

STEAM Subject: Engineering
Lab: The Perfect Paper Airplane

Grades: 2nd-6th

Learning objective:

Students will develop various models of airplane designs and compare their speed and aerodynamic properties.

ENGAGE:

Ask students the following questions:

- Have you heard of aerodynamic before?
- What does “aero” mean? *The word “aero” comes from Greek –'aēr' that usually refers to air*
- What does “dynamics” mean? *Related energy, motion or physical force. The science that studies motion and the forces that cause or stop motion.*
- What do you think it means for an object to be aerodynamic?

EXPLORE:

Paper Airplane Activity:

Students will participate in a kinesthetic activity that will involve making two different paper airplane models. Students will explore the concept of aerodynamics and its applicability regarding aerial machines - airplanes in this case.

Materials needed per student:

- Two pieces of printer paper
- Access to the internet to explore the Fold and Fly Paper Airplane Designs website < <http://www.foldnfly.com/> >.
- Timer (you can use your phone or a regular watch)
- Measuring tape, ruler or other measuring tool
- Pencil

Directions:

- The student will select the desired paper airplane model from the Fold and Fly website. **Note:** Make sure that the student selects a *dart* and a *glider* of their choice. Students will then follow the step-by-step tutorial on making the paper airplane, where they have the option to look at pictures of the airplane as they continuously work on it or watch the video option.
- When your airplane designs are complete (one dart and one glider), fly them in an open space.
- Use the table below to record the flying times for each airplane design (from the launching point until it hits the floor). Record the total distance traveled (in inches or feet) and time aloft in the air (seconds or minutes).

- Compare your designs, test them, and discuss their strengths and weaknesses. Which one flew the longest and shortest distance. Which one stayed in the air the longest and shortest time?

Table of Observations

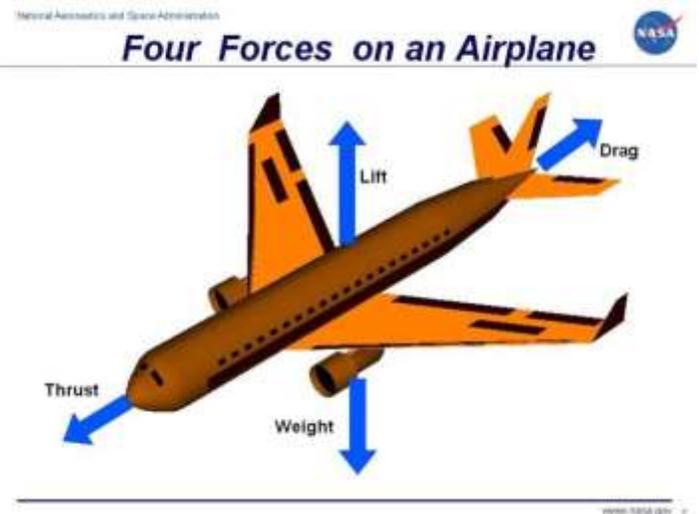
Airplane Design	Launching Time (seconds)	Landing Time (seconds)	Total distance travel (m)
Dart			
Glider			
Other			

Optional Activity: Create a paper airplane that falls under the “Origami” category and compare them in a similar manner to the dart and/or glider. Which one travels the longest distance and which one stays up in the air the longest time?



EXPLAIN:

- [Review Aerodynamics presentation in Google Slides](#)
- Watch video “How airplanes are made”
 - <https://www.youtube.com/watch?v=7rMgpExA4kM>
- **Review Science, Technology, Engineering, Math (STEM) Vocabulary:**
 - **Aerodynamics:** the qualities of an object that affect how easily it is able to move through the air
 - **Distance:** The length of a specific path travelled between two points
 - **Drag:** Force that acts opposite to the direction of motion.
 - **Lift:** Force that elevates objects into the air.
 - One **Meter (m)** is equal to 3.3 feet.
 - **Speed:** quantity that measures the distance traveled over the change in time. The basic unit is meters per second (m/s).
 - **Thrust:** Force that propels an object in the direction of motion.



- **Weight:** Force of gravity.
- Check out more videos and information about aerodynamics and airplanes in NASA Kids:
 - <https://www.grc.nasa.gov/www/k-12/airplane/thrust1.html>
 - <https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-is-aerodynamics-58.html>

EVALUATE:

- Students will offer a presentation to showcase the results of their airplanes trajectory using proportional relationships (e.g., speed as the ratio of distance traveled to time taken). They can make drawings or graphs to show the speed of each airplane design.
- Discuss how the thrust force affected the flight of your airplanes.
- What other vehicles are also aerodynamic? Are some models more aerodynamic than others?

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