Aerodynamics

Grades: Grades 2, 3, 4, 5
Teams: 1-2 participants per team
Duration: 30 minutes
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Summary Description

Teams will design, construct, and fly at least two paper airplanes. Two initial flights will be measured for distance. Two final flights will be measured for flight time.

Concepts Covered

- The four forces at work to make an airplane fly: weight, lift, thrust, and drag.
- Paper airplane design features that lead to the farthest distance flight.
- Paper airplane design features that lead to the longest flight time.
- Manufacturing techniques that lead consistently to a balanced paper airplane.

Rules/Competition Format

This event occurs in two phases.

Phase 1. Each team will have 5 minutes to build at least two paper airplanes using the materials and tools provided.

Phase 2. Each team will fly their own paper airplanes.

Phase 1   -   Construction

1.   Teams should come to the competition empty-handed. All materials and tools will be provided. Notes, drawings and other aides are not allowed.

2.   Teams will have 5 minutes to build two paper airplanes onsite.

3.   Each team will be given four sheets of standard 8½ x 11 inch 20 lb copy paper, two standard non-coated wire 1 ¼" long paper clips and 20 cm of "Scotch" transparent tape to construct two paper airplanes. Each team will also be provided with a pencil, a ruler and one pair of scissors.

4.   4th and 5th grade teams will be given a mystery object, which MUST be incorporated into their plane designs. This object may be something like a larger paperclip, small binder clip, piece of aluminum foil, cotton ball, lengths of tape, toothpicks, etc. The mystery object may

also be something not on this list. Think about how different objects might affect the flight of your airplanes!

5. A plane can consist of paper, paper clips, tape and cannot include the pencil, ruler, or scissors. The mystery object will only be offered to 4th and 5th grade teams and will be required to be incorporated in the airplane.

6. One paper airplane should be designed to fly as far as possible. The other paper airplane should be designed to stay in the air as long as possible.

7. The airplanes must provide lift with wings, blades, or airfoils. "Planes" that provide lift through a rotating flat surface like a helicopter, disc, playing card, or throwing star are not allowed. Throwing a paper ball is not allowed.

Phase 2 - Execution

1. Teams may make a maximum of two flights for each paper airplane. Two flights are measured for distance and two separate flights are measured for time, for a maximum of four total flights. The longest measured distance flight, and the longest measured flight time will be used for scoring.

2. Teams will be given a four minute "Flight Period" starting when the team is called to the launch area. Team members may make adjustments and repairs to the paper airplanes between flights. Time for adjustments and repairs will be part of the four minute flight period.

3. Before launch, the Event Supervisor will call out the paper airplane to be flown.   The call out will be for the "distance plane" or the "time plane".

    a) The "distance plane" will be measured from the starting line to the point where the plane touches the ground (not to the final resting place if it slides).

    b) The "time plane" will be measured from the moment the plane leaves the team member's hand to the moment when any part of the plane touches the floor.

4. Each paper airplane must be launched by one person (the thrower) throwing the airplane unaided from behind a starting line. A run-up or fast walk as part of the launch is not allowed. The thrower must keep both feet on the ground and behind the starting line during launch. Failure to do this will result in a score of zero for that launch. Each launch can be by a different team member.

    The team members must **not** follow the airplane after release. If a team member leaves the launch area before they are called by the Event Supervisor, a score of 0 will be recorded for that flight. After each flight the plane will be marked with a permanent marker to indicate how many flights that plane has flown. Each plane may make only two complete flights. Any plane that flies a third or more times will receive a score of 0 for those flights.

All planes made during the event will be kept by the supervisors until the end of that grade's event. Students must mark their planes clearly with their school and grade

5. Resolution regarding any unusual or unforeseen circumstance affecting a plane during an official flight is at the discretion of the Event Supervisor. If a plane hits the wall in which a door to a classroom is set, and the plane drops, it will count as one of the flights and be recorded as is. If a plane hits a fire alarm or other obstruction and gets caught, whether it is a distance or a time throw, the team will have a chance to redo that throw. In general, walls and the ceiling are in play.

6. The launch area is a large high school corridor and therefore more confined in height and width than a gym or general purpose room. However, there is ample room to fly these paper airplanes.

Scoring

A team's score will be determined by adding the longest distance throw for the "distance plane" and the longest time in the air throw (multiplied by 5.5) for the "time plane".

Distance will be measured along the floor from the starting line to the point where the plane touches the ground (to the nearest tenth of a meter.) For example, if a plane touches the ground between 23.5 and 23.6 meters, the distance recorded will be 23.5 meters.

Time will be measured to the nearest tenth of a second.

Scoring Example

If the longest distance throw for the "distance plane" is 10.2 meters and the longest time for the "time plane" is 2.1 seconds, the team score would be:

distance_in_meters + (time_in_seconds * 5.5)   = Total Team Score

10.2   + (2.1 * 5.5)   = 21.75

Ranking is determined from the highest score to the lowest score. In other words, the higher the number, the better the team does in competition.

Tie Break Criteria

In the event of a tie in total score, the team with the longest time flight will win.

Materials Distributed by WESO

None.

Additional Materials useful for practices

standard 8½ x 11 inch 20 lb copy paper,
standard non-coated wire 1 ¼" long paper clips
20 cm of "Scotch" transparent tape
Pencil
Ruler
Scissors
Stopwatch
Tape measure

Materials to be brought to competition

None. Students are not to bring any notes or materials with them.

**No cell phones or smart watches are allowed in event rooms. Participants who bring those items will be asked to leave them with the event supervisor for the duration of the event. Participants observed using them during the event will be disqualified.

Event Questions
Please go to https://wesoscience.org/events/ for information on how to submit questions about this event to the supervisor.