AvSTEM

Aviation • Science • Technology • Engineering • Mathematics

Virtual Learning

Paper Airplane Activity

Federal Aviation Administration
William J. Hughes Technical Center
Atlantic City, New Jersey

Paper Airplane Activity

The intention of this packet is to aide teachers and/or parents as they teach and conduct a fun aviation-focused STEM activity. The following pages are not instruction sheets for your children or students. Rather, they are to serve as a guide as you lead the lesson. You know your children and students best so this guide leaves it up to you to scale content up or down depending on the age of your children.

Learning Objectives

- Understand basic principles that allow airplanes to fly
- Learn how the design of an airplane mimics nature
- Record measurements
- Analyze data
- Interpret results of an experiment

Supply List

- Sheets of 8.5”x11” paper
- Stop watch*
- Tape measure*
- Ruler*
- Markers*
- Stickers*
- White board*
- Graph paper*^

* All supplies are optional except for sheets of 8.5”x11” paper!
^ Optional for older students

How do airplanes fly?

Use these questions to start a discussion about flight!

How do airplanes fly?

What part of an airplane helps it fly?

These two questions should spark a fun discussion about how an airplane's wings allow it to fly. Then use the following questions to talk about how structures and systems often mimic nature.

Other than airplanes, can you think of something else that flies?

What do birds and insects have that an airplane also has?

Hopefully, the answers will include birds and insects, and the common characteristic with an airplane are their wings.

Vocabulary

Biomimicry – the imitation of elements found in nature to solve human design challenges

Let's Talk About Wings!

Hopefully, the questions and resulting discussion from the previous page led to a conclusion that many of the things that fly have wings. So let's talk about wings and why creatures and structures with wings can fly.

A wing is an air deflector. As an airplane (or bird) moves through air, the wing pushes air downward and then the air pushes the wing upward! This is called lift, and lift keeps an airplane in the air.

Vocabulary

Deflect – to turn away from an object; so a wing is an air deflector because it turns air away from itself

Lift – upward force that holds the airplane in the air

Science Concept
(for 4th grade and up)

Lift is an application of Newton's 3rd Law of Motion. For every action, there is an equal and opposite reaction.

Now that we know how airplanes fly, we're going to make our own paper airplanes to see which designs stay in flight the longest!

Make Your Own Paper Airplane!

This guide includes instructions to make two paper airplane designs.

Dart

1. Fold paper in half.

2. Unfold and then fold the corners into the center line.

3. Fold the top edges to the center.

4. Fold the plane in half.

5. Finally, fold the wings down to meet the bottom edge of the plane's body.

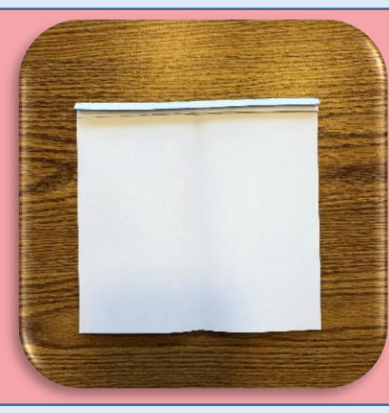
Make Your Own Paper Airplane! (cont.)

Hunting Flight

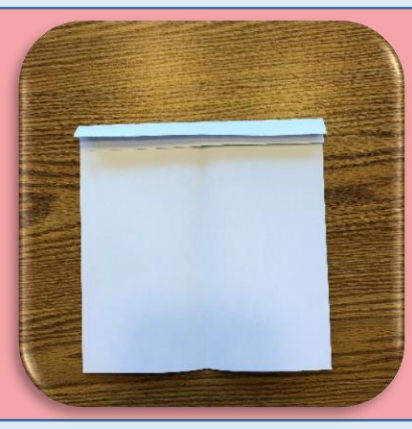
1. Fold paper in half. (same as for the dart)

2. Fold the top edge down about 2 inches.

3. Fold the top edge down again to double up the thick part.



4. Repeat the previous step one more time.



5. Fold the top corners away from you to the back center line.

6. Fold the plane in half towards you.

7. Fold both sides down to create the wings and bend the edges up for speed. The body should be about a 1/2 inch.

Make Your Own Paper Airplane! (cont.)

Finished Products

Dart Design

Hunting Flight Design

Decorate!
Use stickers and markers to make the designs truly unique.

More complex designs can be found at the following website: https://www.foldnfly.com/. Encourage older children to try several designs and even create their own!

Which Design Flies Longer?

After everyone has made and decorated their paper airplane(s), it's time to do a little experiment to see which design stays airborne the longest. This activity can be a structured like a science experiment, or it can be a fun activity for everyone to observe the results.

Steps

1. Find an open, indoor area to fly the paper airplanes.
2. Record the name of each design on the table. (See the table on the next page.)
3. Measure and record the wingspan (wing tip to wing tip across the airplane) of each paper airplane.
4. Fly each design three times. For each trial:
   a) Use a stopwatch (your cell phone works!) to time how long the plane is in the air.
   b) Record each time on the table.

These steps can be scaled up or down depending on the grade level of students.

Tip

For younger students, approximate the measurements: Did the plane fall to the ground quickly? Or did it fall slowly?

Why conduct three trials for each design? Multiple trials ensure the data (time recorded) is reliable. Look at the data. Are the three times for each design similar? Is there one that isn't close to the other measurement? If so, it's called an outlier. Typically, outliers are removed from datasets prior to a mathematical analysis.

Vocabulary

Outlier – a value that is much smaller or larger than the other values in a dataset

Which Design Flies Longer? (cont.)

Use this table or recreate it on a whiteboard to record the results of the experiment.

Design Name	Wingspan (inches)	Flight Time	
		Trial 1	
		Trial 2	
		Trial 3	
		Trial 1	
		Trial 2	
		Trial 3	
		Trial 1	
		Trial 2	
		Trial 3	
		Trial 1	
		Trial 2	
		Trial 3	
		Trial 1	
		Trial 2	
		Trial 3	

Activity Analysis

After all paper airplanes have flown and all data is recorded, use these questions to help draw conclusions from the activity.

Which design stayed in flight the longest?
- What characteristics does that plane have?
- Are its wings wide or narrow?

Which stayed in flight the shortest?
- What characteristics does that plane have?
- Is its wingspan wide or narrow?

You will notice that designs with larger wings stayed in the air the longest. But you probably also noticed that designs with larger wings also did not fly as far. While we focused on lift for this lesson, there are other forces that effect an airplane's flight. Larger wings allowed the paper airplane to stay in the air for a longer time, but the larger wings also created more drag, which prevented it from flying farther.

Follow-on Activities

Other activity ideas:
- Farthest distance – use a tape measure to record the distance each design flies
- Most cargo – tape coins or buttons to each plane to see which one can carry the most cargo

Ideas for middle school students:
- Conduct the farthest distance activity
- Calculate the average distance for each design based on three trials
- Create a scatter plot of wingspan verses distance flown
- Modify designs to build a paper airplane that flies farther and stays in flight longer

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Thank you for trying our Paper Airplane Virtual Lesson! Please share your pictures of this fun aviation activity with us!

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