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# Air Trajectory

## A team of up to 3

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1. **DESCRIPTION:** Teams will design, construct, and calibrate a device capable of launching a projectile into a target area

2. **EVENT PARAMETERS:**

- A. Prior to competition students are to develop and use performance data and calibration charts to assist in determining the best launch parameters.
- B. Launch devices, eye protection, and all materials the teams will use must be impounded prior to the beginning of competition.
- C. Competitors must wear eye protection during set-up and testing of their device. Teams without proper eye protection must be immediately informed and given a chance to obtain it if time allows.
- D. Event supervisors may disqualify any apparatus that is operated in an unsafe manner.

3. **CONSTRUCTION:**

- a. The launching force must be entirely supplied by the gravitational energy from a falling mass  $\leq 5.000$  kg. At some point during each launch, the gravitational energy must be converted to air pressure or movement, which is then utilized to launch the projectile, either directly (e.g. pop gun style, etc.) or indirectly (e.g. using a pneumatic cylinder to swing an arm, etc.).
- b. All parts of the device must start each launch at and automatically return to ambient air pressure.
- c. The launching device must fit within a 1.00 m  $\times$  1.00 m  $\times$  1.00 m cube prior to all launches. Any weights used to stabilize the device must be within the cube.
- d. The triggering device is not considered part of the device. It must extend out of the launch area, allow for the competitors to remain at least 1.00 m away from the launch area, and does not need to return to the launch area after launch. Battery triggered devices are allowed; radio controlled ones are not. The triggering device must not pose a danger to anyone due to flying parts or excessive movement outside of launch area.
- e. Teams will provide unmodified (labeling is permitted) ping-pong balls, or plastic practice golf balls to be used as projectiles.

4. **COMPETITION:**

- a. When instructed by the event supervisor(s), teams will place their device anywhere in a rectangular launch area 1.00 m wide by 1.00 m long (parallel to the launch direction),

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designated by tape on the floor. Tape will also be used to indicate a larger area that is 1.00m away from the sides & back of the launch area.

- b. Students may not touch or hold the device, or be within 1.00 m of the launch area or in the area in front of the line that marks the front edge of the launch area during a launch. They may touch only the part of the triggering device that extends at least 1.00 m outside of the launch area.
- c. No part of the device may extend outside of the launch area before or after a shot. If part of the device extends beyond the launch area during the launching action, it must return to and remain in the launch area immediately after the launch without assistance of the participants.
- d. The target area will be placed in front of the launch area, centered on an imaginary line that bisects it. The target area will be square (~1 m on each side), with a rim no higher than 3.0 cm. The center of the area will be marked so that the distance between them and the center of the initial projectile impact location may be measured.
- e. The center of the target area will be 10.00 m away from the center of the device area.
- f. Each team will have two chances.
- g. The students must inform the supervisor before each launch.

#### 5. PENALTIES:

A 100 point penalty will be added each time any of the following occurs:

- a. A participant is warned by the supervisor(s) for not correctly wearing the eye protection.
- b. The participant is within 1.00 m of the launch area or in front of the line that marks the front edge of the launch area when a launch occurs.
- c. The participant does not give a warning prior to a launch. Such launch, even if unintended, shall count as one of the four launches allowed to a team.
- d. Any part of a team's device is outside the 1.00 m x 1.00 m launch area prior to or after a launch.
- e. Students will be informed of a penalty they have received before the next launch.

#### 6. SCORING:

The winner will be the team with the lowest **Final Score = Target Area Score + Penalties**

- a. Target Area Scores
  - i. The Target Area Score shall be the distance in mm, from the center of the initial projectile impact location to the center of the target area. Teams who miss the target area or if the device fails to launch, will receive a score of 800 mm for that shot.
  - ii. The average distance of two shots will be taken for **Target are a score**.