

OVERVIEW

Applying leadership and 21st century skills, 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

- A. Participants test their pre-built glider for four (4) flights with no additional trim time.

SEMIFINAL ROUND

- A. Forty-five (45) minutes are allowed for the construction of a glider.
- B. Ten (10) minutes are allowed for trimming (test flights) of their glider.

ATTIRE

TSA competition attire is required.

SAFETY

- A. Participants are required to provide and wear safety-approved eyewear during all phases of this event.
- B. Prescription eyewear needs to have side shields to be considered safety eyewear.
- C. 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.
- D. TSA will not supply safety eyewear.
- E. 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

- A. Participants report to the time and place stated in the conference program with:
 - 1. The completed glider
 - 2. The documentation portfolio
 - 3. Safety eyewear
- B. On-site Testing:
 - 1. During the testing participants must provide and wear safety eyewear.
 - 2. No trim time is allotted during the preliminary round.
 - 3. After check-in, participants will test their pre-built glider for four (4) flights.
 - 4. 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.
 - 5. Flight time begins when the glider is released.
 - 6. Flight time ends when the glider hits the floor or ground, or when it comes to rest on an obstruction.

7. One repair is allowed after the individual time trials have begun.
 - a. The repair must be made in three (3) minutes or less.
 - b. No additional trimming is allowed after the repair.
- C. Scoring: After the fourth flight, the top three (3) flight times are combined to obtain the total flight time; if a plane is unable to be tested the time is marked as a zero (0).
- D. Twenty (20) semifinalists are determined by the top twenty (20) total test flight times.
- E. Ties are broken by determining the longest single flight time.
- F. Participants pick up their entries at the time and place stated in the conference program.

SEMIFINAL ROUND

On-site Reconstruction of Glider and Flight Testing

- A. Twenty (20) semifinalist teams report to the event area at the time and place stated in the conference program to demonstrate the leadership and/or 21st century skills acquired by participating in an on-site reconstruction of the glider.
- B. Participants provide their own tool box and building materials for the on-site construction portion (see regulations).
- C. Participants must provide and wear safety eyewear.
- D. Participants use their metric technical drawing to fabricate a glider.
- E. Participants have ten (10) minutes to trim their glider in the designated area.
- F. Documentation portfolios are evaluated.
- G. Participants are allowed four (4) opportunities to fly their gliders for official times. The semifinal launch procedures are the same as the preliminary round.
- H. The combined flight time of the best three (3) of the four (4) flights is used to determine the ten (10) finalists.
- I. Ties are broken by determining the longest single flight time.

REGULATIONS AND REQUIREMENTS

Students will work to develop their leadership and 21st century skills in the process of preparing for and participating in this TSA competitive event. The development and application of those skills must be evident in their submission, demonstration, and/or communication pertaining to the entry.

PRE-CONFERENCE

A. Documentation Portfolio:

1. Documentation portfolio is required and must be secured in a [clear front report cover](#) with 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; one (1) page
 - b. Table of contents; pages as needed
 - c. 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. The technical drawing must:
 - i. Be created using CAD, or be hand-drawn with traditional mechanical drawing instruments
 - ii. NOT be a freehand sketch
 - iii. Depict all parts that make up the glider
 - iv. Be drawn to full scale
 - v. Be drawn on a single sheet of paper that does not exceed 11" x 17"
 - vi. Participants are not allowed to enter the semifinal on-site glider construction round without a completed technical drawing included
 - d. Pictures of two (2) test gliders are included in the portfolio (one [1] picture of each test glider, for a total of two [2] pictures)
 - e. A flight log for each pictured test glider (see Flight Log sample) must be included; pages as needed

- f. 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)
 - g. A technical review of one flight log detailing launch, trim, and flights of the glider must be included; pages as needed
- 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 TSA Conference 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

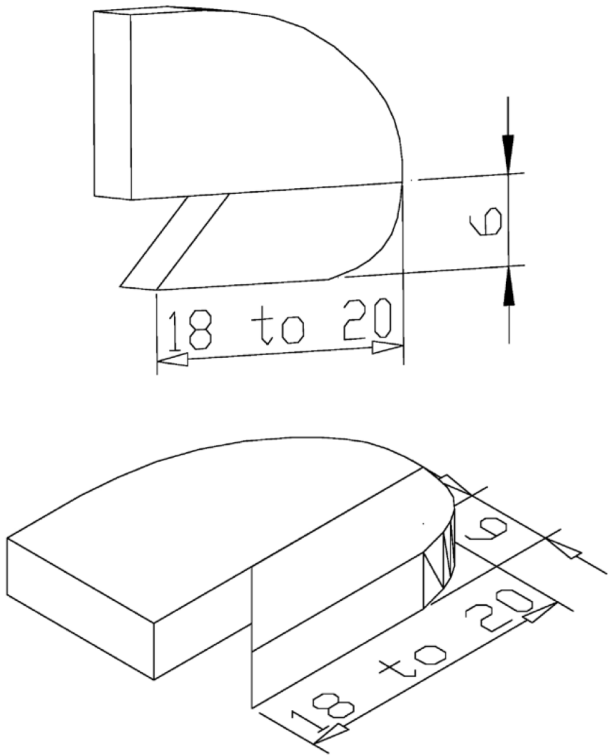
Reconstruction of the Glider

- A. Participants demonstrate their expertise by reconstructing the glider.
- B. 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 tool boxes
- 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. Any materials are allowed to be used to create the glider. The material blanks must fit the regulations below.

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

FINISHED GLIDER SIZE	Length	Width	Notes
Fuselage <small>Measured without ballast (clay, etc)</small>	MAX 285.75mm or 11 ¹ / ₄ "		No extra length allowed for grip
Wing Span	MAX 285.75mm or 11 ¹ / ₄ "		
Wing Chord		MAX 76mm or 3"	Measured parallel to fuselage at widest point
Shark Tooth			Can be part of the fuselage or added on after. Dimensions per the illustration below



- 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 the same material as the blanks to eliminate confusion with pre-made parts.
- ii. Blank specifications:
 - 1. Only one (1) piece is allowed for each glider part listed. Choose materials carefully.
 - 2. A blank is the starting size of material before cutting or sanding.
 - 3. The semifinal glider individual parts must be cut from the blanks on-site during the semifinal round.
- 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 TSA Conference are supplied by TSA.
- b. During time trial flights, ONLY catapults and rubber bands 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.
 - 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 tool box, 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.

EVALUATION

PRELIMINARY ROUND

Tier 1

- A. The combined flight time of the best three (3) of the four (4) flights determine the top twenty (20) semifinalists. Scores will be reset to zero (0) for the semifinalist round.

SEMIFINALIST ROUND

Tier 2

- A. The documentation portfolio
- B. Points earned for the combined flight time of the best three (3) of the four (4) flights

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.

LEADERSHIP AND 21ST CENTURY SKILLS DEVELOPMENT

This event provides opportunity for students to build and develop leadership and 21st century skills including but not limited to:

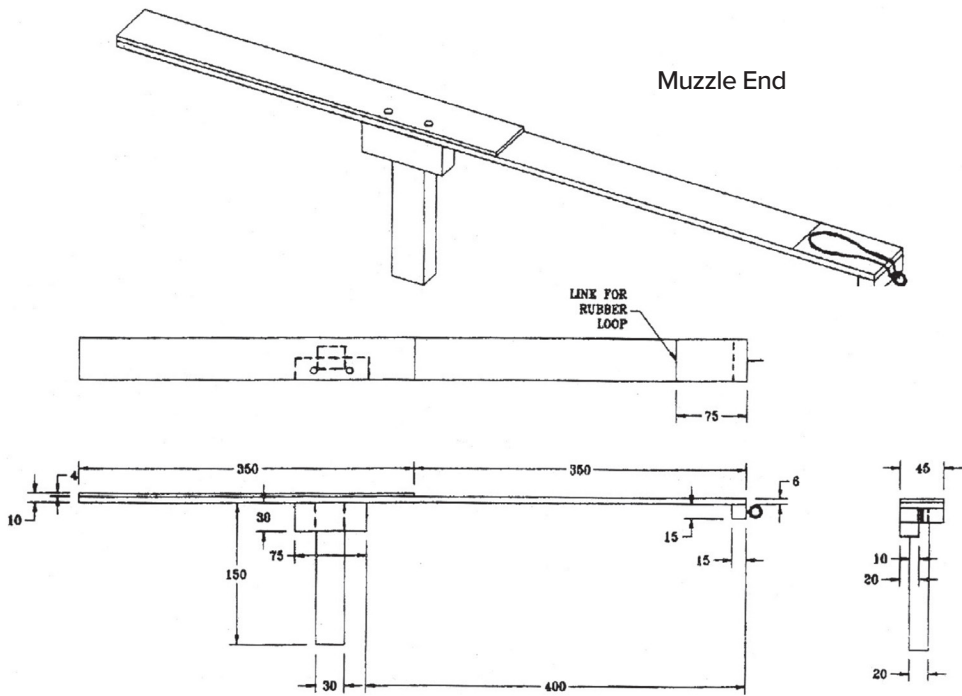
- Communication
- Collaboration/Social Skills
- Initiative
- Problem Solving/Risk Taking
- Critical Thinking
- Perseverance/Grit
- Creativity
- Relationship Building/Teamwork
- Dependability/Integrity
- Flexibility/Adaptability

CAREERS RELATED TO THIS EVENT

This competition has connections 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

2024 & 2025 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.

- ☐ TIER 1 – Glider is present for flight times
- ☐ TIER 2 – Building material including toolkit, documentation portfolio, completed technical drawing
- ☐ ENTRY NOT EVALUATED

TIER 1 – FLIGHT TIMES		
Flight times recorded to the nearest tenth (.1) of a second. Enter the top three (3) flight times		
Duration of Flight #1	Seconds	
Duration of Flight #2	Seconds	
Duration of Flight #3	Seconds	
TIER 1 – FLIGHT TIMES (combine flight #1, flight #2, and flight #3)		TOTAL SECONDS

TIER 2 – SEMIFINAL DOCUMENTATION PORTFOLIO (70 points)				Record scores in the column spaces below.
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points	
Portfolio Components (X1)	Portfolio is unorganized and/or is missing three (3) or more components.	Portfolio is missing one (1) or two (2) components and/or is loosely organized.	Portfolio has all required components in order and is well organized.	
Full Scale Technical Drawing (X1)	Technical drawing is missing two (2) 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 (1) 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.	

TIER 2 – SEMIFINAL FLIGHT TIMES (70 points) – continued				
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.	
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.	
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; leadership and/or 21 st century skills are not evident.	Review of flight logs provide adequate details of launching, trimming and flying of one glider; leadership and/or 21 st century skills are somewhat evident.	Review of flight logs are complete, with a thorough understanding of launching, trimming and flying of one glider; leadership and/or 21 st century skills are clearly evident.	
TIER 2 – SEMIFINAL DOCUMENTATION PORTFOLIO SUBTOTAL (70 points)				

SEMIFINAL FLIGHT TIMES (70 points)							
Flight times recorded to the nearest one hundredth [.01] of a second. Enter the top three (3) flight times.							
Duration of Flight #1						Seconds	
Duration of Flight #2						Seconds	
Duration of Flight #3						Seconds	
SEMIFINAL FLIGHT TIMES (combine flight #1, flight #2, and flight #3) TOTAL 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	
SEMIFINAL FLIGHT SCORE SUBTOTAL (70 points)							

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

Indicate the rule violated: _____

SEMIFINAL SUBTOTAL (140 points)	
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To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary. TOTAL (140 points)	
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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 for 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 eyewear needs to have side shields to be considered safety eyewear.
- C. Should a participant remove their eyewear during the event, they 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 eyewear.
- E. Participants must be instructed by their advisors on the proper use of cyanoacrylate (CA) glue.

RESPONSIBILITIES

AT THE CONFERENCE

- A. Attend the mandatory event coordinator's meeting at the designated time and location.
- B. Report to the CRC room and check the contents of the coordinator's packet.
- C. Review the event guidelines and check to see that enough personnel have been scheduled.
- D. 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.
- E. At least one (1) hour before the event is to begin, meet with judges and assistants to review time limits, procedures, regulations, evaluation, and all other details related to the event. If questions arise that cannot be answered, speak to the event manager before the event begins.

PRELIMINARY ROUND

- A. Check in participants at the time stated in the conference program.
- B. Participants check in:
 - 1. The completed glider
 - 2. The documentation portfolio
 - 3. Safety eyewear
- C. 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.
- D. In order to compete, participants must be on the entry list or must have approval of the CRC.
- E. Distribute the list of entrants assigned to each designated judge/timer.
- F. Timed flight procedure:
 - 1. Each flight time is recorded to the nearest one hundredth (.01) of a second.
 - 2. 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.

3. Three (3) groups may fly simultaneously in the assigned area for the event, with consideration for the safety of gliders and participants.
 4. Each participant receives a new rubber band for each of the test flights.
- G. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and the CRC manager to determine either:
1. To deduct twenty percent (20%) of the total possible points in this round
 2. To disqualify the entry
- The event coordinator, judges, and CRC manager must initial either of these actions on the rating form.
- H. After the test flight, combine the scores and determine the top twenty (20) semifinalists. Evaluate the gliders to make sure they meet the rules criteria.
- I. After the gliders have been tested and evaluated, secure the holding area so that the gliders and documentation portfolios remain safe until the scheduled time for pickup.
3. Three (3) groups may fly simultaneously in the assigned area for the event, with consideration for the safety of gliders and participants.
 4. Each participant receives a new rubber band for each of their test flights.
 5. Judges calculate scores based on the results of the test flight.
 6. Gliders are evaluated.
- I. Documentation portfolios are judged.
- J. Discuss rule violations (e.g., 20% deduction, disqualification) and have all relevant parties initial the rating form.
- K. Judges determine the ten (10) finalists and discuss and break any ties.
- L. Submit the finalist results and all related forms in the results envelope to the CRC room.
- M. If necessary, manage security and the removal of materials from the event area.

SEMIFINAL ROUND

- A. Check in semifinalists at the time stated in the conference program.
- B. Check to verify that the tool boxes and building materials are within the specifications outlined.
- C. Announce any specific rules and regulations pertaining to the on-site construction challenge.
- D. Manage the on-site construction of gliders.
- E. 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.
- F. Designate times for test flying/trimming and communicate the thirty (30)-minute segments scheduled for each group of participants.
- G. Designate times for groups to make four (4) official flights for time.
- H. Timed flight procedure:
 1. Each flight time is recorded to the nearest one hundredth (.01) of a second.
 2. After the fourth flight, the top three (3) flight times are averaged to obtain a score; each glider is placed with its documentation portfolio.