MOUSETRAP VEHICLE

Science, Math, and Engineering

KCSOS Kern County Superintendent of Schools
KERN COUNTY STEAM OLYMPIAD

DESCRIPTION: Teams design, build, and test **one vehicle** using one or more mousetraps as its sole means of propulsion to reach a target point as directly as possible.

A TEAM OF UP TO: 4 per grade level

EVENT PARAMETERS:

a. Each team must bring and impound one vehicle, alignment devices (if used) and additional spare parts for inspection by judges before competition.
b. Teams may bring data and a stand-alone calculator of any type and non-electrical tools which do not need to be impounded.
c. All participants must wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection.
d. Teams must be able to answer questions regarding design, construction and operation of device.

CONSTRUCTION PARAMETERS:

a. All propulsive energy must come from **one or two snap mousetrap(s)** with a base of 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. The mousetrap must retain all of its original parts and structural integrity. Altering the structural integrity of the mousetrap is prohibited, including welding, bending, and cutting. Items may be added to the 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 into the mousetrap to attach it to the vehicle.
b. Conversion of mechanical energy of the mousetraps is permissible, but any energy converters must be at their lowest energy states in the ready-to-run configuration. Pre-loaded energy storage devices may be used to operate other vehicle functions (e.g., braking system) as long as they do not provide kinetic energy to propel the vehicle.
c. Electronic components and electric devices are not permitted except for calculators.

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d. A **jumbo paperclip** (i.e. the large ones) **must be attached to the front** of the vehicle and bent so that **ONE end of it is pointing down toward the surface** of the track. The paperclip **must not be cut or shortened**. The end toward the track surface will be the vehicle's measurement point for distance measurements. The measurement point **must extend at least 0.5 cm beyond the front** of all parts of the vehicle **except the drive arm and drive string**. The measurement point must be **less than 1.0 cm above the surface** of the track. The event supervisor must have easy access and be able to clearly see the measurement point.
e. In the ready-to-run configuration, all wheels/treads (in their entirety) must fit in a **40.0 cm x 60.0 cm** space of any height and any orientation. Axles, drive arms, and other parts of the vehicles may extend beyond these parameters.
f. All parts of the vehicle must move as a whole; no anchors, tethers, tie downs, launching ramps, or other separate pieces are allowed. The only parts allowed to contact with the floor in the ready-to-run configuration. Pieces falling off during the run constitutes a construction violation.

THE COMPETITION:

a. Only participants and the Event Supervisors will be allowed in the competition area. Once the participants enter the competition area, they must not leave or receive outside assistance, materials, or communication.
b. Teams have **10 minutes** of event time to set up and start **up to 3 runs**. Vehicles in the ready-to-run configuration before the end of the event time will be allowed to complete a run.
c. Electrical tools must not be used except for the calculator described above.
d. In the ready-to-run configuration, the vehicle's measurement point must be over the start point. The vehicle must remain at the starting position without being touched.
e. Teams may adjust their vehicle (e.g., change mousetraps, distance, aiming) within their event time, though the event supervisor may re-verify that the vehicle meets specifications prior to each run. Timing is paused during any measurements made by the event supervisor. Timing resumes once the participants pick up their vehicle or begin making their own measurements. Teams may use their own non-electronic measuring devices to verify the track dimensions during their event time.
f. Only **non-electric/non-electronic** 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.
g. Substances applied to the vehicle must be approved by the event supervisor prior to use and must not damage or leave residue on the floor, track and/or event area. Teams may clean the track during their event time, but it must remain dry.
h. Teams must start the vehicle using any part of an unsharpened #2 pencil with an unused eraser, supplied by the event supervisor, in a motion approximately perpendicular to the floor, to actuate a trigger. They may not touch the vehicle to start it, hold it while actuating the trigger, or "push" the vehicle to get it started. Once they start a run, the participants must not follow their vehicle and wait until called by the event supervisor to retrieve their vehicle.

i. The vehicle must travel forward so that the measurement point clearly passes the 1 m line, reverse direction, and come to a stop with the measurement point at the target point located behind the start point.
j. If the vehicle does not move upon actuation of the trigger, it does not count as a run. The team may continue to work on their device in order to attempt 3 runs within the event time.
k. A failed run can occur if the vehicle starts before the event supervisor is ready, if its distance cannot be measured (e.g., the participants pick it up before it is measured), or if the team pushes the vehicle down the track. If a team has a failed run, any construction and/or competition violations must be recorded for that run as well. A team having only one successful run during the 10 minute event time will be assessed a failed run for a 2nd run score. If the vehicle does not move during the event time, the team will be assessed 2 failed runs.
l. If the vehicle does not reverse within **3 seconds after coming to a stop**, the run is considered to have ended.
m. Failure to **reverse** or failure to **pass the 1 m line** is a competition violation.
n. Once the vehicle begins a run, the competitors must move outside the lane, not follow the vehicle, and wait until called by the event supervisor to retrieve their vehicle following measurement.
o. The event supervisor will review with the team the data and penalties recorded on their scoresheet.

THE TRACK:

a. The track will be on a smooth, level, and hard surface. Refer to soinc.org for a diagram of the track.
b. The event supervisor must mark the track as follows:
    i. Start point- An approximately 5.0 cm by 2.5 cm piece of tape with the start point marked at the center of the tape.
    ii. 1 m line- A line of 2.5 cm tape, in front of the start point, approximately 70 cm long, placed perpendicular to an extended imaginary line. The edge of the tape farthest from the start point must be 1.0 m from the start point.
    iii. Target point- An approximately 5.0 cm by 2.5 cm piece of tape with the target point will be between 1.00 m and 4.00 m. Target point distance will be at the discretion of event supervisor. Participants will be notified of target point distance the day of the competition.
c. The exact target distance from the start point to the target point will be between 1.00 m and 4.00 m. Participants will have time to adjust their vehicle to meet the parameters during the event time.

SCORING:

a. Each team's final score is the sum of their 2 best run scores out of their 3 runs + any final score penalties. Low score wins.
b. Run time begins with the first movement of the vehicle and ends when the vehicle comes to a complete stop (including recoil). The run time is recorded in seconds to the precision of the timing device used and may be used as a tiebreaker.
c. The run score for each run = Distance Score + Run Penalties

d. The Distance Score = 1 pt./cm x vehicle distance. The distance score for a failed run is 2500 points.
e. The Vehicle Distance is the point-to-point distance from the measurement point to the target point in centimeters measured to the nearest 0.1 cm.
f. Run Penalties:
   i. Competition Violation: 1500 points added to each run score that has 1 or more competition violations.
   ii. Construction Violation: 3000 points added to each run score that has 1 or more construction violations.
g. Two or more teams tied with 2 failed run scores, without competition or construction violations, will remain scored as ties. Other ties are possible.
h. Tiebreakers in order:
   1. Better vehicle distance of the 2 scored runs.
   2. Shortest run time of the better scored run.
   3. Better vehicle distance of the non-scored run.

SCORING EXAMPLE:

A vehicle has 3 runs in the allotted time.
The 1st run has 2 competition violations and a vehicle distance of 57.8 cm.
The 2nd run has a competition violation and a vehicle distance of 143.9 cm.
The 3rd run has no competition violations and a vehicle distance of 87.5 cm.

1st run's score:	57.8 pts + 1500 pts = 1557.8 pts
2nd run's score:	143.9 pts + 1500 pts = 1643.9 pts (not used in final score)
3rd run's score:	87.5 pts + 0 pts = 87.5 pts

	1st run		3rd run		Final Score
Final score:	1557.8	+	87.5	=	1645.3 pts