FLIGHT ENDURANCE

OVERVIEW

Participants apply leadership and/or 21st century skills during the design iteration process in which participants build, fly, and adjust (trim) a rubber-band powered model aircraft to make long endurance flights inside a contained airspace. Models must be of fixed-wing design and comply with all event specifications.

ELIGIBILITY

Two (2) individuals per chapter may participate.

TIME LIMITS

Thirty (30) minutes is allowed to trim flights.

ATTIRE

TSA competition attire is required for this event.

PROCEDURE

ON-SITE TESTING OF PRE-BUILT AND TRIMMED AIRCRAFTS

A. Participants check in the following at the time and place stated in the conference program:
   1. The completed aircraft
   2. The portfolio
   3. Safety glasses

ON-SITE TESTING

A. Participants arrive at the competition site for trim flying during the time designated for their heat.
B. Time allotted for the trim portion of the event may be extended according to the number of participants and site scheduling.
C. Participants have two (2) opportunities to fly their models for official times.
D. Participants attend a pilot's meeting to review the sequence for making official flights.

OFFICIAL FLIGHT TEST

A. In an orderly fashion, participants proceed to a group timer for permission to fly.
B. Participants place their models on the floor and wait for the release signal from the timer. Timing begins when the model rises off the ground.
C. Flight time ends when models hit the floor/ground or when they come to rest on an obstruction.
D. The timekeeper records two (2) official flight times for each participant.
E. Immediately following the second flight, the participant hands his/her motor to the judge for weighing.

SCORING

A. Judges begin with the top flight times and evaluate models, portfolios, and flight boxes until the top ten (10) finalists have been determined.
B. The top ten (10) finalists are announced at the awards ceremony.

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.

A. Flight Endurance is an individual event.
   1. No one may assist the participant in any way during either trim or official flights.
   2. Violation of this regulation will result in disqualification.

B. Documentation Portfolio:
   1. Documentation materials (comprising "a portfolio") are 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 the event title, the conference city and state, and the year; one (1) page

Flight Log:

Participant ID#:			Dates:		
Flight #	# of winds	Time aloft	Flight pattern	Trim adjustment	Advisor sign off
#1					
#2					
#3					
#4					
#5					
#6					
#7					
#8					
#9					
#10					

b. A flight log (see official sample above), with the previous ten (10) flights signed off by the chapter advisor.

c. The technical attributes of the design and a description and identification of parts; pages as needed

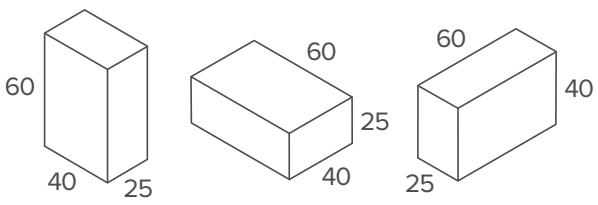
d. An analysis of the modifications and an explanation of why each was made must be included; pages as needed

e. A technical review of the flight log that explains the trim adjustments and modifications required to improve endurance. Experts from the Academy of Model Aeronautics (AMA) and the National Free Flight Society (NFFS) may scrutinize this information for validity; one (1) page

f. Assembly drawing of plane; pages as needed.

g. Scaled engineered drawings of all structural parts of the plane; pages as needed

C. The model and its parts must be contained in a flight box that does not exceed 25cm x 40cm x 60cm. Flight box hardware, such as hinges, handles, and wheels, are not measured.



D. **Models that violate any part of Regulation C will be disqualified.**

E. Models:
   1. Models are to be made of any materials that are typically found in model construction. This includes, but is not limited to: wood, foam, foam board, and plastics.
      a. Hardeners are permitted but are not required.
      b. **The use of any materials that are deemed unsafe will not be tested and will be disqualified.**
   2. Models must use a fixed-pitch propeller with a minimum of 140mm to a maximum of 170mm in diameter.
      a. Propellers may be trimmed, shaped, balanced, or re-pitched, but must remain fixed in pitch.
      b. Variable-pitch propellers and/or mechanisms are NOT permitted.
   3. Rotary-wing aircrafts and aerostat (lighter than air) aircrafts are NOT permitted.
   4. Fuselage dimension: minimum of 315mm in length, measured with prop assembly attached.
   5. Wingspan: maximum of 45cm horizontally projected, wing chord 9cm projected.
   6. Rubber motor: maximum weight of motor is 1.50 grams, including the O-rings.
      a. No length measurement is made.
      b. Spare motors are allowed during the official flights.
      c. Two (2) rubber O-rings may be used on the rubber motor loop for easier handling of wound motors.
   7. Model weight: minimum of 7.0 grams, maximum of 21.0 grams.
      a. Models are weighed without motors attached.
      b. Clay is permitted for trim ballast.
      c. Model is weighed with clay ballast.
   8. Steel wire may be used only for the propeller shaft, motor hook, landing gear, and the connection between fuselage and tail. Small plastic tubes, such as coffee stirrers, may be used.
   9. The two (2) wheels must be a minimum of 15mm in diameter, made of plastic or wood, and they must roll freely by the weight of the plane on a smooth surface.

F. Acceptable flight support equipment includes the following:
   1. Mechanical rubber motor winders or battery-powered motor winders may be used. No AC-powered winders are allowed.
   2. A winding stooge may be used to anchor the model while the motor is being wound. A person may not serve as a winding stooge.
   3. A poster board launching platform is provided.

G. When at rest, the landing gear must support the model without the fuselage and/or propeller touching the floor or launching pad.

H. Only minor repairs are allowed during trim and time trials.

EVALUATION

A. Flight Duration
   1. A bonus of ten (10) seconds is added to the flight time per flight if the model successfully lands on its wheels and comes to a rest on them.
   2. Ties are broken by determining the longest single flight time.

B. The documentation portfolio

C. The flight log

Refer to the official rating form for more information.

NOTES

Two organizations—the Academy of Model Aeronautics (AMA) and the National Free Flight Society (NFFS)—welcome your inquiries and offer suggestions, help, and technical information concerning model aircraft and flight technology.

Contact the AMA: www.modelaircraft.org.

Contact NFFS: www.freeflight.org.

STEM INTEGRATION

This event aligns with the STEM (Science, Technology, Engineering, and Mathematics) educational standards.

LEADERSHIP AND 21ST CENTURY SKILL 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 teacher

Participant/Team ID# _____

FLIGHT ENDURANCE

2021 & 2022 OFFICIAL RATING FORM

HIGH 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.

☐ Documentation portfolio is present
☐ Model is present
☐ Flight box is present
☐ ENTRY NOT EVALUATED

DOCUMENTATION PORTFOLIO (60 points)				
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	Record scores in the column spaces below.
	1-4 points	5-8 points	9-10 points	
Portfolio Components (X1)	Portfolio is unorganized and/or missing three (3)or more components.	Portfolio is organized adequately, with most components present.	No components are missing in the portfolio, and content and organization are clearly evident.	
Technical Attributes (X1)	Attributes of the design reflect no knowledge of flight design.	Attributes of the design are included and adequately reflect basic knowledge of flight design.	Clear and precise attributes of the design are given; an in-depth knowledge of flight design is exhibited.	
Description and Identification of Parts (X1)	The majority of the parts are not described, sourced, or identified accurately; scaled engineered drawings are incomplete or missing.	Most parts are described and sourced accurately; scaled engineered drawings include most details.	All parts are described and sourced completely and accurately; engineering drawings are complete.	
Modifications and Technical Review of Flight Log (X1)	Only one (1) modification is noted, and/or an explanation of why the modification was made is missing; leadership and/or 21st century skills are not evident.	Modifications are given with adequate explanations for how they improved flight endurance; leadership and/or 21st century skills are somewhat evident.	Modifications and an explanation of why they were made are provided; a clear and precise explanation for how they improved the flight endurance is provided; leadership and/or 21st century skills are clearly evident.	
Assembly Drawing (X1)	Assembly drawing is unclear; the majority of the design principles are not addressed or are missing; pictures are missing.	Assembly drawing is partially clear; most of the design principles are addressed and/or present; some pictures are missing.	Assembly drawing is clear, accurate, and executed well; all design principles are addressed; no pictures are missing.	
Flight Log (X1)	The flight log is incomplete; the advisor's signature is not included.	The flight log is generally complete; the advisor's signature is present.	The flight log is complete, with the advisor's signature; a thorough understanding of the flight log's purpose is evident.	
			DOCUMENTATION PORTFOLIO SUBTOTAL (60 points)	

FLIGHT ENDURANCE

FLIGHT TIMES (60 points)								
Flight times recorded to the nearest tenth (.1) of a second.								
Duration of Flight #1							Seconds	
Duration of Flight #2							Seconds	
Landing Bonus – add ten (10) seconds for each successful landing							Seconds	
Total Flight Scores (combine flight #1, flight #2, and bonus for landing/s)							Seconds	
1st	2nd	3rd	4th	5th & 6th	7th & 8th	9th-12th	13th – 16th	
60 Points	55 Points	50 Points	45 Points	40 Points	35 Points	30 Points	20 Points	
							SUBTOTAL FLIGHT SCORE (60 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: _____

To arrive at the TOTAL score, add any subtotals and subtract rules violation points, as necessary.	**TOTAL** (120 points)

Comments:

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

JUDGE

Printed name: _____ Signature: _____

FLIGHT ENDURANCE
EVENT COORDINATOR INSTRUCTIONS

PERSONNEL

A. Event coordinator
B. Assistants, two (2) or more
C. Judges, two (2) or more
D. Timekeepers, two (2)

MATERIALS

A. Coordinator's packet, containing:
    1. Event guidelines, one (1) copy for the coordinator and for each judge
    2. TSA Event Coordinator Report
    3. List of judges/assistants
    4. Results envelope
B. Marking pens (felt tip, fine point)
C. Two (2) metric tape measures
D. Two (2) rolls of caution tape
E. 125 zip lock bags
F. Three (3) launch pads (poster board, 30" x 40")
G. Signs for door(s) reading Do Not Open, Flight in Progress, Knock for Entry
H. Three (3) helium balloons
I. One (1) fishing reel with line
J. Stopwatches, three (3)
K. Electronic gram scale (to .01 gram)

RESPONSIBILITIES

AT THE CONFERENCE

A. Attend the mandatory 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 judges and assistants have been scheduled.
D. Inspect the area(s) in which the event is to be held for appropriate set-up, including room size, tables, chairs, 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.

EVENT CHECK-IN

A. Check in participants and evaluate models for special compliance during the scheduled trim session (completed flight log is inspected).
B. Anyone reporting who is not on the entry list may check in only after official notification is received from the CRC.
C. Late entries are considered on a case-by-case basis and only when the delay is caused by events beyond participant control.
D. Secure models in the holding area so that they remain safe until the scheduled time for the official flights.

ON-SITE CHALLENGE

A. Distribute a list of entrants assigned to each designated judge/timer.
B. Each flight is recorded to the nearest one-tenth (.1) of a second.
C. After the second flight, the times are added together.
D. Up to three (3) groups may fly simultaneously in the assigned area for the event, with consideration for the safety of the models and participants.
E. Models and flight boxes of all participants are checked again. Models showing deviations may be disqualified.
F. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and CRC manager to determine either:
    1. to deduct twenty percent (20%) of the total possible points in this round or
    2. to disqualify the entry

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

G. Judges determine the ten (10) finalists and discuss and break any ties.

H. Submit the finalist results and all related forms in the results envelope to the CRC room.

I. If necessary, manage security and the removal of materials from the event area.