

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

EVENT TIME: 8 minutes

2. **EVENT PARAMETERS:**

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

3. **CONSTRUCTION PARAMETERS:**

- Helicopters may be constructed from published plan(s), commercial kits and/or a student's design.
- Participants must not use any components with 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 the flight.
- Any materials except Boron filaments may be used in construction of the helicopter.
- Total mass of the helicopter throughout the flight, excluding the rubber motor, must be **3.00 g** or more.
- The helicopter may use up to three fixed pitch rotors, not exceeding a maximum diameter of **30.00 cm**. There is no maximum limit on the number of blades or their chord. Rotors are defined as one or more separate lifting surfaces, referred to as blades, that contribute lift by rotating on a common path around a vertical axis. There must not be any other lifting surfaces.
- Participants 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.
- Participants may use any type of winder, but electricity may not be available.
- 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.
- Each helicopter must be labeled so the event supervisor can easily identify to which team it belongs.
- Participants must be able to answer questions regarding the design, construction, and operation of the device per the Building Policy found at www.soinc.org.

4. **THE COMPETITION:**

- The event will be held indoors. Tournament officials will 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.
- Once participants enter the cordoned off competition area to trim, practice, or compete they must not receive outside assistance, materials, or communication. **Only participants may handle helicopter components until the event ends.** Teams violating this rule will be ranked below all other teams. Spectators will be in a separate area.
- 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 or torque 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 landing, etc.).
- At the Event Supervisor's discretion:
 - Multiple official flights may occur simultaneously according to the event supervisor's direction.
 - Test flights may occur throughout the contest but must yield to any official flight.
 - 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.
- A self-check inspection station may be made available to participants for checking their helicopters prior to being checked by the event supervisor.
- Participants will present their helicopter(s), motor(s), and flight log for inspection immediately prior to their **Preflight Period**.
- All motors that meet specifications will be collected at check-in and will be **re-issued** to the team only for their **Preflight Period** and 8-minute **Flight Period**. **Time taken during the Preflight Period will impact a team's final score (see 5.b.).** Timers will follow and observe teams as they are winding their motors. Event supervisors are strongly encouraged to return flight logs after inspection.

- h. A team's **Preflight Period ends with their first flight, trim or official, which starts their 8-minute Flight Period or 9 minutes passes after their motor has been returned; whichever comes first.**
 - i. Any flight beginning within the 8-minute Flight Period will be permitted to fly to completion. Teams may make adjustments/repairs/trim flights during their official 8-minute Flight Period. Teams must declare to the Timers before any launches during their 8-minute Flight Period whether it is an official flight or trim flight. If teams do not indicate the flight type before the launch, it will be considered official. Teams will not be given extra time to recover or repair their helicopters.
 - j. Teams may make up to a total of 2 official flights using 1 or 2 helicopters.
 - k. Time aloft for each flight starts when the helicopter leaves the participant'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 Timers determine the flight to be over.
 - l. Event supervisors are strongly encouraged to utilize three (3) timers on all flights. The middle value of the three (3) timers must be the official Time Aloft for that flight, recorded in seconds to the precision of the device used.
 - m. Participants must not steer the helicopter during flight.
 - n. 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 8-minute Flight Period does not apply to such a flight.
 - o. The supervisor will review with the team data being recorded on their scoresheet.
5. **SCORING:**
- a. The base score is the Team's longest single flight time. Ties will be broken by the longest non-scored flight time.
 - b. **Once a team has been re-issued their motors, prior to their 8-minute Flight Period, a timing official will start a Preflight Period stopwatch. If their first helicopter flight, trim or official, is launched within 3 minutes of the return of motors a 5% bonus will be added to the base score. If the 8-minute Flight Period begins between 3 minutes and 6 minutes, no bonus is awarded. If the 8-minute Flight Period begins after 6 minutes, 10% will be deducted from the base score. After 9 minutes have passed since the return of motors the 8-minute Flight Period will start.**
 - c. Teams with a helicopter with non-coaxial rotors whose axes of rotation are separated by at least the radius of the rotors (e.g., Chinook or Piasecki style) must have their recorded flight time multiplied by 2.5 for scoring purposes.
 - d. **A bonus of 10% of the flight time will be added to the flight time of a helicopter that has the surface of at least one blade between the leading and trailing edges and between the outermost and next inboard rib on each rotor marked with a black marker or covered with black tissue. If no ribs are present, the whole surface must be black.**
 - e. Teams with incomplete flight logs must have 10% of their flight time deducted from each flight.
 - f. Teams without flight logs must have 30% of their flight time deducted from each flight.
 - g. 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: The Science Olympiad Store (store.soinc.org) carries the Helicopters Video and Problem Solving/Technology CD; other resources are on the event page at soinc.org.

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