FLIGHT ENDURANCE

OVERVIEW

Participants analyze flight principles with a rubber band-powered model aircraft. Participants have the opportunity to build, fly, and adjust (trim) a model to make long endurance flights inside a contained airspace. Models must be of fixed-wing design and comply with all event specifications. Rotary-wing aircraft and aerostat (lighter than air) aircraft are NOT permitted.

☑ Each year it is amazing when students demonstrate their mastery of this event by flying planes in graceful arcs around an indoor space. Flights do not always go that way, but when they do, they are beautiful.

ELIGIBILITY

Participants are limited to two (2) individuals per chapter, one (1) entry per individual.

TIME LIMITS

A. Entries must be started and completed during the current school year.

B. Participants are provided a minimum of thirty (30) minutes for trim flights at the event site.

C. Semifinalists will participate in a LEAP interview that will last a maximum of five (5) minutes.

LEAP LEADERSHIP RESUME/INTERVIEW

An Individual LEAP Leadership Resume is required for this event and must be submitted at event check-in. Semifinalists will respond to interview questions related to their submitted LEAP Resume for a maximum of five (5) minutes.

ATTIRE

Competition attire, as described in the National TSA Dress Code section of this guide, is required for this event.

PROCEDURE

A. Participants report to the event coordinator at the time and place stated in the conference program to sign up for flight heats and submit a LEAP Leadership Resume.

B. Participants arrive at the flying site for trim flying during the time designated for their heat. 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 the official flights.

E. In an orderly fashion, participants wind their models and proceed to a group timer for permission to fly.

F. 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. A poster board launching platform will be provided.

G. Flight time ends when models hit the floor/ground or when they come to rest on an obstruction.

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

I. The timekeeper will record two (2) official flight times for each participant.

J. Immediately following the second flight, the participant will hand his/her motor to the judge for weighing.

K. Portfolios and models will be placed on flight boxes for judging. Judges will begin with the top flight times and will evaluate models, portfolios, and flight boxes until the top twelve semifinalists have been determined. Models that violate any part of Regulation C will be disqualified.

L. Ties are broken by determining the longest single flight time.

M. Semifinalists will be determined and posted by the CRC.

N. Semifinalist teams will report at the time and place stated in the conference program to sign up for a semifinalist LEAP interview.

O. The LEAP interview will last a maximum of five (5) minutes.

It is essential that students and advisors routinely check the TSA website (www.tsaweb.org) for updated information about TSA general rules and competitive events. This information is found on the website under Competitions/Updates. When students participate in any TSA competitive event, they are responsible for knowing of updates, changes, or clarification related to that event.

☑ Read the General Rules and Regulations section in the front of this guide for information that applies to all of TSA's competitive events.

REGULATIONS

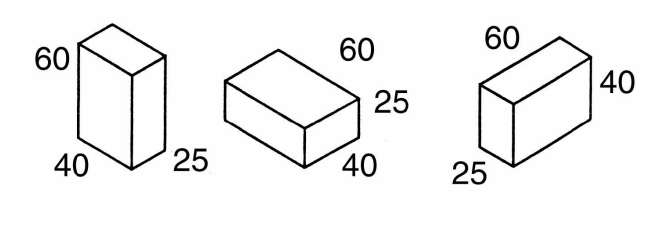
A. Documentation materials (comprising "a portfolio") are required and must be secured in a clear front report cover. The portfolio must include a flight log (see official sample that follows), with the previous ten (10) flights signed off on by the participant's advisor. The report cover must include the following single-sided, 8½" x 11" pages, in this order:

1. The technical attributes of the design and a description and identification of parts
2. The modifications and an explanation of why each was developed
3. 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.
4. A graphic flow chart with pictures and design principles used in building and adjusting the model plane used for successful flights
5. Scaled Engineered Drawings of all structural parts of the plane

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. 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.



☑ The flight box is required and is intended to protect the model in transit.

C. Materials include the following:

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. Hardeners are permitted but are not required. The use of any materials that are deemed unsafe will not be tested and will be disqualified.
2. Models MUST use commercially available "fix-pitch" propeller or "fixed-pitch" propeller assembly: minimum of 140mm to a maximum of 170mm in diameter. Propellers may be trimmed, shaped, balanced, or re-pitched, but must remain fixed in pitch. Variable-pitch propellers and/or mechanisms are NOT permitted.
3. Fuselage dimension: minimum of 300mm in length, measured with prop assembly attached.
4. Wingspan: maximum of 45cm horizontally projected, wing chord 9cm projected.
5. Rubber motor: maximum weight of motor is 1.50 grams, including the O-rings. No length measurement is made. Spare motors are allowed during the official flights. Two (2) rubber O-rings may be used on the rubber motor loop for easier handling of wound motors.
6. Model weight: minimum of 7.0 grams, maximum of 21.0 grams. Models are weighed without motors attached. Clay is permitted for trim ballast. Model is weighed with clay ballast.
7. 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.
8. The two 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.

D. 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.

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

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

G. LEAP Leadership Resume (see Forms Appendix or TSA website)/Interview — Students document, in the LEAP leadership resume (see resume template), the leadership skills that they have developed and demonstrated while working on this event. Semifinalists will respond to questions about the content of their resume as part of their LEAP interview. The LEAP Leadership Resume/Interview guidelines and other resources can be found on the TSA website.

EVALUATION

Evaluation is based on the duration of flight, documentation, flight log, flight box, and LEAP requirements. 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. Please 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 educational standards noted below. Please refer to the STEM Integration section of this guide for more information.

Science, Technology, Engineering, Mathematics

TSA AND CAREERS

This competition connects to one or more of the career areas featured in the TSA AND CAREERS section of this guide. Use *The Career Clusters* chart and the *TSA Competitions and The Career Clusters* grid as resources for information about careers.

CAREERS RELATED TO THIS EVENT

Aeronautical engineer
Aircraft systems engineer
Physics teacher

FLIGHT ENDURANCE
EVENT COORDINATOR INSTRUCTIONS

PERSONNEL

A. Event coordinator

B. Assistants, two (2) or more

C. Evaluators, two (2) or more

D. Timekeepers, two (2)

E. Evaluators for semifinalist interviews, two (2) or more

MATERIALS

A. Coordinator's packet, containing:
   1. Event guidelines, one (1) copy for the coordinator and for each evaluator
   2. TSA Event Coordinator Report
   3. List of evaluators/assistants
   4. Pre-populated flash drives for evaluators
   5. Marking pens (felt tip, fine point)
   6. Two (2) metric tape measures
   7. Two (2) rolls of caution tape
   8. 125 zip lock bags
   9. Three (3) launch pads (poster board, 30" x 40")
   10. Signs for door(s) reading Do Not Open, Flight in Progress, Knock for Entry
   11. Three (3) helium balloons
   12. One (1) fishing reel with line
   13. Stopwatches, three (3)
   14. Electronic gram scale (to .01 gram)
   15. Results envelope
   16. Envelope for LEAP Leadership Resumes
   17. LEAP Interview Judging Protocol

RESPONSIBILITIES

A. Upon arrival at the conference, report to the CRC room and check the contents of the coordinator's packet. Review the event guidelines and check to see that enough evaluators/assistants have been scheduled.

B. Inspect the area(s) in which the event is being held for appropriate set-up, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.

C. One (1) hour before the event is scheduled to begin, meet with evaluators/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.

D. For participants who violate the rules, the decision either to deduct 20% of the total points earned or to disqualify the entry must be discussed and verified with the evaluators, event coordinator, and a CRC manager.

E. Check in participants, collect LEAP Leadership Resumes, and evaluate models for special compliance during the scheduled trim session (completed flight log is inspected).

F. Secure models in the holding area so that they remain safe until the scheduled time for the official flights.

G. Distribute a list of entrants assigned to each designated evaluator/timer.

H. Each flight is recorded to the nearest one-tenth (.1) of a second. After the second flight, the times are added together. 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.

I. Models and flight boxes of all participants are checked again. Models showing deviations may be disqualified.

J. Evaluators determine the twelve (12) semifinalists.

K. Submit semifinalist results to the CRC for posting.

L. Inspect the area in which the interviews are to take place. Ensure that there is a table and seating for participants and evaluators.

M. Meet with semifinalist evaluators to review the LEAP Judging Protocol. If questions arise that cannot be answered, speak to the event manager before the semifinalist presentations begin.

N. Conduct semifinalist LEAP interviews. Interviews should be a maximum of five (5) minutes in length.

O. Evaluators determine the ten (10) finalists, in rank order.

P. Review and submit the finalist results and all items/forms in the results envelope to the CRC room.

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

Participant/Team ID# _____

FLIGHT ENDURANCE

2017 & 2018 OFFICIAL RATING FORM **HIGH SCHOOL**

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 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.

- ☐ **Portfolio is present.**
- ☐ **Model is present.**
- ☐ **Flight box is present.**
- ☐ **Completed LEAP Leadership Resume is present.**
- ☐ **ENTRY NOT EVALUATED**

Documentation (70 points)

CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points	Record scores in the column spaces below.
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.				
Portfolio components See Regulation A (X1)	Portfolio is unorganized and/or missing three or more components.	Portfolio is organized adequately, with most, if not all, components present.	No components are missing in the portfolio, and content and organization are clearly evident.	
Technical attributes (X1)	Attributes of the design are very sketchy in nature.	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, or there is a statement of no created parts present.	
Modifications and technical review of flight log (X1)	Only one modification is noted, and/or an explanation of why the modification was made is missing.	Modifications are given with adequate explanations for how they improved flight endurance.	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.	
Graphic flow chart (X1)	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 present; some pictures are missing.	Graphic flow chart is clearly followed; all design principles are addressed; no pictures are missing.	
Flight log (X1)	The flight log is incomplete; the advisor 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.	
Flight box (X1)	The flight box exceeds dimensions by more than 1%.	The flight box exceeds dimensions by less than 1%.	The flight box adheres to the maximum size restrictions.	
			SUBTOTAL (70 points)	

Flight Times 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**	
	SUBTOTAL FLIGHT SCORE	

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

Indicate the rule violated: _____

Semifinalist LEAP Interview (20 points)				
CRITERIA	Minimal performance 1-4 points	Adequate performance 5-8 points	Exemplary performance 9-10 points	
LEAP Leadership Resume/Interview See Regulation G and instructions on TSA website (X2)	The individual's efforts are not clearly communicated, lack detail, and/or are unconvincing. Few, if any, attempts are made to identify and/or incorporate the LEAP Be. Know. Do. criteria.	The individual's efforts are adequately communicated, include some detail, are clear, and/or are generally convincing. Identification and/or incorporation of the LEAP Be. Know. Do. criteria is adequate.	The individual's efforts are clearly communicated, fully-detailed, and convincing. Identification and/or incorporation of the LEAP Be. Know. Do. criteria is excellent.	
			SUBTOTAL (20 points)	

Rules violations (a deduction of 20% of the total possible points in the semifinalist section) must be initialed by the evaluator, 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 (points to be determined)**

Comments:

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

Evaluator

Printed name: _____ Signature: _____