

HELICOPTER DURATION rev. 9-24-09

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

A TEAM OF UP TO: 2

IMPOUND: motors only

TIME: 8 minutes

2. **CONSTRUCTION PARAMETERS:** Teams shall construct and test helicopters prior to the tournament. All helicopters must meet the following specifications:
 - a. **DESIGN:** Helicopters may be constructed from published plan(s), commercial kits and/or a student's design.
 - b. **MATERIALS:** Helicopters must be constructed only from wood, paper, plastic film covering and glue. The major components (rotors, vertical stabilizing surfaces, and motor stick) may be attached to each other using thread, music wire, malleable wire, paper or plastic tubes, and/or rubber bands. Kits may be used however; they may 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:** Up to three fixed pitch rotors, not exceeding a maximum diameter of 40.0 cm each may be used to provide lift. There is no maximum limit on the number of blades or their chord. Rotors are defined as surfaces that contribute lift by rotating around a vertical axis. There shall be no other lifting surfaces.
 - e. **ROTOR CONSTRUCTION:** Students shall construct the rotors themselves. Commercially available rotors or propellers shall not be used. Bearings, rotor thrust bearings may be commercially available items.
 - f. **POWER:** The helicopter will be powered by rubber motor(s) not exceeding a total mass of 2.0 grams (including any attachments such as o-rings). The motor(s) will 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 in such a way as to be easily identified by the event supervisor.
3. **THE COMPETITION:**
 - a. **FLYING SPACE:** The event must be held indoors. The room dimensions (approximate length, width and ceiling height) shall be made available to teams in advance of the competition. Directors and supervisors are urged to minimize the effects of environmental factors such as air currents (e.g., doors, fans) by pre-arranging for ventilation to be turned off, windows to remain closed, and doors to be kept closed during flights. .
 - b. **SPORTSMANSHIP:** Once teams enter the flight room on the day(s) of Helicopter Duration competition, no persons may attempt to give teams outside assistance, materials or communication. This applies to any trim periods as well as during the official flying schedule. Teams violating this rule will be disqualified. Competitors may offer assistance to other teams. A separate area will be designated for spectators, who may not interact with the teams except with encouragement
 - c. **FLIGHT LOGS:** Each team must present flight log of recorded data during inspection. Data will include at least 6 parameters for at least ten test flights prior to the competition. The three required parameters to be recorded are: 1) motor size before windup, 2) number of turns on the motor at launch, 3) flight time. The team must choose the 3 additional data parameters beyond those required, for example, turns remaining after landing, estimated/recorded peak flight height, estimated flight path diameter, the torque at launch, etc.
 - d. **PRACTICE FLIGHTS:** At the Event Supervisor's discretion, practice flights may occur throughout the event but will 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.

- e. A self-check inspection station may be made available to competitors for checking their helicopters prior to being checked by the judges.
 - f. The use of any type of motor winder is permitted.
 - g. CHECK IN and PREPARATION: Inspection for each team will take place 15 minutes prior to that team's 2 official flights. Team members will present their event materials (at most TWO helicopters, any number of motors, and flight log) during their inspection. Flight Logs are returned to the team members after inspection. Each team's approved motors will be dispensed by the official timer during said team's official flights. Timers will be assigned to accompany and observe teams as they prepare for flight, wind their motors and fly.
 - h. FLIGHTS: Teams may make up to a total of 2 official flights using one or two helicopters.
 - i. Teams will be given an 8 minute "Flight Period", starting when their first official flight begins, to launch their official flights. 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. Teams must declare before any launches during their 8 minute flight period as whether it is an official flight or trim flight. Teams will not be given extra time to recover or to repair their helicopter(s).
 - j. MOTORS: The official timer will allow the team members to select a motor for each official flight from their approved motors.
 - k. TIMING: The judges will measure and record the "Time Aloft" to the nearest tenth of a second for each flight. Time Aloft for each flight starts when the helicopter leaves the student's hand and will stop when any part of the helicopter touches the floor or is arrested on or in any object, or when the judges have determined the flight has ended.
 - l. CONCURRENT FLIGHTS: The Event Supervisor may permit other official flights during the flight of another team's helicopter once the prior helicopter has started its descent. In the unlikely event of a collision with another helicopter, teams may elect to re-fly that flight. The decision to re-fly may be made after the helicopter lands. Re-flights shall not be limited by the 8 minute flight envelope.
 - m. STEERING: Steering the helicopter during flight is prohibited.
4. **SCORING:** Base score is the team's longest flight time for a single flight. Ties will be broken by the longest time of the second flight.
- a. Bonus:
 - i. State Tournaments Only: 15% of the flight time will be added if the helicopter uses only two rotors.
 - ii. National Tournament Only: 30% of the flight time will be added if the helicopter uses only one rotor.
 - b. Teams with incomplete flight logs will have 10% of their flight time deducted from each flight.
 - c. Teams without flight logs will 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 will be ranked after all teams that do not violate those rules.

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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