

# Fun with Airplanes

► In this STREAM program activity, you will create an airplane glider and then modify it, forming a new design.



## Materials Needed

- One foam airplane glider
- Timer (phone, stopwatch, clock, etc.)
- Distance measuring tool (measuring tape, yardstick, or step pace count)
- Paper
- Pencil
- Internet-accessible device (tablet, laptop, computer, phone)

## Vocabulary/Key terms

- |                              |                        |                |
|------------------------------|------------------------|----------------|
| ■ dependent variable         | ■ independent variable | ■ quantitative |
| ■ drag                       | ■ lift                 | ■ thrust       |
| ■ engineering design process | ■ observation          | ■ variable     |
| ■ force                      | ■ prototype            | ■ weight       |
| ■ hypothesis                 | ■ qualitative          |                |

## Learning Objectives

After this activity, students should be able to:

- Go through the engineering design process to modify a foam airplane glider.
- Form a hypothesis predicting the effects their modification will have on the flight of their newly designed airplane glider.
- Record qualitative and quantitative observations describing their airplane glider and their flight results.
- Find the average distance and time in the air of flight trials.
- Identify independent and dependent variables.
- Graph their results.
- Explain how engineers often create small-size models of new products to test designs.

## Introduction

Let's make an airplane. A glider is an airplane that does not have an engine. In this activity, you will create an airplane glider and then modify it, forming a new design. Four forces will act on your airplane glider. The initial force acting on the glider is called thrust. Powered aircraft have an engine that generates thrust. Your airplane glider's thrust comes from when you throw it into the air. When in flight, a glider has three forces acting on it (lift, drag, and weight).

Engineers often create miniature models of new products to test the product's design. This is often the routine with airplanes. Model testing gives the engineer an idea of how the design will respond to different air conditions and different shapes of the airplane. Prototypes that do not work are discarded, which is much more cost-effective than disposing of a full-sized aircraft that does not work.

In the engineering design process, engineers often modify or change a variable or multiple variables from an initial prototype or initial model. After changing a variable from the initial design, they test and compare the results between the prototype and the newly modified design.

## Procedure

1. Follow the instructions provided with your airplane glider kit to build your model.
2. Form and record a hypothesis for the average distance and time you predict your airplane glider will fly.
3. Choose a location to fly your airplane. Mark your start location where you will throw your airplane. On your record sheet, write some qualitative observations describing the environment where you will be flying your airplane.
4. Simultaneously, start your timer and throw your airplane glider in the air. Stop the timer when your glider lands.
5. On your record sheet, write the amount of time your airplane was in the air and the distance it flew.
6. Repeat these steps for three separate trials and record your results.
7. Calculate and record the average distance and time your airplane glider was in the air for the three trials.
8. Now modify the airplane glider design. Change anything about the glider. Feel free to use supplies you may have around the house (with your parents' permission). The goal is to try to improve the airplane glider's performance by either causing it to fly a further distance or stay in the air for a longer time. Describe your modifications on your record sheet.
9. Repeat steps 2-7 for your newly modified airplane glider.
10. Complete your record sheet.

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## Record Sheet

### 1. Hypothesis

Make a prediction of the average distance and time of your prototype airplane.

What is your predicted average flight time (seconds)?	What is your predicted average flight distance (___)?

### 2. Qualitative Observations (Observations without using numbers)

- Will your flight start with the wind or against the wind? \_\_\_\_\_
- Will your flight start going down a slope (downhill), up a slope (uphill), or no slope (flat)? \_\_\_\_\_

### 3. Prototype Airplane Glider Trials

	Start Time	End Time	Total Flight Time	Flight Distance
Trial 1				
Trial 2				
Trial 3				
		Average		

### 4. Hypothesis

Make a prediction of the average distance and time of your **modified** airplane.

What is your predicted average flight time (seconds)?	What is your predicted average flight distance (___)?

Steps 5–8 continued on back.

## 5. Modified Airplane Glider Trials

	Start Time	End Time	Total Flight Time	Flight Distance
Trial 1				
Trial 2				
Trial 3				
		Average		

## 6. Graph

Graph your results from comparing your average prototype and your average modified results. Time will be recorded on the X-axis and distance on the Y-axis.


## 7. Interpret

Interpret your results. Describe what your graph tells you about the prototype airplane glider compared to the modified glider. \_\_\_\_\_

## 8. Conclusion

Was your hypothesis correct? What would you make different? \_\_\_\_\_

## References

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