Transportation Challenge 2019

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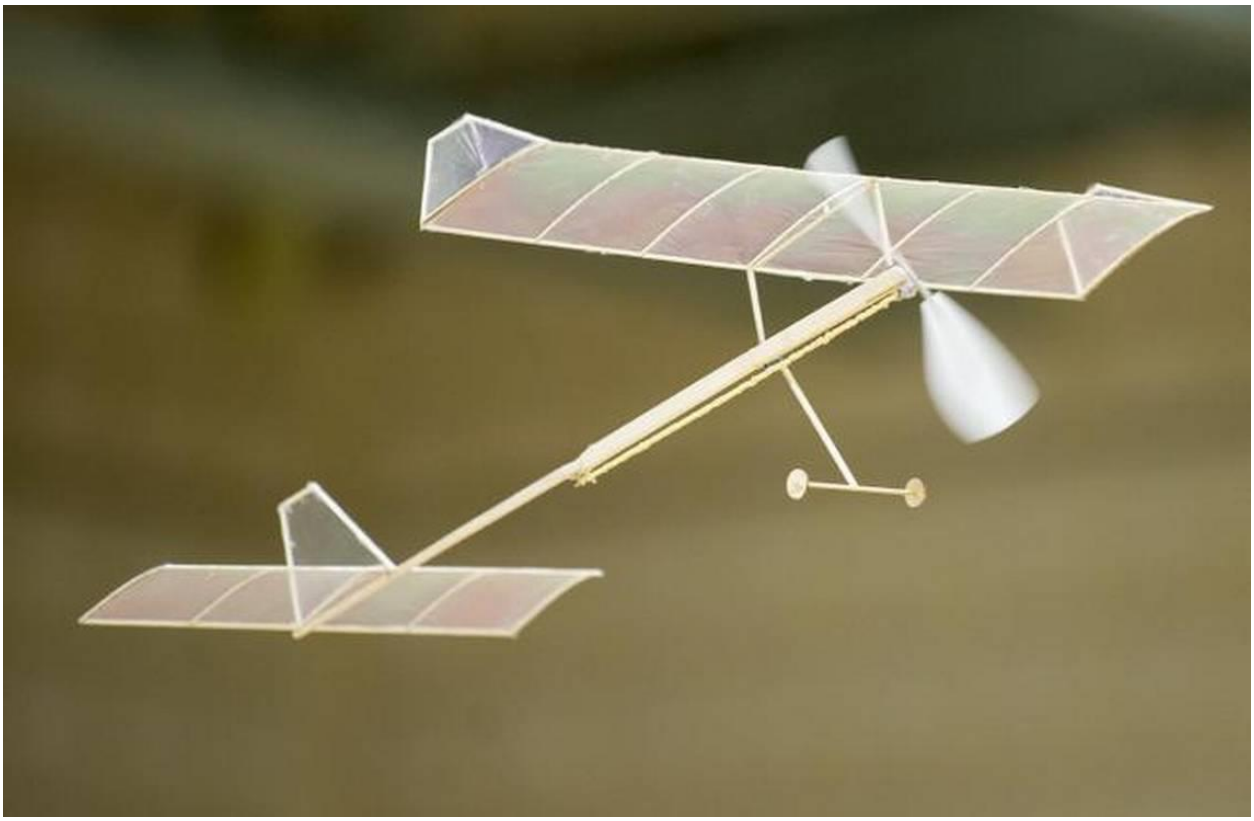
Challenge Description

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.



Standards and Benchmarks

International Technology And Engineering Educators Association (ITEEA)

- Standards for Technological Literacy
  - **Standard 11:** Students will develop abilities to apply the design process.
    - **Benchmark L:** Make a product or system and document the solution.
    - **Benchmark Q:** Develop and produce a product or system using a design process.
  - **Standard 18:** Students will develop an understanding of and be able to select and use transportation technologies.
    - **Benchmark K**: The design of intelligent and nonintelligent transportation systems depends on many processes and innovative techniques.

- **Benchmark G**: Transportation vehicles are made up of subsystems, such as structural, propulsion, suspension, guidance, control, and support, that must function together for a system to work effectively

Knowledge and Skills

- Aerodynamics
- Flight Endurance
- Propulsion Systems
- Control Surfaces
- Suspension Systems
- Types of Control
- Scientific Principles
- Mathematical Computation
- Teamwork
- Written and visual communication

Rules and Constraints

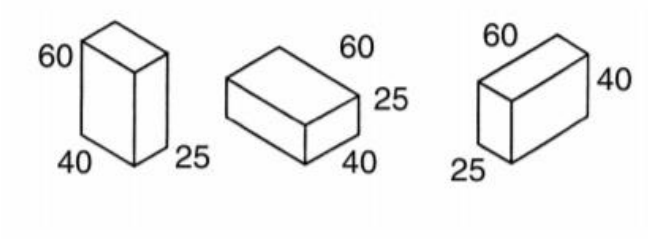
A. Documentation materials (comprising "a portfolio") are required and must be secured in a clear front report cover. The portfolio must include a flight log (see official sample that follows), with the previous ten (10) flights signed off on by the participant's advisor. The report cover must include the following singlesided, 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
#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.



Participants

Participants are limited to six (6) individuals per TEECA chapter, one (1) entry per individual.

Timeline

1. The challenge will be distributed prior to September 20th.

2. All individuals participating needs to email the coordinator Trevor Maiseroulle at tmaiseroulle@vikingnet.net by October 15, 2019 with 1.) Name of participant 2.) Email and phone number 3.) Name of University
3. Fabrication of the vehicle is to be done off-site at your institution and prior to the competition. Time should be allocated to make design adjustments during and after the practice time.
4. Each team will receive at least five minutes practice time.

a. Location will be announced during the opening session.
b. Teams need to bring their vehicles to the opening session.

5. Each team will have two trials in the competition. The better of the two trials will be counted in the final scoring.
6. Refer to the transportation rubric for documentation to be submitted, which is due at the performance.
7. The vehicles will be collected immediately following the event. **Note:** Vehicles will be returned at the Awards Banquet.
8. The portfolios will be submitted at a later time and location announced at the event.

Challenge Procedure

Participants report to the event coordinator at the time and place stated in the conference program to sign up for flight heats.

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.

Participants have two (2) opportunities to fly their models for official times.

Participants attend a pilot's meeting to review the sequence for making the official flights.

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

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.

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

Only minor repairs are allowed during trim and time trials.

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

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

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.

Ties are broken by determining the longest single flight time.

Equipment and Materials

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.

Evaluation and Judging

Evaluation is based on the duration of flight, documentation, flight log, flight box. 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.

Learning and Resources

- Khan Academy includes lessons on physics and math related to this challenge.

FAQ

Based on any questions emailed, the FAQ list may be updated so all teams benefit from any needed updates.

References

International Technology and Engineering Educators Association (2007). *Standards for technological literacy: Content for the study of technology*. Reston, VA: Author. Retrieved October 6, 2013, from http://www.iteea.org/TAA/Publications/TAA_Publications.html