

# How Do Heavy Things Fly?

by Sandy McMahan

## Concept:

Gravity, lift, thrust and drag are forces that affect the flight of an airplane. Understanding force and motion is essential to comprehending the natural sciences.

## Alaska Science Education Standards:

- ✓ A5) understand the strength and effects of *forces of nature* including gravity and electromagnetic radiation;
- ✓ A6) understand that forces of nature cause different types of *motion* and describe the relationship between these forces and motion;
- ✓ B1) use the processes of science – observing, classifying, measuring, interpreting data, inferring, communicating, controlling variables, developing models and theories; hypothesizing, predicting and experimenting.

For a description of Alaska Education Standards visit the State of Alaska Department of Education & Early Development Website: [www.eed.state.ak.us](http://www.eed.state.ak.us)

## Lesson:

Using student-designed airfoils, parachutes, kites and paper airplanes to demonstrate laws of motion and forces that resist motion help unit concepts become clearer and understandable.

Students are required to partake in all the activities, record their data, make inferences, create team reports and take written tests.

## Materials:

- ✓ sheet of notebook paper
- ✓ paper clips
- ✓ notebook for recording predictions and results

## Vocabulary:

Lift, Motion, Ailerons, Spiral, Glide, Streamlined, Trailing edge of a wing, Glider.

## Gear-Up:

Cultural myths and fables involving birds and flight: Read (or tell) the Athabaskan myth- "Why the Raven Doesn't Fly South in the Winter," an Inupiaq myth -- "Mother Eagle's Message," an Alaska Haida myth -- "Eagle Man's Revenge" and the Greek myth "Dacdalus and Icarus."

1. Ask what is common to all the myths.
2. Discuss man's age-long desire to fly.
3. Briefly discuss the background of the Wright Brothers and the importance birds and gliders played in their airplane invention.
4. Ask what flies and how different things fly.

**Explore:**

Make a chart to record the predictions and results of the different flight tests.  
Design and make paper airplanes.

1. Toss the airplane forward.
2. Throw the airplane backward.
3. Drop the airplane without throwing it forward.
4. Bend the wings until the plane turns in a spiral.
5. Experiment with weight (paper clips) to make the plane turn to the right or left.

**Generalize:**

1. Why does an airplane have to move forward through the air to fly?
2. What was done to the wings to get the plane to spiral? (*Bending the trailing edge of one wing up and the trailing edge of the other wing down.*)
3. What did you do to make the plane turn to the right or left? (*Aileron concept.*)
4. Predict the difference in flight when using the same airplane design, but heavier paper.
5. How does the design of an airplane affect flight?

**Apply/Assess:**

1. An airplane's motion is determined by its shape and thrust.
2. Infer what keeps a real glider in the air. (*Forward motion and lift from the air.*)
3. Why is the shape of an airplane important?
4. What was the best shape? (*Streamlined shape that does not offer resistance to airflow.*)
5. What is essential for lift? (*Wings.*)

**Extensions:**

*Limitless! This is only the beginning!*

- ✓ Chinese kite invention
- ✓ Compare how birds and airplanes fly
- ✓ History of powered flight
- ✓ The four forces that affect an airplane's flight
- ✓ Gliders and German engineer Otto Lilienthal
- ✓ Helicopters-how the design of rotor blades affects flight
- ✓ Newton's Laws of Motion
- ✓ Properties of air
- ✓ Major aviation contributors
- ✓ Parachutes
- ✓ Rockets
- ✓ Space Shuttles
- ✓ Time, speed and distance problems

## Scoring Guide: How Do Heavy Things Fly?

<b>Alaska Standard</b>	<b>Rating 1- Poor</b>	<b>Rating 2 = Fair</b>	<b>Rating 3= Competent</b>	<b>Rating 4= Outstanding</b>
<b>A-5</b>	Students can describe in simple terms an understanding of gravity.	Students can describe in simple terms an understanding of gravity/	Students can explain in appropriate words the term gravity.	Students can explain in detail the uses and applications for gravity.
<b>A-6</b>	Students can describe in simple terms elements of the forces of nature	Students can describe & compare the relationship between the forces of nature & motion (birds and wings)	Students can describe & identify the application of the forces of nature & motion (describe how planes fly)	Students can describe, apply & create the forces of nature (create a flying machine that can stay aloft for long periods of time)
<b>B-5</b>	Students follows general directions for exploration	Students follows the details of directions for exploration	Student is competent in recording & evaluating exploration	Student is competent in all phases of exploration & in analysis of results