



SCRAMBLER

Read the General Rules in the manuals and on www.soinc.org as they apply to every event.

1. **DESCRIPTION:** Prior to the competition the participants will design and build a mechanical device that uses only the energy from a falling mass to transport an egg along a straight track, stopping as close as possible to a terminal barrier **without contacting the barrier or breaking the egg**. **Participants must bring and wear safety spectacles/goggles with side shields (or greater eye protection) or they will not be allowed to participate.**
A TEAM OF UP TO: 2 **IMPOUND: YES** **APPROXIMATE TIME: 20 min**
2. **PARAMETERS:**
 - a. The Scrambler device will consist of an egg transport and an energy propulsion system. These may be separate or combined into a single unit. When it is in the **ready-to-launch** configuration the entire Scrambler device (including the egg and the falling mass) must fit into a 0.75 m cube. No part of the egg transport or energy propulsion system may extend more than 0.75 m behind the starting line prior to the team initiating the run.
 - b. All energy used to propel the egg transport must come from a falling mass not to exceed **1.50 kg**. Any part of the device whose potential gravitational energy decreases after the team initiates a run is considered part of the falling mass. The mass need not travel with the egg transport. No part of the falling mass may be outside the 0.75 meter cube when a run is initiated. To facilitate mass measurement, the device must be impounded with the mass detached.
 - c. Energy from the falling mass may be transferred to other energy storage devices, but those devices must be in their lowest energy state prior to initiating the run. Additional sources of mechanical energy may be used to stop the device. The Scrambler may not contain any electrical/electronic devices.
 - d. The egg transport may not be remotely controlled or tethered in any way to guide it or to make it stop.
 - e. The competition will be on a straight and level 2-meter wide lane with a relatively smooth, hard, low-friction surface (e.g., hardwood, tile, and stone). A terminal barrier extending completely across the lane will be located at a randomly chosen distance (in half meter intervals for regional and state and tenth meter intervals for the national tournaments) between 8-12 m from the starting line. The actual distance will not be announced until just prior to the start of the event after all devices have been impounded.
 - f. Liquid substances, except for potable water provided by the judge(s), may not be applied to the wheels of the transport. Substances may be applied to other parts of the transport provided they do not leave residue on the track and/or event area, **except that the judge(s) may apply a substance to the pointed end of the egg that will leave a visible mark if the egg contacts the barrier.**
3. **CONSTRUCTION:**
 - a. The egg transport should be designed to travel any distance from 8.00-12.00 meters as quickly as possible without leaving the 2.00 meter wide lane and come to a complete stop with the egg as close as possible to the terminal barrier **without contacting it**.
 - b. The stopping mechanism must work automatically and be contained completely within the egg transport.
 - c. The egg transport must have a rigidly attached egg mount with a rigid and unpadded **flat surface at least 5.0 cm x 5.0 cm and be no less than 1.25 cm thick**.
 - d. An uncooked, grade A large chicken egg must be mounted with the "pointed" end of the egg 5.0-15.0 cm above the floor, **pointing toward the barrier**, and extending at least 2.0 cm in front of the foremost part of the transport. Tape will be provided to secure the egg to the **egg mount**. Tape may not be placed on the front or rear 2.0 cm of the egg. **Both ends of the egg must be exposed to the view of the judge(s).**
 - e. If used, sighting/aligning devices must be attached to the egg transport and/or energy propulsion system and remain installed during a run.
4. **THE COMPETITION:**
 - a. The entire Scrambler system must be impounded before the start of the event and will be released from impound when the team has finished competing. Appeals by teams will not be processed after they remove their device from impound unless it has been released by the appeals committee.
 - b. Once teams enter the event area to compete, they may not leave the area or receive outside assistance, materials, or communication until they are finished competing.
 - c. At the direction of the Event Supervisor the students will retrieve all impounded items and move immediately to the **Measurement Area located adjacent to the impound area**. **At the Measurement Area teams will be given one egg by the judge and have their mass checked.**



SCRAMBLER (CONT.)

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- d. Teams will be given a 10-minute Event Time to make up to 2 official runs with their device.
 - e. The Event Time **begins once the egg is readily available to the team, the mass has been returned to the team and the team has moved to the starting line. The Event Time ends** when the 10-minute time expires, the last official run is complete, **or the egg is determined to be broken.** A run may be completed if the mass has been released before the **10-minute time** expires.
 - f. Students may not back up the transport device on or near the track to set the distance into the stopping mechanism. Teams may adjust their device, but they may not increase the falling mass once it has been measured. If the device cannot start at least one run within the 10-minute period, the team will receive participation point(s) only.
 - g. Once the Scrambler is setup in ready-to-launch configuration on the track, the judge shall pause the Event Time to verify construction. Once verification is complete the Event Time shall resume.
 - h. Prior to the beginning of each run, the pointed tip of the egg will be placed even with the starting line anywhere along its length. All parts of the Scrambler and egg must be behind the starting line and within the 2-meter wide lane when the mass is released. **All the wheels of the egg transport must be on the floor at the start.**
 - i. Either the egg transport or the falling mass, but not both, may be held and released by the team to initiate the run. The mass and device may not be pushed or pulled to start it. All energy must come from the falling mass.
 - j. The Run Time starts when the mass or the egg transport is released and ends when the egg transport comes to a complete stop.
 - k. Once the team initiates the run, they may not control or touch the egg transport in any way until it has come to a complete stop. Participants may not be on the track until after the judge has completed all measurements.
 - l. No portion of the **egg transport, including the egg,** may make contact with the barrier.
 - m. **The Stopping Distance will be measured from the centerline of the barrier to the pointed end of the egg along the plane of the track. The time for the judge(s) to measure the Stopping Distance will not be included in the Event time. The smallest distance that may be assessed by the judge(s), where the egg is not touching the barrier, will be 0.1 cm.**
 - n. If, at any time during the event the egg is determined by the judge(s) to be broken, the event is concluded and the participants may make no further run(s). An egg shall be considered broken only when a paper towel, placed lightly on the cracked portion of the egg for a period of at least 3 seconds, shows a wet spot or when there is visible leakage of egg white or yolk.
5. **SCORING:**
- a. Runs will be assessed one Run Penalty for each of the following:
 - i. The egg is broken. See Para. 4.n.) above.
 - ii. Any part of the egg transport, **including the egg,** makes contact with the barrier.
 - iii. Any part of the egg transport runs outside of the lane at any point of the run.
 - iv. The device doesn't travel at least $\frac{1}{2}$ the chosen track distance.
 - v. Any rule under "THE COMPETITION" that does not have a specific penalty is violated.
 - b. One Construction **Penalty** will be assessed for each rule under "**PARAMETERS**" and "**CONSTRUCTION**" that is violated.
 - c. Teams will be ranked in three tiers using the single run (including **run penalties and construction penalties** for that run only) that will give them the best overall place (low score wins), where:
$$\text{Performance Value} = [2 \times \text{Run Time (in seconds)} + \text{Stopping Distance (in cm)}]$$
 - i. 1st Tier: Runs with no Penalties will be ranked by their Performance Value.
 - ii. 2nd Tier: Runs with **Run Penalties**, but no **Construction Penalties**, will be ranked by:
$$\text{Performance Value} \times (\# \text{ Run Penalties}).$$
 - iii. 3rd Tier: Runs with **Construction Penalties** will be ranked by:
$$\text{Performance Value} \times (\# \text{ Construction Penalties} + \# \text{ Run Penalties})$$

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