

Air Rockets – Flying through the Hoop (45 Minutes - Coach Scheduled Event)

Description: Each team will build and fly a forced air propelled paper rocket using provided materials towards a target set at a distance while flying through an elevated hoop. This event may take place outside, inside, or both depending on site restrictions for events. If the event takes place outside it may be delayed or canceled if inclement weather with rain or lightning predicted, but not wind. This event has a written test.



Participants per team: 2

Spirit of the competition:

- It is a rules violation if coaches, parents, mentors, or spectators enter the competition area or communicate with the team members at any time during the competition. Violation of this rule will place the team below all other teams.

Safety Requirements:

Safety glasses labeled ANSI Z87.1+ (impact rated)

- All competitors must wear their eye protection during any competitor's flight phase of the competition.
- If a team does not have the required eye protection, they will be given the opportunity to obtain it, time allowing, but will not receive extra time.
- If a team is unable to obtain eye protection, the team will not compete and will receive a no-show score.



Team members must bring:

Safety glasses, a standard hexagonal unsharpened "#2 pencil." With a hexagonal height of 6 mm and 19 cm length, a ruler/straight edge, scissors, and a team chart showing testing results for a minimum of 2 rocket designs with 10 test flights per design created before the competition.

Materials Provided:

Each team will receive two sheets of 8 ½ x 11-inch 20-pound copy paper, 2 paper straws of unknown diameter, and cellophane tape. Teams may use no other materials.

The Competition:

Teams will be trying to hit the center of a target between 2- and 8-meters distance while flying through a hoop.

The estimated time to finish the written test is 15 minutes and 45 minutes for the entire event.

Part 1 – Written Test and Construction Phase:

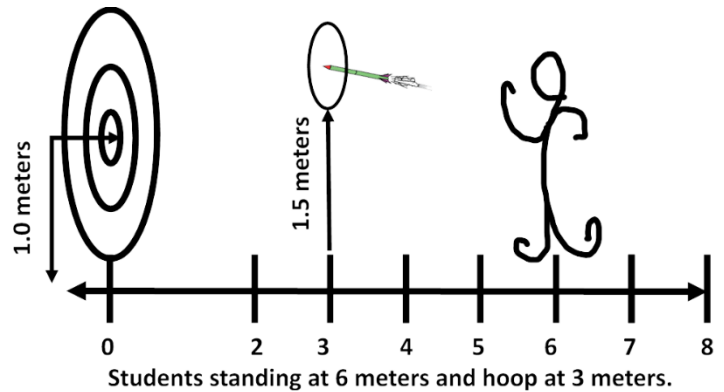
The team members will take a test on the principles of rocket flight. As a part of the written test the team will estimate the distance their "rocket" will hit from the center of the target.

- The team will provide a chart showing testing results for the launching of a practice "rocket". The chart must contain a minimum of 5 distances to target with launch and estimation times for each flight.
- Teams will have 20 minutes to build, weigh and may complete up to 3 test launches of 2 paper rockets of any design.
- Test launching will not occur at the same distance as the event target.
- There will be no extra time for testing.
- Teams will give one estimate for their distance to target without any penalties.

- An event judge will supervise the weighing of all rockets before flight.
- Teams must write their team number on their rocket.
- The flight phase will commence after each team has used their test launches.

Part 2 – Flight Phase:

- All launches will start from a flat-footed position with both feet on the ground; No running or fast walking starts.
- Using only the air in their lungs, the students will launch their rocket at a target with a center point located 1 meter above the floor on a wall from their chosen start point between 2 and 8 meters from the wall.



- Between the target and the start line will be a hoop with a diameter of between 15 and 20 cm at a height of 1.5 meters and halfway between their chosen start point and the wall.
- The rockets must pass through the hoop on the way to the target.
- Each team member may choose a different start distance.
- Students may not artificially launch the rocket.
- Each team member will have 1 official launch.
- For tiebreaking purposes, the Event Supervisor will time the flight with timing to start when they see the rocket launch by the student.
- During an official flight, time will continue if the rocket bounces off an object but will stop when the rocket gets stuck or comes to a complete rest.
- Team members will retrieve their rocket only when prompted by the Event Supervisor after their official flight.

Scoring:

Teams will receive two weighted rankings. These rankings will be added to find the final placements. The team with the lowest sum will place first. The distances and test score rankings will then be averaged to the 1/100 place value.

- 25% of team score: Teams receive a ranking based on their written test score.
- 75% of team score: Teams receive a flight ranking based on the below points.
 - The average of the two team members' flights.
 - All teams will be ranked based on their average start point; with teams starting further from the target receiving a better ranking. Team members may choose different starting points.
 - Teams will receive a ranking based on their average distance to the center of the target.
 - Teams not flying through the hoop will receive a tier violation.

Tiebreakers:

- Tiebreaker No. 1: The team with the closest measurement between their estimate and their distance to the center of the target for their first flight.
- Tiebreaker No. 2: Completeness of the team chart showing testing. Team members showing more testing details will be ranked above others. (Minimum requirement: 5 distance launches and 5 timed launches)
- Tiebreaker No. 3: The longest flight time.

Scoring Example:

Equation: (written test ranking x 0.25) + (building ranking x 0.75) = final ranking

- Team A ranks 3rd on the written test. This scores 0.75 ranking points. The team also earns 5th for their flight ranking. This scores 3.75 ranking points. The team's final ranking score is 4.5.
- Team B ranks 2nd on the written test. This scores 0.5 ranking points. The team also earns 7th for their flight ranking. This scores 5.25 ranking points. The team's final ranking score is 5.75.
- Team A is placed first in the rankings.

Possible Resources

Division A will not release previous tests, or the exact resources used by the Event Supervisor or test writer for any events. The listed resources are meant as a starting point. It is up to the competitor to research further.

- [Student Project: Make a Straw Rocket | NASA/JPL Edu](#)
- [Lesson: Soda Straw Rockets](#)