

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: motors only at check-in

TIME: 15 minutes

2. **CONSTRUCTION PARAMETERS:**

- a. DESIGN: Helicopters may be constructed from published plan(s), commercial kits, and/or a student's design.
- b. MATERIALS: The **functional components** (rotors, rotor blades, vertical stabilizing surfaces, and motor stick) of the helicopter must be constructed only from wood, paper, plastic film covering, and glue. **The functional components must not be constructed from rigid plastic.** The functional components may be attached to each other using **tape**, thread, music wire, malleable wire, paper, metal or plastic tubes, and/or rubber bands. **The helicopter may be braced with string of any base material.** Kits must not contain any pre-glued joints or pre-covered surfaces. Plastic or rubber o-rings may be used to attach the motor to the helicopter rotor(s).
- c. MASS: Total mass of the helicopter throughout the flight, excluding the rubber motor, must be 4.0 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 40.0 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) not exceeding a total mass of 2.0 g, including any attachments such as o-rings. **Motor(s) must be removable from the helicopter for check-in.** The motor(s) must be massed separately from the helicopter. Motors may be lubricated before and/or after check-in. Motors will be massed at check-in, and officials will impound qualified motors. Qualified motors will be made available to the team for official flights.
- g. MARKING: Each helicopter must be labeled so the Event Supervisor can easily identify to which team it belongs.

3. **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 (e.g., doors, fans).
- 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 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. Team members must present their event materials (helicopter(s), motor(s), and log) for inspection immediately prior to a team's 2 official flights. **Qualified motors must be held by the official timer and dispensed at the team's choosing during the team's 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 after check-in (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 **and qualify additional motors** during their official 8-minute period. Teams must declare 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 launch, it **must** be considered official. Teams **must** not be given extra time to recover or repair their helicopter(s).
 - j. **The team may select any previously approved motors held by the timer for each official flight.**
 - k. 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 **or the rotors no longer support the weight of the helicopter (such as the helicopter landing on a girder or basketball hoop).**
 - 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.
4. **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>

National Science Education Standard: Content Standard E: All students should develop abilities of technological design and understandings about science and technology.

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