

## HELICOPTERS

1. **DESCRIPTION:** Teams construct and test free flight rubber-powered helicopters prior to the tournament to achieve maximum flight times.

**A TEAM OF UP TO:** 2

**IMPOUND:** None

**TIME:** approximately 15 minutes

2. **EVENT PARAMETERS:**

- a. Teams must bring up to 2 helicopters. Teams may bring any tools and their flight log.
- b. Event Supervisor provides all measurement tools and timers.

3. **CONSTRUCTION PARAMETERS:**

- a. **DESIGN:** Helicopters may be constructed from published plan(s), commercial kits and/or a student's design. Kits must not contain any pre-glued joints or pre-covered surfaces. A flat balsa wood disc, large enough to cover a dime, must be the upper most part of the helicopter (the part that would touch a flat ceiling first during a flight) - rule 4.j. applies to the balsa disc.
- b. **MATERIALS:** Boron filaments must not be used anywhere on the helicopter. Any other material may be used anywhere on the helicopter.
- c. **MASS:** Total mass of the helicopter throughout the flight, excluding the rubber motor, **must be 3.0 grams or more.**
- d. **ROTORS:** Rotors are defined as surfaces that contribute lift by rotating on a common path around a vertical axis. The helicopter may use up to three fixed pitch rotors, not exceeding a **maximum diameter of 30.0 cm.** There is no maximum limit on the number of blades or their chord. There must not be any other lifting surfaces.
- e. **ROTOR CONSTRUCTION:** Competitors must construct the rotors themselves. Commercially available rotors or propellers must not be used in whole or part. Rotor thrust bearings may be commercially available items.
- f. **POWER:** The helicopter must be powered by rubber motor(s) of any mass. Motor(s) must be removable from the helicopter for check-in. Motors may be lubricated before and/or after check-in. Officials need not mass the motors.
- g. **MARKING:** Each helicopter must be labeled so the Event Supervisor can easily identify to which team it belongs.



4. **THE COMPETITION:**

- a. The event must be held indoors. Tournament officials must announce the room dimensions (approximate length, width and ceiling height) in advance of the competition. Tournament officials are urged to minimize the effects of environmental factors such as air currents (e.g., doors, fans). Rooms with minimal ceiling obstructions are preferred over very high ceilings.
- b. Once competitors enter the cordoned off competition area to trim, practice or compete, they must not receive outside assistance, materials or communication. Teams violating this rule will be ranked below all other teams. There must be a separate area designated for spectators.
- c. Each team must present a flight log of recorded data during inspection. Data must include at least 6 parameters for at least 10 test flights prior to the competition. The required parameters are: 1) motor size before windup, 2) number of turns on the motor at launch, 3) flight time. The team must choose 3 additional data parameters beyond those required (e.g. turns remaining after landing, estimated/recorded peak flight height, the motor torque at launch).
- d. At the Event Supervisor's discretion, practice flights may occur throughout the event but must yield to any official flight. Multiple practice flights may occur at the same time. No trim (practice) flights will be permitted in the last half-hour of the event, except for teams that declare a trim flight during their 8-minute flight period.

- e. A self-check inspection station may be made available to competitors for checking their helicopters prior to being checked by the Event Supervisor.
  - f. Competitors may use any type of winder, but electricity may not be available.
  - g. Competitors must present their event materials (helicopter(s), motor(s), and log) for inspection immediately prior to a team's 2 official flights. Event supervisors are strongly urged to return flight logs after inspection. Timers must follow and observe teams as they are winding their motors.
  - h. Teams may make up to a total of 2 official flights using 1 or 2 helicopters.
  - i. Teams will be given an 8-minute "Flight Period," starting when their first flight (trim or official) after check-in begins. Any flight beginning within the 8-minute period will be permitted to fly to completion. Participants may make adjustments/repairs/trim flights during their official 8-minute period. During their 8-minute flight period, all flights must be considered an official flight unless they are declared a trim flight prior to launch. Teams must not be given extra time to recover or repair their helicopter(s).
  - j. The timing official will measure and record the "Time Aloft" in hundredths of a second for each flight. Time Aloft for each flight starts when the helicopter leaves the competitor's hand and stops when any part of the helicopter touches the floor, the rotors no longer support the weight of the helicopter (such as the helicopter landing on a girder or basketball hoop) or the judges otherwise determine the flight to be over.
  - k. Event supervisors are strongly encouraged to utilize 3 independent timers on all runs. The middle value of the 3 timers will be the officially recorded time.
  - l. The Event Supervisor may permit other official flights during the flight of another team's helicopter.
  - m. Competitors must not steer the helicopter during flight. In the unlikely event of a collision with another helicopter, a team may elect a re-flight. The decision to re-fly may be made after the helicopter lands. The eight-minute period does not apply to such a flight.
5. **SCORING:** The base score is the team's longest single flight time. Ties will be broken by the longest non-scored flight time.
- a. Teams with incomplete flight logs must have 10% of their flight time deducted from each flight.
  - b. Teams without flight logs must have 30% of their flight time deducted from each flight.
  - c. Teams that violate a rule under "CONSTRUCTION" or "THE COMPETITION" that does not have a specific penalty must be ranked after all teams that do not violate those rules.

**Recommended Resources:** All reference and training resources including the **Helicopters DVD** are available on the Official Science Olympiad Store or Website at <http://www.soinc.org>

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