where it is not allowed. The action will also not count for points.**
   e. Devices impounded after the deadline will be scored after devices impounded on time.

7. **TIEBREAKERS:**
   a. Ties are broken as follows:
      i. Fewest penalty points
      ii. Smallest overall dimension (L+D+H) of the device

**Recommended Resources:** The Science Olympiad Store (store.soinc.org) carries the Mission Possible Video Download and Problem Solving/Technology CD; other resources are on the event page at soinc.org.

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# MOUSETRAP VEHICLE

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

1. **DESCRIPTION:** Teams design, build, and test a vehicle using one or two snap mousetraps as its sole means of propulsion to push a **paper** cup forward, reverse direction, and stop **as close as possible to a Vehicle Target Point.**

   **A TEAM OF UP TO:** 2 **IMPOUND:** Yes **EYE PROTECTION:** B **EVENT TIME:** 8 minutes

2. **EVENT PARAMETERS:**
   a. **Each team must bring and impound a single vehicle, a practice log, and any additional/spare parts**.
   b. **Teams** may bring a **stand-alone** calculator of any type, data, and non-electric tools for their vehicle which do not need to be impounded.
   c. All participants must properly wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without eye protection will not be allowed to compete.

3. **CONSTRUCTION PARAMETERS:**
   a. **Teams** will construct a vehicle where all propulsive energy must come from one or two snap mousetraps **of base 6.0 cm x 12.0 cm or smaller. No part of the jaw/hammer may extend more than 1.0 cm beyond the base.** Mousetraps must retain all of their original parts and structural integrity. Altering the structural integrity of the mousetrap is prohibited, including welding, bending, and cutting. Items may be added to each mousetrap through methods including, but not limited to: soldering, taping, tying, gluing, and clamping. Added items cannot increase the potential energy of the unmodified mousetrap. Up to 4 holes may be drilled in each mousetrap to attach it to the vehicle.
   b. Conversion of the mechanical energy of each mousetrap's spring is permissible, but any additional sources of kinetic energy must be at their lowest states in the ready-to-run configuration.
   c. The vehicle must not be remotely controlled or tethered and must stop and reverse automatically.
   d. Electric/electronic components and devices are not permitted.
   e. **An approximately** ¼" diameter round **wooden** dowel must be attached to the vehicle approximately perpendicular to the floor. The bottom of the dowel must be ≤ 1.0 cm from the track's surface **and be easily accessible by the Event Supervisor**.
   f. Wheels/treads in their entirety in the ready-to-run configuration must fit in a **40.0** cm x 40.0 cm space of any height. Axles, drive arms, and other parts of the vehicle may extend beyond these parameters.
   g. Only non-electric sighting/aiming devices are permitted. If placed on the track, they must be removed before each run. If placed on the vehicle, they may be removed at the team's discretion.
   h. All parts of the vehicle must move as a whole. The only parts allowed to contact the floor during the run are wheels/treads, drive string(s), and **any** parts already in contact with the floor in the ready-to-run configuration. Pieces falling from the vehicle are a construction violation. The cup is not considered part of the vehicle.
   i. 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 vehicle distance, cup distance, and run time of at least 10 practice runs while varying at least one vehicle parameter (e.g., # of string wraps around the axle) for each run.**
   b. Logs will be impounded and **returned when the team is called to compete**.

5. **THE COMPETITION:**
   a. Only participants and the event supervisors will be allowed in the impound and track areas. Once participants enter the event area, they must not leave or receive outside assistance, materials, or communication.
   b. Teams have 8 minutes to set up their vehicle and complete up to 2 runs. Vehicles in the ready-to-run configuration before the end of the 8-minute time period will be allowed to complete a run. Teams may not use AC outlet power during their 8 minutes.
   c. **The Event Supervisor will provide a 3-oz. paper cup that is at least 5.0 cm tall. Teams must place the cup** upside down to cover the Start Point. The Start Point can be anywhere under the cup as long as it is completely covered.
   d. In the ready-to-run configuration, the vehicle's dowel must touch the cup, **and the vehicle must remain at the starting position without being touched**.