

HELICOPTER

1. **DESCRIPTION:** Prior to the tournament teams design, construct, and test free flight rubber-powered helicopters to achieve maximum time aloft.

A TEAM OF UP TO: 2

IMPOUND: None

TIME: 8 minutes

2. **EVENT PARAMETERS:**

- a. Teams bring up to 2 helicopters. Teams may bring any tools and their flight log.
- b. Event Supervisors must provide all measurement tools and timing devices.

3. **CONSTRUCTION PARAMETERS:**

- a. 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.
- b. 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 the flight.
- c. Any materials except Boron filaments may be used in construction of the helicopter.
- d. Total mass of the helicopter throughout the flight, excluding the rubber motor, must be 3.0 g or more.
- e. The helicopter may use up to three fixed pitch rotors, not exceeding a maximum diameter of **25.0 cm**. Rotors are defined as **one or more blades** that rotate on a common path around a vertical axis. There must not be any other lifting surfaces. There is no maximum limit on the number of blades per rotor or blade chord.
- f. **If a single-bladed rotor is used, the maximum radius from the center of rotation to the blade tip must be less than 15.0 cm. This does not include any non-lift generating counterweights. A blade is defined as a single surface designed to create lift force as it moves through the air.**
- g. Competitors must construct the rotors themselves. Commercially available rotors or propellers must not be used in whole or part. Commercial rotor thrust bearings may be used.
- h. 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.
- i. 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 and the Event Supervisor are urged to minimize the effects of environmental factors such as air currents. 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 must be ranked below all other teams. Spectators must be in a separate area.
- c. During inspection each team must present a flight log of recorded data. Data must include 6 or more parameters (3 required and at least 3 additional) for 10 or more 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, etc.).
- d. At the Event Supervisor's discretion:
 - i. Multiple official flights may occur simultaneously according to the Event Supervisor's direction.
 - ii. Test flights may occur throughout the contest but must yield to any official flight.
 - iii. No test flights will occur in the final half-hour of the event's last period, 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 their 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. After check-in teams must be given an 8-minute Flight Period, starting when their first flight (trim or official) begins. Any flight beginning within the 8-minute period will be permitted to fly to completion. Competitors may make adjustments/repairs/trim flights during their official 8-minute period. Competitors must declare to the Timers before any launches during their Flight Period whether it is an official flight or trim flight. If teams do not indicate the flight type before the launch, it must be considered official. Teams must not be given extra time to recover or repair their helicopters.
 - j. 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 Timers on all flights. The middle value of the 3 Timers must be the official Time Aloft for that flight, recorded in seconds to the precision of the device used.
 - l. Competitors must not steer the helicopter during flight.
 - m. 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. Timers are allowed to delay a launch to avoid a possible collision. 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. **For every single-bladed rotor assembly on the helicopter (up to 3) teams receive a 10% bonus added on their flight time (max 30%).**
 - b. Teams with incomplete flight logs must have 10% of their flight time deducted from each flight.
 - c. Teams without flight logs must have 30% of their flight time deducted from each flight.
 - d. 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: 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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