

How far? How does structure affect flight?

How far could I go in aviation-connected careers?

How is flight part of Chicago?

This activity develops math and science competence essential to the Common Core Math Practice Standards and Next Generation Science Standards.

Math:

Estimation, Measurement, Data Collection and Analysis
Model with Mathematics—apply math in realistic situations.
Use appropriate tools strategically.

Science and Engineering

Designing solutions; Analyzing and interpreting Data
Core Concepts: Structure and Function; Cause and Effect

Career Connections:

The activity begins and concludes with the identification of careers related to flight, particularly in Chicago.

Materials Needed:

- Paper—If you include varying weights of paper that will be useful.
- Models of paper airplanes—this site includes explanations of the principles of flight http://www.aeronautics.nasa.gov/pdf/axes_control_surfaces_5-8.pdf You will find more designs by searching the web—here’s another resource that includes video: <http://www.paperairplanes.co.uk/planes.php> .
- Paperclips
- Tape
- Measuring tape or another way to measure Students can make up their own measuring device such as a string with marks at equal distances to measure by segments.
- Chart paper or chalkboard to record measurements

The Context

Explain:

Flight has always been important in Chicago nature—the birds that live here, the birds that migrate through Chicago, butterflies and other insects—they all have structures that enable them to fly. It’s not just that they have wings. It is the size and shape of the wings, the relationship of the wings to the animal’s body, the weight of the animals, and other variables that scientists analyze. Those are all structures that help the animals fly. Each structure has a function—a role it takes in enabling the animal to fly. The wing enables the animal to “lift off” and stay in the air. The shape of the animal’s body enables it to cut through the air.

Preview:

Point out that air travel applies principles of science that are part of nature. People design aircraft that have structures that enable them fly. Air travelers all depend on those designs. In Chicago, air transportation is a major employer. While they will be designing paper airplanes, this activity is part of an industry—air transportation is a major part of Chicago’s economy.



The Activity

Students design paper airplanes that they predict will fly a longer distance than other models.

Students should use the NASA guide or another resource to identify three forces that affect flight—lift, drag, and weight—that they will consider in designing their planes.

Ask students what kinds of structures they would design to enable a paper airplane to fly as far as possible. Then each student or team designs a paper airplane.

- Students predict the success of their design based on the structures they have used. Then they launch their planes from the same place and put a small piece of paper with their name on it to indicate where it landed.
- The students will be providing the 4th force--thrust as they propel their planes. To ensure consistent basis for the measurements, only one student should launch the planes, using the same height and energy in the “thrust”. However, that may be difficult to maintain reliably.
- Students can make a table on which they list the distances.
- Students analyze the structures to figure out which structures enable the planes to go farther.

✓ Start with paper only, then add the options of adding paperclips or tape to adjust the plane design and re-fly with those adjustments.

✓ This activity can take place outside so students also can analyze the effects of wind.

Assessment

Students can prepare a “how to” guide to designing a paper airplane including explanations of how different structures help the plane to move more efficiently through the air.

Chicago Career Connections

Point out that there are many jobs in Chicago that enable people to travel by air.

- Ask students to list jobs they could have in enabling planes to fly more efficiently. Define efficiency as using less energy to accomplish the same task. (Don't deal with crowded passenger space!)
- Then ask them to list the jobs that people do in Chicago to support the airline industry. Their lists can expand to include advertising as well as the maintenance jobs and other roles at the airports.

To see Chicago aviation-related careers, students can use a search engine and/or start with these two sources:

<http://www.flychicago.com/business/en/careers/Careers.aspx>

<http://www.indeed.com/q-Air-Transportation-l-Chicago,-IL-jobs.html>