

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) individuals per chapter may participate.

TIME LIMITS

PRELIMINARY ROUND

1. Participants will test their prebuilt glider for three (3) flights with no additional trim time.

SEMIFINAL ROUND

1. Participants have forty-five (45) minutes to construct a glider.
2. Participants are given a maximum of fifteen (15) 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.

ATTIRE

TSA competition attire is required.

SAFETY

1. Participants are required to provide and wear safety-approved eyewear during all phases of this event.
2. Prescription eye wear will need to have side shields to be considered safety eyewear.
3. Should a participant remove his/her eyewear during the event, he/she will be reminded once to replace it. If there is a second infraction, the participant will be disqualified and asked to leave the competition.

4. TSA will not supply safety glasses.
5. Participants must be instructed by their advisors on the proper use of cyanoacrylate (CA) glue.

PROCEDURE

PRELIMINARY ROUND

On-site Testing of Pre-Built and Trimmed Gliders

1. Participants check-in the following at the time and place stated in the conference program:
 - a. The completed glider
 - b. The portfolio
 - c. A hard copy of the LEAP Response with no report cover, and separated from the portfolio
 - d. Safety glasses
2. On-site Testing:
 - a. During the testing participants must provide and wear safety glasses.
 - b. No trim time is allotted during the preliminary round.
 - c. After check-in, participants will test their prebuilt glider for three (3) flights.
3. Scoring: After the third flight, the three (3) flight times are averaged to obtain the average flight time; If a plane is unable to be tested the time will be marked as a zero (0).
4. Twenty (20) semifinalists will be determined by the top twenty (20) averaged test flight times.
5. Participants pick up their entries at the time specified in the conference program.

SEMIFINAL ROUND

On-site Reconstruction of Glider and Flight Testing

1. Twenty (20) semifinalist teams report to the event area at the time and place stated in the conference program.
2. Participants will provide their own toolbox and building materials for the on-site construction portion (see regulations).
3. Participants must provide and wear safety glasses.

4. Participants use their metric technical drawing to fabricate a glider.
5. Participants will have 30 minutes to trim their glider in the designated area.
6. Portfolios are evaluated.
7. Participants have three (3) opportunities to fly their gliders for official times.
8. Launch Procedures:
 - a. Participants are called by their group timer to the designated launch area.
 - i. Each participant receives a turn to fly his/her glider.
 - ii. Participants must do all four (4) flights consecutively during their turn.
 - iii. 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 or less on the catapult. The altitude and angle of the catapult (with the glider on it) are determined by participants as the glider is launched.
 - iv. The participant releases the glider after getting the OK from the official timer.
 - b. Flight time begins when the glider is released.
 - c. Flight time ends when the glider hits the floor or ground, or when it comes to rest on an obstruction.
 - d. One repair will be allowed after the individual time trials have begun
 - i. The repair must be made in three (3) minutes or less.
 - ii. No additional trimming will be allowed after the repair.
9. The combined flight time of the best three (3) of the four (4) flights is used to determine the twenty (20) semifinalists.
10. Ties are broken by determining the longest single flight time.
11. A list of twenty (20) 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 AND REQUIREMENTS

PRE-CONFERENCE

- A. 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 current year, and the participant's ID number
 - b. Full-size metric technical drawing of the glider including dimensions on an 11" x 17" paper, which may be folded to fit into the sheet protector.
 2. The technical drawing must:
 - a. Be created using CAD, or be hand-drawn with traditional mechanical drawing instruments
 - b. NOT be a freehand sketch
 - c. Depict all parts that make up the glider
 - d. Be drawn to full scale
 - e. Be drawn on a single sheet of paper that does not exceed 11"X17"
 - f. Participants are not allowed to enter the semifinal on-site glider construction round without a completed technical drawing included.
 3. Pictures of two (2) test gliders will be included in the portfolio (one [1] picture of each test glider, for a total of two [2] pictures).
 4. A flight log for each pictured test glider (see Flight Log sample) must be included.
 5. A detailed drawing demonstrating compliance with the rules and features, including design principles used in building and adjusting gliders, must be included on 11" X 17" paper (may be folded to fit in the sheet protector).

6. A technical review of one flight log detailing launch, trim, and flights of the glider must be included.
- B. For pre-built glider and home-testing catapult regulations and specifications, refer to the “Glider Reconstruction Materials” section in the semifinal round of this guide.

PRELIMINARY ROUND

The Flight Test

- A. Participants are required to provide and wear safety eyewear for this event.
- B. Catapults for timed flights at the national event site are supplied by TSA.
- C. During time trial flights, ONLY catapults provided by TSA may be used.
- D. No trim time is allotted.

SEMIFINAL ROUND

Reconstruction of the Glider

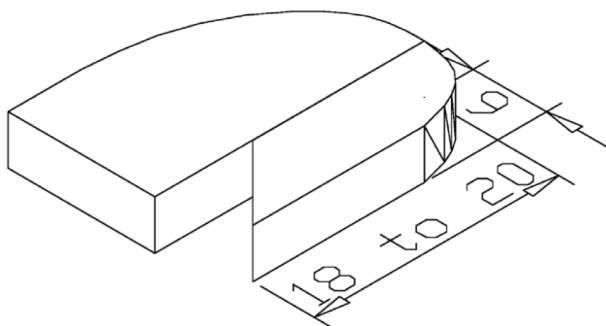
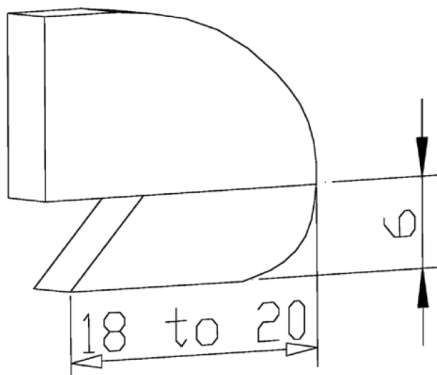
- A. Participants are required to provide their own tool box for use in the semifinal on-site construction challenge. Participants should bring only the tools needed and leave the rest behind. Transporting and checking in will be made simpler with a smaller and lighter tool box.
1. Each tool box must:
 - a. Include identification (school name, address, and advisor cell phone number)
 - b. Not exceed twenty (20) inches (508 mm) length x ten (10) inches (254 mm) width x ten (10) inches (254 mm) height
 - c. Contain all items needed to fabricate the solution
 - d. Participants are not permitted to share toolboxes
 - e. The following is a suggested list of tools:
 - i. Cutting devices – none may be electric
 - ii. Adhesives – This event requires the use of cyanoacrylate glue (best known as Super/Krazy glue) instead of aliphatic resin glue. Participants should practice with this material before the conference.
 - iii. Aerosol and electric applicators are not allowed

- iv. A bottle of Uncure or Debonder is recommended
- v. A single two (2)-ounce bottle of accelerant (pump or drip) is permitted
- vi. Temporary fastening devices
- vii. Straight pins
- viii. Clamps
- ix. Tape
- x. A cutting surface that prevents table-top marring (required)
- xi. Rulers, straightedges, and/or measuring scales
- xii. Abrasives sheets, sponges, boards
- xiii. Marking devices (pens, pencils, etc.) and sharpener
- xiv. Sheet of wax paper, as large as is needed for the competition (required)

2. Glider reconstruction materials (supplied by the participant)
 - a. Participants are not permitted to share.
 - b. Moldable ballast material, i.e., clay
 - c. Only balsa and/or basswood may be used to create the glider.
 - i. Templates, jigs, and fixtures MAY be used in constructing gliders (these are to help facilitate fast and accurate construction), however, these templates, jigs, and fixtures must be developed and built by students, and must not be bass wood or balsa wood to eliminate confusion with pre-made parts.
 - ii. No precut pieces will be allowed.
 - iii. Wood blank specifications:
 1. Only one (1) piece is allowed for each glider part listed. Choose wood carefully.
 2. The following table describes the wood blanks allowed. A blank is the starting size of material before cutting or sanding.

BLANKS	Length	Width	Thickness
Fuselage	MAX 300mm or 11 $\frac{7}{8}$ "	MIN 13mm or $\frac{1}{2}$ "	MIN 3mm or $\frac{1}{8}$ "
Wing	MAX 300mm or 11 $\frac{7}{8}$ "	MAX 76mm or 3"	MIN 1.5mm or $\frac{1}{16}$ "
Stabilizer	MAX 150mm or 5 $\frac{7}{8}$ "	MAX 50mm or 2"	MIN .75mm or $\frac{1}{32}$ "
Fin	MAX 76mm or 3"	MAX 25mm or 1"	MIN .75mm or $\frac{1}{32}$ "
Shark Tooth	MAX 20mm or $\frac{3}{4}$ "	MAX 6mm or $\frac{1}{4}$ "	MIN 3mm or $\frac{1}{8}$ "

FINISHED GLIDER SIZE	Length	Width	Notes
Fuselage Measured without ballast (clay, etc)	MAX 300 mm or 11 $\frac{7}{8}$ "		No extra length allowed for grip
Wing Span	MAX 300 mm or 11 $\frac{7}{8}$ "		
Wing Chord		MAX 76mm or 3"	Measured parallel to fuselage at widest point



3. Catapult specifications (to be used for trim and testing at home, school, and during preparation prior to time trial flights):
 - a. Catapults for timed flights at the national event site are supplied by TSA.
 - b. During time trial flights, ONLY catapults provided by TSA may be used.
 - c. Catapults are made from hardwood or plywood.
 - d. Participants who prefer to do so may use their own catapults during trim flights.
 - e. Catapult wooden stick dimensions:
 - i. 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).

- ii. 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.
 - iii. The rubber loop is a #19 rubber band $3\frac{1}{2}$ " x $\frac{1}{16}$ " 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.
 - iv. 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.
4. Storage container—All student-made items and fixtures must fit in the toolbox, which is not to exceed 254mm high x 254mm wide x 508mm long.
 5. Student made fixtures may include:
 - a. 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.
 - b. 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

A. 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

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

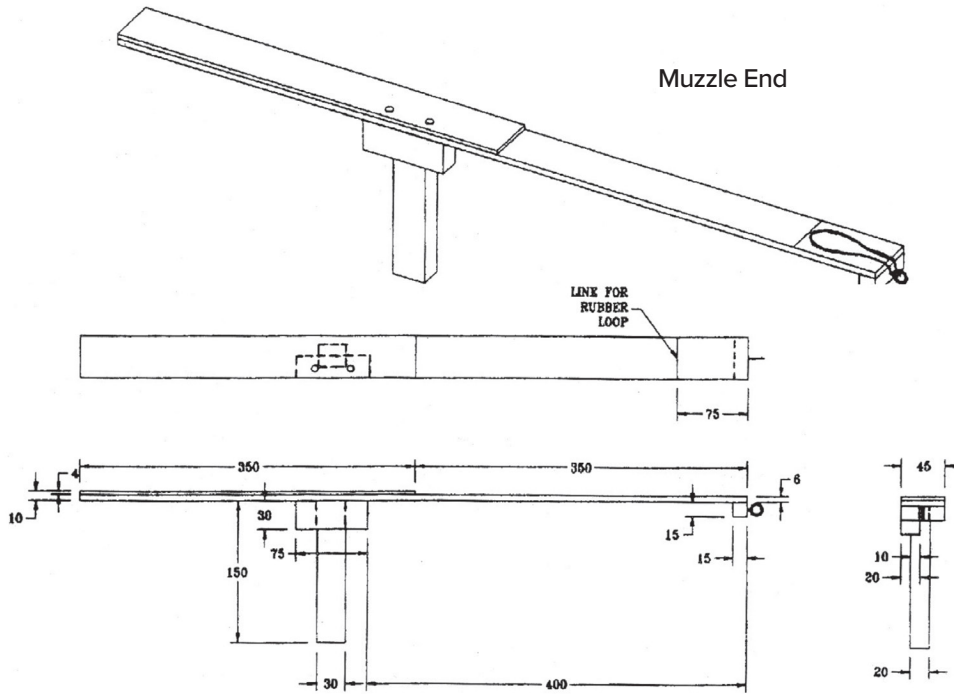
This event has connections to the STEM areas of Science, Technology, Engineering, and Mathematics.

CAREERS RELATED TO THIS EVENT

This competition connects to one (1) or more of the careers below:

- Aeronautical engineer
- Aircraft systems engineer
- Physics instructor

CATAPULT DRAWING



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

2020 & 2021 OFFICIAL RATING FORM

MIDDLE SCHOOL

Judges: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline in the rating form, 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.

Go/No Go Specifications

- Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box.
- If an item is missing, leave the box next to the item blank and place a check mark in the box labeled ENTRY NOT EVALUATED.
- If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

- Completed Glider is present
- Building material including toolkit are present
- Completed portfolio is present
- Completed LEAP document is present
- ENTRY NOT EVALUATED

DOCUMENTATION (70 points)				Record scores in the column spaces below.
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
		1-4 points	5-8 points	9-10 points
Portfolio (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.	
Full scale technical drawing (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" x 17", 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.	
Technical drawing/built glider correlation (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.	
Test glider pictures (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.	
Flight logs (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.	
Detail Drawing (X1)	Detail drawing is unclear, non-compliant with the regulations and design feature specifications; adjustments are not addressed or are missing.	Detail drawing illustrates compliance with most rules and design features used in building; adequate details for adjustments are provided.	Detail drawing illustrates compliance with all rules and design features used in building and adjusting the glider.	
Technical Review of Flight Log (X1)	Review of flight logs are missing many details of launching; trimming and flying of one glider are not clear.	Review of Flight Logs provide adequate details of launching, trimming and flying of one glider.	Review of Flight Logs are complete, with a thorough understanding of launching, trimming and flying of one glider.	
DOCUMENTATION SUBTOTAL (70 points)				

FLIGHT

FLIGHT TIMES (70 points)							
Flight times recorded to the nearest one hundredth [.01] of a second.							
Duration of flight #1		Seconds		Duration of flight #3		Seconds	
Duration of flight #2		Seconds		Duration of flight #4		Seconds	
1st	2nd	3rd	4th	5th	5th	7th	8th
70 Points	67 Points	64 Points	61 Points	58 Points	55 Points	52 Points	49 Points
9th	10th	11th & 12th	13th & 14th	15th & 16th	17th & 18th	19th – 20th	
46 Points	43 Points	36 Points	30 Points	24 Points	18 Points	12 Points	
SUBTOTAL FLIGHT SCORE (70 points)							

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initiated by the judge, coordinator, and manager of the event. Record the deduction in the space to the right.

Indicate the rule violated: _____

PRELIMINARY SUBTOTAL (140 points)

LEAP RESPONSE (14 points)			
CRITERIA	Minimal performance	Adequate performance	Exemplary performance
LEAP Response (10% of total event points)	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.
LEAP RESPONSE SUBTOTAL (14 points)			

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initiated by the judge, coordinator, and manager of the event. Record the deduction in the space to the right.

Indicate the rule violated: _____

SEMIFINAL SUBTOTAL (154 points)

To arrive at the **TOTAL** score, add any subtotals and subtract rules violation points, as necessary. **TOTAL (154 points)**

Comments:

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

JUDGE

Printed name: _____ Signature: _____

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
- C. Metric rulers

SAFETY

- A. Participants are required to provide and wear safety-approved eyewear during all phases of this event.
- B. Prescription eye wear will need to have side shields to be considered safety eyewear.
- C. 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.
- D. TSA will not supply safety glasses.
- E. Participants must be instructed by their advisors on the proper use of cyanoacrylate (CA) glue.

RESPONSIBILITIES

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 personnel 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.

PRELIMINARY ROUND

1. Check in participants at the time stated in the conference program.
2. Participants are to check in:
 - a. The completed glider
 - b. The portfolio
 - c. A hard copy of the LEAP Response with no report cover, and separated from the portfolio
 - d. Safety glasses
3. Late participants and/or entries are considered on a case-by-case basis and only when lateness is caused by events beyond the participant's control.
4. In order to compete, participants must be on the entry list or must have approval of the CRC.
5. Distribute the list of entrants assigned to each designated judge/timer.
6. 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 divided by three (3) to obtain the average 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 the test flights.
7. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and the CRC manager to determine either:
- To deduct twenty percent (20%) of the total possible points in this round
 - To disqualify the entry

The event coordinator, judges and CRC manager must all initial either of the violations on the rating form.

- 8. After the test flight, average the scores and determine finalists.
- 9. After the gliders have been tested, secure the holding area so that the gliders and documentation portfolios remain safe until the scheduled time for pickup.

SEMIFINAL ROUND

- 1. Check-in semifinalists at the time stated in the conference program.
- 2. Check to verify that the tool-boxes and building materials are within the specifications outlined.
- 3. Announce any specific rules and regulations pertaining to the on-site construction challenge.
- 4. Manage the on-site construction of gliders.
- 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 segments 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 averaged to obtain a 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. Judges independently evaluate the LEAP Response for each semifinalist participant using the official rating form.
- 11. Discuss rule violations (e.g. 20% deduction, disqualification) and have all relevant parties initial the rating form.
- 12. Judges determine the ten (10) semifinalists and discuss and break any ties.
- 13. Submit the finalist results and all related forms in the results envelope to the CRC room.
- 14. If necessary, manage security and the removal of materials from the event area.