



## OVERVIEW

Participants study the principles of flight and design in order to fabricate a glider that stays in flight for the greatest elapsed time. The glider must be designed to be launched from a catapult that is provided on site. The design process is documented in a portfolio that is submitted for evaluation.

## ELIGIBILITY

Two (2) members per chapter may participate, one (1) entry each.

## SAFETY

- A. Participants are required to provide and wear safety-approved eyewear during all phases of this event.
  - 1. Prescription eye wear will need to have side shields to be considered safety eyewear.
  - 2. Should a participant remove his/her eyewear during the event, s/he will be reminded once to replace it. If there is a second infraction, the participant will be disqualified and asked to leave the competition.
  - 3. TSA will not supply safety glasses.
- B. Participants must be instructed by their advisors on the proper use of cyanoacrylate (CA) glue.

## TIME LIMITS

- 1. Participants have ninety (90) minutes to construct a glider.
- 2. Participants are given a maximum of thirty (30) minutes for trimming (test flights) of their glider.

## LEAP

An individual LEAP Response is required for this event and must be submitted at event check-in (see LEAP Program).

## ATTIRE

TSA competition attire is required.

## PROCEDURE

### Preliminary Round

- 1. Participants report to the event area at the time and place stated in the conference program with their metric technical drawing, portfolios, tools, and supplies, and submit their LEAP Response.
- 2. Participants use their metric technical drawing to fabricate a glider.
- 3. Portfolios are evaluated.
- 4. Participants have four (4) opportunities to fly their gliders for official times.

### Launch Procedures

- 1. Participants are called by their group timer to the designated launch area.



- a. The timers give each participant a turn to fly his/her glider. Participants must do all four (4) flights consecutively during their turn.
  - b. The glider is hooked to the rubber loop of the catapult provided by TSA, and the participant pulls the glider's shark tooth point back to the wooden stop in front of the 350mm stop block on the catapult. The altitude and angle of the catapult (with the glider on it) are determined by participants as the glider is launched.
  - c. The participant releases the glider after getting the OK from the official timer.
2. Flight time begins when the glider is released and ends when the glider hits the floor or ground, or when it comes to rest on an obstruction.
  3. One repair will be allowed after the individual time trials have begun.
    - a. The repair must be made in three (3) minutes or less.
    - b. No additional trimming will be allowed after the repair.
  4. Each participant has the times of four (4) trial flights recorded by the timer.
  5. Ties are broken by determining the longest single flight time.
  6. The combined flight time of the best three (3) of the four (4) flights is used to determine the twelve (12) semifinalists.
  7. A list of twelve (12) semifinalists (in random order) will be posted.

### **Semifinal Round**

1. The LEAP Response will be judged for semifinalists.
2. Ten (10) finalists will be announced during the conference award ceremony.

## **REGULATIONS**

### **Preliminary Round**

- A. Students are required to provide and wear safety eyewear for this event.
- B. Documentation materials (comprising a "portfolio") are required and should be secured in a clear front report cover. (Click [here](#) for a sample.)
  1. The report cover must include the following single-sided, 8½" x 11" pages, in this order:
    - a. Title page with event title, conference city and state, the year, and the participant's ID number; one (1) page
    - b. Full-size metric technical drawing with dimensions of the glider to be built; 11" x 17" paper may be folded to fit in the sheet protector.
    - c. Pictures of two (2) test gliders will be included in the portfolio (participants are to submit only one (1) picture of each test glider, for a total of two (2) pictures).
    - d. Flight log for each pictured test glider (see Flight Log sample)
    - e. A graphic flow chart with picture and design principles used in building and adjusting gliders used for successful flights.
  2. Participants are not allowed to construct a glider without a completed technical drawing in their documentation portfolio.
- C. The technical drawing must
  1. be created using CAD, or be hand-drawn with traditional mechanical drawing instruments
  2. NOT be a freehand sketch

3. show all parts that make up the glider
  4. show metric dimensions
  5. be drawn to full scale
  6. be drawn on a single sheet of paper no larger than 11" x 17"
- D. Participants are required to provide their own tool box.
1. Each tool box must include identification (school name, address, and advisor cell phone number).
  2. The tool box is not to exceed twenty (20) inches (508 mm) length x ten (10) inches (254 mm) width x ten (10) inches (254 mm) height.
  3. The box must contain all items needed to fabricate the solution.
  4. Participants are not permitted to share toolboxes.
  5. The following is a suggested list of tools:
    - a. Cutting devices; NONE may be electric
    - b. Adhesives
      - i. aerosol and electric applicators are not allowed
      - ii. a bottle of Uncure or Debonder is recommended
      - iii. a single two (2)-ounce bottle of accelerant (pump or drip) is permitted
    - c. Temporary fastening devices
      - i. straight pins
      - ii. clamps
      - iii. tape
    - d. A cutting surface that prevents table-top marring (required)
    - e. Rulers, straightedges, and/or measuring scales
    - f. Abrasives sheets, sponges, boards
    - g. Marking devices (pens, pencils, etc.) and sharpener
    - h. Sheet of wax paper, as large as is needed for the competition (required)
    - i. Safety glasses, as required
- E. Materials (**SUPPLIED BY THE PARTICIPANT**)
1. There is no limit on the size or quantity of materials brought to this competition.
  2. Balsa and/or basswood must be the material used to create the glider.
  3. Mold-able ballast material, i.e. clay
  4. Participants are not permitted to share.
  5. No precut pieces will be allowed.
- F. Glider Size Regulations
1. Extra wooden parts will not be allowed, therefore wood should be chosen carefully.
  2. Balsa and/or basswood plus ballast material
    - a. fuselage
 

Thickness	Min 3mm ( $\frac{1}{8}$ " )		
Height	Min 9.525(3/8")	Max 19.05mm (3/4")	
Length	Min 260.35 (10 1/4")	Max 273.05mm (10.75")	

- b. wing blank
 

Thickness	Min 1.5mm (1/16")	
Width	Min 63.5mm (2 1/2")	Max 77mm (3")
Length	Min 241.3 (9 1/2")	Max 300mm (11 7/8")
- c. stabilizer
 

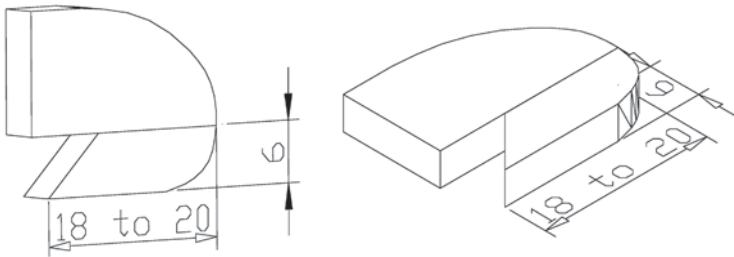
Thickness	Min .75mm (1/32")	
Width	Min 25.4mm (1")	Max 51mm (2")
Length	Min 77mm (3")	Max 150mm (5 7/8") long
- d. fin
 

Thickness	Min .75mm (1/32")	
Width	Min 25.4mm (1")	Max 51mm (2")
Height	Min 25.4mm (1")	Max 77 mm (3")
- e. wooden shark's tooth hook is permitted (glued to the bottom of the fuselage or cut into the fuselage)
 

Thickness	Min 3mm (1/8")	
Width	Min 6mm (0.23622")	Max 7 mm (0.275591")

  - i. Distance from the front to the bottom of the tooth
 

Min 18mm (0.708661")	Max 20mm (0.787402")
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- G. Catapult specifications (to be used for trim and experimentation at home, school, and during preparation prior to time trial flights):
1. Catapults for timed flights at the national event site are supplied by TSA.
  2. Participants who prefer to do so may use their own catapults during trim flights.
  3. During time trial flights, ONLY catapults provided by TSA may be used.
  4. Catapults are made from hardwood or plywood.
  5. Catapult wooden stick dimensions: laminate a piece of wood (10mm thick x 45mm wide x 700mm long) to a second piece of wood (6mm thick x 45mm wide x 350mm long), aligning the pieces at the handle end and gluing them face-to-face (see drawing).
  6. The handle is 20mm thick x 30mm wide x 150mm long and is attached by screws to a 15mm thick x 30mm wide x 75mm long block using a middle-lap joint. The 75mm long block then is screwed to the laminated main catapult stick beginning at 400mm from the muzzle end.
  7. The rubber loop is a #19 rubber band 3 1/2" x 1/16" threaded through the screw eye of the launcher. Rubber bands are available in bulk from office suppliers such as Office Max, Office Depot, and Staples.
  8. The screw eye is attached to the center of the 15mm thick x 15mm wide x 45mm long wooden block connected to the underside of the muzzle end of the catapult.
- H. Templates, jigs, and fixtures MAY be used in constructing gliders (these are to help facilitate fast and accurate construction).

- I. Templates, jigs, and fixtures must be developed and built by students.
- J. Storage container—All student-made items must fit in a box not exceeding 254mm high x 254mm wide x 508mm long.
- K. Sanding blocks—These may have two (2) grits affixed to the top and bottom; grits are chosen by the student.
- L. Traction plate with sandpaper (150mm x 300mm maximum) attached to a thin piece of rigid material, i.e., plywood, foam core board, press board, cardboard, plastic, etc.
- M. Dihedral fixture—This is an all-wood apparatus that assists in sanding the critical dihedral joints and secures the model as the glue dries to ensure a precise prototype.

### **Semifinal Round:**

- N. The LEAP Response:
  1. Participants document the leadership skills they have developed and demonstrated while working on this event, and on a non-competitive event leadership experience.
  2. Find specific LEAP Response regulations in the LEAP Program section of this guide, and on the [TSA website](#).

## **EVALUATION**

Evaluation is based on:

1. Points earned for the quality of the documentation portfolio
2. Points earned for the accumulated flying time of three (3) trials
3. The content and quality of the LEAP Response (semifinalists only)

Refer to the official rating form for more information.

## **STEM INTEGRATION**

This event has connections to the STEM areas of Science, Technology, Engineering, and Mathematics.

## **CAREERS RELATED TO THIS EVENT**

This competition connects to one or more of the careers below:

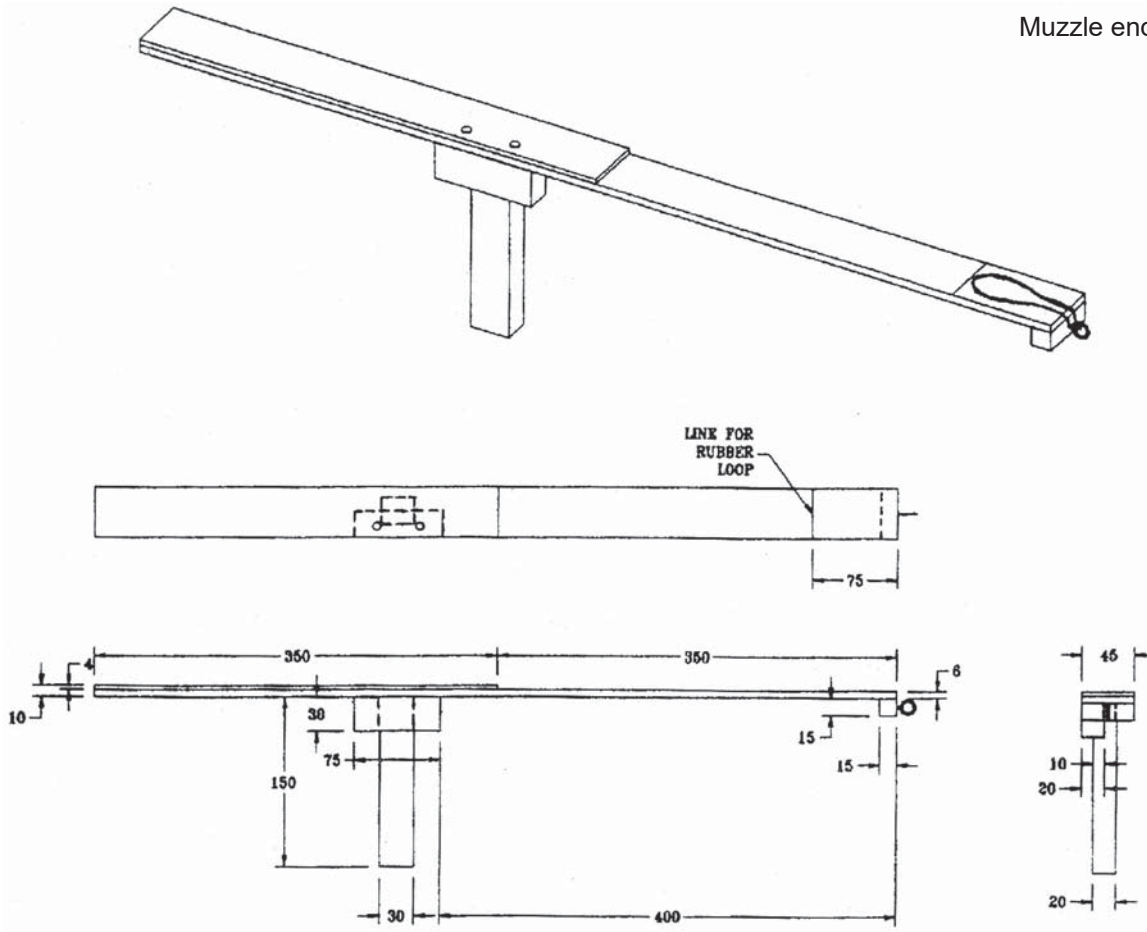
- Aeronautical engineer
- Aircraft systems engineer
- Physics instructor

## **NOTES**

1. Tools must fit inside the tool box, which must measure no more than twenty (20) inches (508 mm) length x ten (10) inches (254mm) width x ten (10) inches (254 mm) height. Participants should bring the tools needed and leave the rest behind. Transporting and checking in will be made simpler with a smaller and lighter tool box.
2. This event requires the use of cyanoacrylate glue (best know as Super/Krazy glue) instead of aliphatic resin glue. Participants should practice with this material before the conference.

### CATAPULT DRAWING

Muzzle end



### Flight Log sample

Glider #1 or Glider #2 (circle one)			Dates:	
Flight #	Time aloft	Flight pattern	Trim adjustment	Advisor sign-off
#1				
#2				
#3				
#4				
#5				
#6				
#7				
#8				
#9				
#10				

# FLIGHT

## EVENT COORDINATOR INSTRUCTIONS

### PERSONNEL

- A. Event coordinator
- B. Judges:
  - 1. Preliminary round, two (2) or more
  - 2. Semifinal round, two (2) or more
- C. Assistants, two (2) or more
- D. Timekeepers, two (2) or more

### MATERIALS

- A. Coordinator's packet, containing
  - 1. Event guidelines, one (1) copy for the coordinator and each judge/assistant
  - 2. TSA Event Coordinator Report
  - 3. List of judges/assistants
  - 4. Stopwatches, two (2) or more
  - 5. Results envelope with coordinator forms
- B. Other supplies
  - 1. Measuring scales
  - 2. First aid kit with strip bandages and debonder
  - 3. Catapults, five (5)
  - 4. #19 rubber bands
  - 5. Metric rulers

### RESPONSIBILITIES

- A. At the conference:
  - 1. Attend the mandatory coordinator's meeting at the designated time and location.
  - 2. Report to the CRC room and check the contents of the coordinator's packet.
  - 3. Review the event guidelines and check to see that enough evaluators/assistants have been scheduled.
  - 4. Inspect the area(s) in which the event is to be held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.
  - 5. At least one (1) hour before the event is scheduled to begin, meet with judges/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.
- B. Preliminary round:
  - 1. Check in participants at the time stated in the conference program.
  - 2. Check each documentation portfolio for the sketch.
  - 3. Check each toolbox for allowed items (including safety glasses, cutting board, and wax paper) and for appropriate size.
  - 4. Distribute the list of entrants assigned to each designated judge/timer.



5. After the gliders have been constructed, secure the holding area so that the gliders and documentation portfolios remain safe until the scheduled time for trimming.
  6. Designate times for test flying/trimming and communicate the thirty (30)-minute segment scheduled for each group of participants.
  7. Designate times for groups to make four (4) official flights for time.
  8. Timed flight procedure
    - a. Each flight time is recorded to the nearest one hundredth (.01) of a second.
    - b. After the fourth flight, the top three (3) flight times are added together, then multiplied by three (3) to obtain the total flight score; each glider is placed with its documentation portfolio.
    - c. Three (3) groups may fly simultaneously in the assigned area for the event, with consideration for the safety of gliders and participants.
    - d. Each participant will receive a new rubber band for each of their test flights.
  9. Documentation portfolios are judged.
  10. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either
    - to deduct twenty percent (20%) of the total possible points in this round or
    - to disqualify the entry
    - The event coordinator, judges and CRC manager must all initial either of these actions on the rating form.
  11. Judges determine the twelve (12) semifinalists and discuss and break any ties.
  12. Submit the semifinalist results and all related forms in the results envelope to the CRC room.
  13. If necessary, manage security and the removal of materials from the event area.
- C. Semifinalist Round:
1. Judges independently evaluate the LEAP Response for each semifinalist participant using the official rating form.
  2. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either
    - to deduct twenty percent (20%) of the total possible points in this round or
    - to disqualify the entry
    - The event coordinator, judges and CRC manager must all initial either of these actions on the rating form.
  3. Judges determine the ranking of the ten (10) finalists and discuss and break any ties.
  4. Submit the finalist results and all related forms in the results envelope to the CRC room.
  5. If necessary, manage security and the removal of materials from the event area.



Participant/Team ID# \_\_\_\_\_

# FLIGHT

## 2018 & 2019 OFFICIAL RATING FORM

## MIDDLE SCHOOL

Safety glasses must be worn for all phases of this competition. Should a participant remove his/her eyewear during the event, s/he will be reminded once to replace the eyewear. If there is a second infraction, the participant will be disqualified.

Safety glasses  
warning

Safety glasses  
disqualification

### Go/No Go Specifications

Before judging an entry, ensure all items are present; indicate presence with an "X" in the box. If an item is missing, leave the box blank and place an "X" in the box labeled ENTRY NOT EVALUATED; this disqualifies the entry and it is not to be judged.

- Safety eyewear is present
- Toolbox size
- Building material
- Portfolio is present
- Completed LEAP document is present
- ENTRY NOT EVALUATED

### Criterion Performance Levels

CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
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Evaluators: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline, record the scores earned for the event criteria in the column spaces to the right. The X1 or X2 notation in the criteria column is a multiplier factor for determining the points earned. (Example: an "adequate" score of 7 for an X1 criterion = 7 points; an "adequate" score of 7 for an X2 criterion = 14 points.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.

### Documentation (60 points)

<b>Portfolio</b> (X1)	Portfolio is unorganized and/or missing three or more components.	Portfolio may be missing up to two components; it is mostly organized.	All components are included in the portfolio, and content and organization are clearly evident.
<b>Full scale technical drawing</b> (X1)	Technical drawing is missing two or more components; parts of the glider are not shown; non-metric dimensioning is used; technical drawing is not drawn to full scale and/or is on paper larger than 11"x17", and/or it is sloppy.	Technical drawing may be missing one component; the technical drawing is largely correct and neatly completed.	All components are included in the technical drawing and the drawing is correctly and neatly completed.
<b>Technical drawing/built glider correlation</b> (X1)	Glider built for the competition does not match the technical drawing in dimensions or appearance; glider is not designed/built properly for the event.	Glider is similar to the technical drawing within a tolerance of 5mm; glider is designed correctly to fly in the competition.	Glider is within a tolerance of 2mm of the technical drawing; glider is constructed exactly as the technical drawing illustrates.
<b>Test glider pictures</b> (X1)	One test glider photo is missing, and/or pictures are not clearly visible, and/or they lack definition/detail of each glider.	Pictures of both test gliders are included; each picture is clearly visible, but pictures provide only adequate definition and/or detail.	Both test glider pictures include significant details and annotations about each glider; clearly visible pictures are defined.
<b>Flight logs</b> (X1)	One flight log is missing, and/or the logs are incomplete, and/or advisor signature is not included.	Both logs are included and they are generally complete.	Both logs are included and are complete, with a thorough understanding of a flight log's purpose as a flight aid.

Record scores in the column spaces below.



Documentation continued (60 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>Graphic flow chart (X1)</b>	Graphic flow chart is unclear; the majority of the design principles are not addressed or are missing; pictures are missing.	Graphic flow chart is partially clear; most of the design principles are addressed and/or are present; some pictures are missing.	Graphic flow chart is clearly followed; all design principles are addressed; all pictures are present.
<b>DOCUMENTATION SUBTOTAL (60 points)</b>			
Flights (recorded to the nearest one hundredth [.01] of a second)			
<b>Duration of flight #1</b>			<b>Seconds</b>
<b>Duration of flight #2</b>			<b>Seconds</b>
<b>Duration of flight #3</b>			<b>Seconds</b>
<b>Duration of flight #4</b>			<b>Seconds</b>
<b>The flight duration times of the three (3) longest flights are added, then multiplied by three (3) to obtain the subtotal flight score.</b>			
<b>SUBTOTAL Flight Score</b>			
Rules violations (a deduction of 20% of the total points earned) must be initiated by the evaluator, coordinator and manager of the event. Record the deduction in the space to the right.			
Indicate the rule violated: _____			
Semifinal LEAP Response (6 points)			
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points
<b>LEAP Response (10% of the total event points)</b>	The individual's efforts are not clearly communicated, lack detail, and are unconvincing; few, if any, attempts are made to identify and incorporate the SLC Practices.	The individual's efforts are adequately communicated, include some detail, are clear, and are generally convincing; identification and incorporation of the SLC Practices are satisfactory.	The individual's efforts are clearly communicated, fully-detailed, and convincing; identification and incorporation of the SLC Practices are excellent.
<b>SEMIFINAL LEAP RESPONSE SUBTOTAL (6 POINTS)</b>			
Rules violations (a deduction of 20% of the total points earned) must be initiated by the evaluator, coordinator and manager of the event. Record the deduction in the space to the right.			
Indicate the rule violated: _____			
<b>SEMIFINAL SUBTOTAL (6 POINTS)</b>			
(To arrive at the TOTAL score, add the PRELIMINARY SUBTOTAL and the SEMIFINAL SUBTOTAL.)			<b>TOTAL (66 POINTS)</b>

Comments:

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I certify these results to be true and accurate to the best of my knowledge.

Evaluator

Printed name: \_\_\_\_\_ Signature: \_\_\_\_\_