

Trial/Pilot Event

Contact the organizers of your tournament to find out what trial/pilot events will be held.

Airjectory

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Airjectory is a fast-paced, indoor alternative to Bottle Rockets that emphasizes creative problem solving and rapid decision making. The event combines a number of previous Science Olympiad events in a new way to create an entertaining and engaging event that is fun for both students and spectators. At its core, Airjectory is a new take on bottle rockets. Students build a rocket and launcher prior to competition and impound it for inspection. Instead of the rocket being launched vertically for maximum height, the rocket is launched parabolically in an attempt to hit a target some distance away — much like Trajectory. Metric estimation skills come into play in Airjectory because the distance to the target is not known prior to launch. Students must estimate the distance visually and then calibrate their device accordingly. The handicap of not knowing the target distance is overcome by allowing the students to launch their rocket as many times as they are physically able, within a six minute window. The only catch is that only the last measurable launch is counted for points. This is where rapid decision making skills come into play. After each launch, the students must analyze their situation and determine if they can attain a better score by launching again. If the rocket does not land closer to the target on the second launch, the new, lower score is now the student's score and the decision making cycle begins again. By creatively blending existing Science Olympiad events, Airjectory delivers an entertaining and energetic event that engages both students and spectators alike.

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AIRJECTORY

1. **DESCRIPTION:** Prior to the tournament, participants will design and construct air powered rockets that, when launched, will land as close to a target as possible.

A TEAM OF UP TO: 2 **IMPOUND: Yes** **APPROXIMATE TIME: 6 minutes**

2. **EVENT PARAMETERS:**

- a. Each team may bring 1 or 2 rockets and a launcher of their own design to the tournament. A launcher will not be provided.
- b. The event supervisor will provide a mechanically operated bicycle pump terminated with a chuck to fit a common bicycle/automotive valve stem (7.7 mm outside diameter schraeder valve).
- c. Safety
 - i. Contestants must bring and wear Particle Protection Goggles at all times during competition.
 - ii. Air pressure in the rocket's pressure vessel may not exceed 30 psi at any time.
 - iii. The pressure vessel (bottle) may not be modified in any way that reduces its structural integrity. This includes, but is not limited to physical, thermal or chemical changes such as cutting, sanding or using hot glues or super glues.
 - iv. Metal may not be used for any purpose on the rocket; however, it may be used in/on the launcher.
 - v. Radio control and other methods subject to interference may not be used to activate the launcher.
 - vi. In case it is necessary to depressurize the rocket, the launcher must use a common valve stem (schraeder valve) for connecting the air supply. Depressurizing the rocket can then be accomplished by disconnecting the air supply and pressing the "center pin" of the valve.
 - vii. If the judges determine the launcher is pointing in an unsafe direction, the team must disconnect the air supply, bleed off any pressure in the pressure vessel, reorient the launcher, and reattach the air supply themselves. The 6-minute clock will not be stopped during this procedure.

3. **CONSTRUCTION:**

- a. Rockets must use a single one or two liter plastic carbonated beverage bottle for the rocket's pressure vessel.
- b. Adhesive such as silicone adhesive, polyurethane based adhesives and others that do not damage the structural integrity of the pressure vessel may be used to attach fins and other components.
- c. Rockets may not use extenders that increase the pressure vessel's volume. Commercial model rockets or model rocket parts may not be used. The rocket(s) must be marked so that judges can identify to which team they belong.
- d. Rocket components may separate after launch, but only the part of the rocket containing the pressure vessel will be used for scoring.
- e. All propulsive energy imparted to the rocket must originate from the air pressure provided by the judges. Other energy forms may be used to aid in launching the rocket but may not impart any forward velocity to the rocket itself. Remote controls or tethers may not be used to guide the rocket's trajectory in any way.
- f. Launchers and rockets must fit in a 1m x 1m x 1m cube when coupled together and ready to launch.
- g. Participants must activate their launcher remotely from a minimum distance of one meter using a pull string, an electrical signal or some other means. Radio transmitters may not be used to activate a launcher. Participants must be able to activate their launcher from a minimum distance of one meter.
- h. To be compatible with the air supply provided by the event supervisor and to allow depressurizing the rocket, the launcher must have a common bicycle/automotive tire valve stem (7.7 mm outside diameter schraeder valve) or compatible fitting for pressurizing the rocket.

4. **THE COMPETITION AREA** The competition area will consist of:

- a. A 3-meter wide by 12-meter long competition lane with one of the 3-meter sides designated by the judges as the zero meter or launch line.
- b. A launch box, 3 meters wide and 1 meter deep, located outside of the launch lane, adjacent to the launch line.
- c. Two safety boxes. One on each side of the launch box.
- d. A scoring pin placed on the centerline of the competition lane between 8 and 12 meters from the launch line. The distance to the scoring pin will not be disclosed to the contestants.

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5. **THE COMPETITION:**

- a. All rockets and launchers must be impounded before the start of the competition and will be released only after the last team has finished competing. Once impounded, physical alterations to the rocket or launcher may be made only during the 6-minute launch period. Appeals by teams will not be processed after they remove their device from impound unless it has been released by the appeals committee. Tools and spare parts do not need to be impounded.
- b. Once a team enters the event area to compete, they may not leave the area or receive outside assistance, materials, or communication until they have finished competing. Teams violating this rule will be disqualified.
- c. Sequence of events:
 - i. Team retrieves rocket and launcher from impound area and places them in the launch box where judges measure them in launch configuration.
 - ii. Team is given a 6 minutes to launch either or both rockets as many times as they wish. Once the 6-minute clock is started, it is stopped only when the 6 minutes has expired or the team indicates to the judges that they will make no additional launches, whichever occurs first.
 - iii. Teams, at their discretion, modify or repair their rockets and launcher and adjust the air pressure, launch angle and launcher position/orientation within the launch box before each launch. The rocket must be depressurized before any adjustments, modifications or repairs may be performed.
 - iv. Team pressurizes rocket and retreats to either or both of the safety boxes before activating the rocket launcher. They may not approach their rocket or launcher, or cross the launch line after the rocket has been pressurized.
 - v. Team launches rocket. If a malfunction occurs and they are unable to launch a pressurized rocket, they must receive permission from the judges before approaching the rocket to depressurize it.
 - vi. If any part of the rocket containing the pressure vessel comes to rest in the launch lane, judges place a scoring marker such as a golf tee or coin in/on the ground to mark the point of the rocket closest to the scoring pin. As soon as the scoring marker is placed, the competitors may retrieve the rocket and prepare it for another launch, if they so choose.
 - vii. Team assesses their launch and decides if they want to make another launch. They may measure the distance between the scoring marker and the scoring pin. If they do not wish to make another launch, one team member must tell the judges to stop the clock.
 - viii. If another launch is to be attempted, the team recovers their rocket and repeats steps iii to vii
- d. Judges will record the number of launches, the total time used and the Launch Score.

6. **SCORING:**

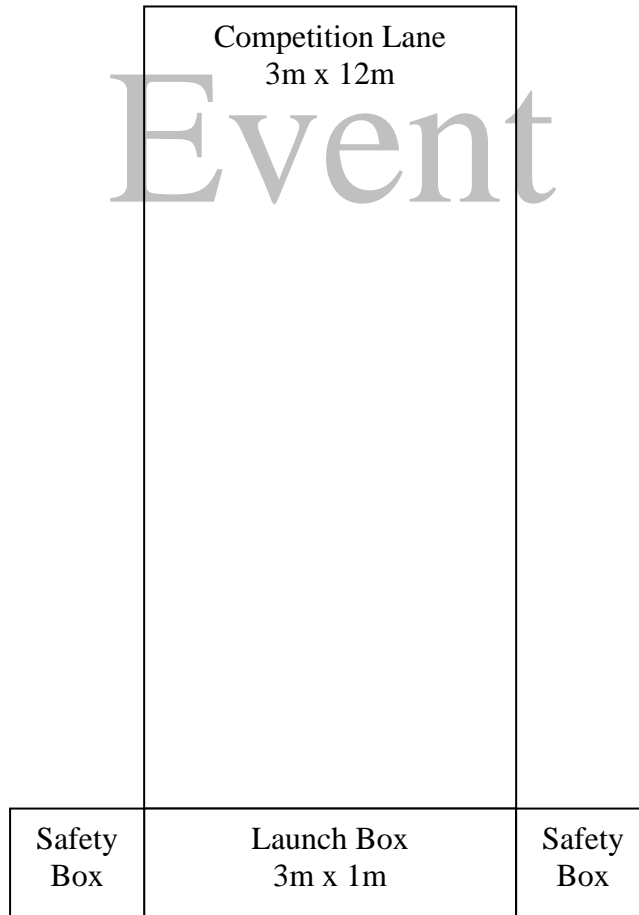
- a. A team's Launch Score will be determined by where the portion of the rocket containing the pressure vessel comes to rest. Only a team's last scorable launch will to be measured/scored.
 - i. Teams whose last launch comes to rest completely outside the competition lane or hits the ceiling will not receive a launch score for that launch and the launch will be considered unscorable. The last scorable launch will be used.
 - ii. The Launch Score for teams where any part of the rocket comes to rest within the competition lane will be the distance, in centimeters, measured between the Scoring Marker and the Scoring Pin.
 - iii. The Launch Score for a rocket physically touching the Scoring Pin will be zero cm.
- b. Teams with a Launch Score will be in ranked in one of two tiers:
 - i. Teams that comply with all construction and safety guidelines will be ranked, by their Launch Score, in the first tier (lowest score wins).
 - ii. Teams violating one or more of the construction or safety guidelines will be ranked, by their Launch Score, in a second tier beneath all teams in the first tier. Teams whose rockets and/or launchers are judged to be unsafe must modify their device during their 6-minute launch time before being allowed to launch.
- c. Teams who are unable to correct safety deficiencies, who are unable to produce a scorable launch or who are unable to complete a launch will be awarded participation point(s) only.
- d. Ties will be broken first in favor of the lesser number of launches and then in favor of the least time, in seconds, used for launches.

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THE COMPETITION AREA

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Event



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Airjectory Score Sheet

Team Name/Number: _____

Student Names: _____

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Safety

- | | Yes/No |
|--------------------------------------|--------|
| 1. Unmodified pressure vessel? | ___ |
| 2. No metal on rocket? | ___ |
| 3. Goggles worn at all times? | ___ |
| 4. Pressure not greater than 30 psi? | ___ |
| 5. Radio control not used? | ___ |
| 6. Launcher can depressurize? | ___ |

Construction

- | | |
|---|-----|
| 7. No extenders or commercial rocket parts? | ___ |
| 8. All propulsive energy comes from air pressure? | ___ |
| 9. Launcher and rocket fit in 1m x 1m x 1m cube when ready to launch? | ___ |
| 10. Launcher activated remotely? | ___ |
| 11. Air line terminated with a schraeder valve (common bicycle/automotive tire stem)? | ___ |

If anything above is NO, then the team is second tier.

Number of launches: _____

Seconds used to achieve launch completion: _____

Whole centimeters between scoring marker and scoring pin: _____

Low score wins! Ties will be broken first by the number of launches attempted and then by the number of seconds taken to achieve launch completion.

Judging Notes:

1. Place a scoring marker below the pressure vessel at the point closest to the scoring pin after every measurable launch.
2. Only measure with a meter tape the final measurable launch.
3. If at any time the launcher points any direction other than downrange or you deem the launcher's trajectory unsafe, the team must disconnect the air pump, bleed off any pressure inside the pressure vessel, reorient the launcher, and reattach the air pump themselves. The six minute clock will not be stopped during this procedure.

Tier: _____

Rank: _____

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Event Supervisor's Guide to Running Airjectory

Airjectory is a fun and straightforward event to run. The event execution is broken down into four basic phases: setup, impound, judging, and completion. Each of the four activities are discussed in detail below.

Setup – Use masking or painters tape to divide the floor up into the four competition zones as outlined in the rules and the competition area diagram. Rope off an area for impound and spectator space. Ensure that the spectator space is either behind the launch box or parallel to the competition lane. Do not allow anybody to stand at the end of the competition lane.

You must provide a scoring marker to place on the ground between measurable launches. A quarter with tape on the back will work. As will a wad of sticky-tack.

When placing the fixed scoring pin inside the competition lane, try to use an actual pin that sticks off the ground a bit. A golf tee shoved through a piece of cardboard and taped to the floor will work.

Impound – All launchers and rockets must be impounded before the event begins. Have the students place their devices inside the impound area and have them fill out the top two lines of the score sheet. Place each score sheet in beside its corresponding device after it has been filled out.

Judging – When a team is ready to judge, have them bring out their device and set it up inside the launch box. Once the device is in the ready to launch configuration, measure it to ensure that it fits within the size requirements specified in the rules. Once measurement is complete, instruct the students to retreat to the safety box to prepare for launch. Remind the students that they may launch as many times as they would like, but only their last measurable launch will count for a score. Also tell them that either student may stand in either safety box and that they do not have to be in the same box together. At the count of Go!, the six minute clock will start and the students will begin pressurizing their device and pull the trigger for launch. When the rocket has come to a rest, place a scoring marker under the main rocket body at the point closest to the scoring pin. Use a pen or ruler to ensure accurate placement. As soon as you have placed the marker, the team is free to take their rocket for another launch. Repeat the launch and mark cycle as many times as the team wishes or until the six minute clock runs out. Be sure to inform the students when three, two, and one minutes remain on the clock. Once launching has finished, record the distance in whole centimeters between the scoring marker and the scoring pin for the last measurable launch. Congratulate the team and bring the next team in.

If at any time the launcher points any direction other than downrange or you deem the launcher's trajectory unsafe, the team must disconnect the air pump, bleed off any pressure inside the pressure vessel, reorient the launcher, and reattach the air pump themselves. The six minute clock will not be stopped during this procedure.

Completion – At the end of the tournament, rank teams by shortest distance between the scoring marker and the scoring pin. Break any ties first by the number of attempted launches and second by the number of seconds to achieve launch completion. Turn in your scores to the scoring room.