

SCIENCE OLYMPIAD INDOOR TOWLINE GLIDER

1. **DESCRIPTION:** Teams will construct and test up to two monoplane gliders that will be launched from a towline to achieve maximum flight times.

A TEAM OF UP TO: 2 IMPOUND: NO TIME: 8 MINUTES

2. **CONSTRUCTION:** Prior to the tournament, participants may construct and test gliders from published plans, commercial kits and/or a student's design. All gliders must meet the following specifications:

- (a) Gliders must be constructed only from wood, plastic foam, paper or plastic film covering, and glue. The major components (wing assembly, tail assembly or fuselage) may be attached together using thread, music wire, malleable wire, paper or plastic tubes, and/or rubber bands. Kits may not contain any pre-glued joints or pre-covered surfaces. Wing and tail assemblies may not be solid wood.
- (b) Any dense material may be used for ballast.
- (c) Total mass of the glider must be at least 4.0 grams and less than 8.0 grams throughout the flights.
- (d) The glider must be a monoplane (one wing) not exceeding a maximum horizontally projected wingspan of 45.0 cm, a maximum wing chord (straight line distance from leading edge of wing to trailing edge, parallel to fuselage) of 12.0 cm, a maximum horizontally projected stabilizer span of 25.0 cm and a maximum stabilizer chord of 8.0 cm.
- (e) Each glider must be labeled in such a way as to be easily identified by the event supervisor.

3. **THE COMPETITION:**

- (a) The event must be held indoors. The room dimensions (approximate length, width and ceiling height) should be made available to teams in advance of the competition. Directors and event supervisors are urged to minimize the effects of environmental factors such as air currents (e.g. opened doors, HVAC fans, people walking/running in the event area).
- (b) Only contestants and judges will be allowed in the event area while teams are competing. Once teams enter the event area to compete, they may not leave the area to receive outside assistance, materials or communication until they are finished competing. Teams violating this rule will be disqualified. A separate area should be provided for spectators.
- (c) Each team should present a flight data log at check-in. To be complete, the log must contain a minimum of 4 parameters recorded for each of ten or more flights flown prior to the competition. The minimum of parameters recorded must be:
 - i. Approximate height of the glider after release from the towline
 - ii. Flight time from towline release until the glider stops flying
 - iii. Length of towline let out before towing.
 - iv. Any other parameter selected by the team. The same parameter must be recorded for each flight. Suggested parameters are towline attachment location (distance from wing leading edge; distance from side of fuselage), towing method (walking, pulling in line, etc.), center

of gravity location (distance from wing leading edge).

- (d) Each team must supply a towline equipped with a visible “flag,” at least 2 cm by 10 cm, to indicate when the towline falls away from the glider. The flag must be no more than 0.5 meter away from the glider when attached. The towline is attached to the glider’s fuselage in such a manner that uncoupling the two is readily accomplished, e.g. hook and ring. There is no limit on the length or composition of the towline. Towing methods are restricted to either walking with the towline or pulling in line (hand-over-hand or with a reel). Running with the towline will not be allowed.
 - (e) 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 practice flights will be permitted in the last half-hour of the event.
 - (f) A self-check inspection station may be made available to competitors for checking their gliders prior to being checked by the judges.
 - (g) Students will check in with their event gliders, towline, and flight data log for inspection immediately preceding their official flights.
 - (h) Teams may make up to a total of three official flights using one or two gliders.
 - (i) Teams will be given an 8-minute “Flight Period,” starting when their first official flight begins (glider on tow separates from the towline). Any flight beginning within the 8-minute period will be permitted to fly to completion. Participants may make adjustments/repairs to the gliders between flights, however, time for such adjustments/repairs will be part of the 8-minute flight period. Teams may make practice flights during their 8-minute flight period if they so declare. Flights not declared as practice flights will be scored as official flights.
 - (j) The judges will measure and record the “Time Aloft” to the nearest tenth of a second for each flight. Time aloft begins when the towline “flag” is seen to leave the glider and stops when any part of the glider touches the floor or when the judges determine that the flight has ended.
 - (k) Steering the glider during flight is prohibited. In the event of a collision of the glider with another aircraft or a towline of another team, a team may elect a re-flight. The decision to re-fly may be made after the glider lands. The 8-minute period does not apply to such a re-flight.
4. **SCORING:** The winner is the team with the longest Time Aloft for two flights. The best two flights will be added together and that will be the overall score. Ties will be broken by the third longest flight time.
- a. Teams with incomplete flight data logs will have 10% of the flight time deducted from each flight.
 - b. Teams without a flight data log will have 30% of the flight time deducted from each flight.
 - c. 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 the rules.

Chuck Markos, April 19, 2010
Illinois event supervisor

Rationale for Indoor Towline Glider Event in Science Olympiad competition.

Flight events in the Science Olympiad competitions have been dominated by rubber-powered models (Wright Stuff) for several years. The Balloon Launch Glider event had generated some enthusiasm among Div B schools but the expense of helium-filled balloons was a problem. There is need for a bona-fide flight event in the Science Olympiad event rotation. A towline glider event has an advantage over the rubber-powered and balloon glider events in minimal auxiliary expense. The only element outside of the airplane itself is a length of fishing line and, possibly, a fishing reel, available at any sporting goods store. No other resources outside those already available to the Science Olympiad flight events are required.

Indoor towline gliders have been flown recently in contests sanctioned by the Academy of Model Aeronautics (AMA) with specifications similar to those proposed in this document. The major change from those specifications for the Science Olympiad proposal is to raise the minimum mass from 3 grams to 4 grams. Three-gram models of the size specified for the Science Olympiad have a performance capability of about 35 – 50 seconds in a typical school gymnasium. A 4-gram minimum mass is proposed to lessen the need for more exotic coverings and also to provide an airframe that will stand up to the stresses of towing in the hands of beginners. To show feasibility I have run tests with obsolete tissue paper-covered Wright Stuff models converted to towline models weighing about 4-5 grams after removing the propeller. The action of towing an Indoor glider is quite gentle. A slow- to moderate walking pace will do. A second method of flying the glider requires no walking at all. The flyer simply pulls in line hand-over-hand to gain altitude. An 8-gram maximum mass is proposed to make the event a true Indoor model airplane event. Heavier airplanes will require vigorous effort to gain altitude that will not be compatible with an Indoor setting see Rules 3(a) and 3(d) above.

There is a new set of challenges to the participants. To attain altitude gain by towing is a difficult task that first of all requires an airplane that actually flies. I have observed many Balloon Gliders that were so poorly balanced that a true gliding flight was impossible. They either just dive to the floor or waft back and forth like a leaf falling from a tree. Once balance is attained, the skill to make a glider that flies in a circle reach altitude on tow takes not a small amount of practice and flight adjustment. Experiments with towline attachment locations, center of gravity locations, and wing incidence adjustments will be required. The challenge in building is to engineer the structure so that high-stress areas are made stronger (heavier) than low-stress areas while keeping the total airframe weight close to the minimum allowed.

One team at the 2010 Illinois State Tournament accomplished an 80+ second flight two days after building their airplane (2.5 hours from a kit that I prepared) and over three hours of practice flying. They still had not optimized the flight of the glider that had potential for an 150 second flight in the UICU 90-ft armory. Teams that have tried and succeeded with Indoor towline gliders are universally enthusiastic about the event unlike the response given to the ill-fated “Flying Bird” trial event.