Indoor Paper Box Kite Model

Overview

In this experience students investigate how moving air causes a kite to fly. Students construct a paper box kite to investigate weight and lift. Students build and fly the model and collect data and record observations on a Flight Research Card.

Objectives

Data Collection:

Students will:

- build and fly a model paper box kite.
- observe that a kite lifts off the ground despite its weight due to the opposing forces exerted by the string and by moving air.

Sense-Making:

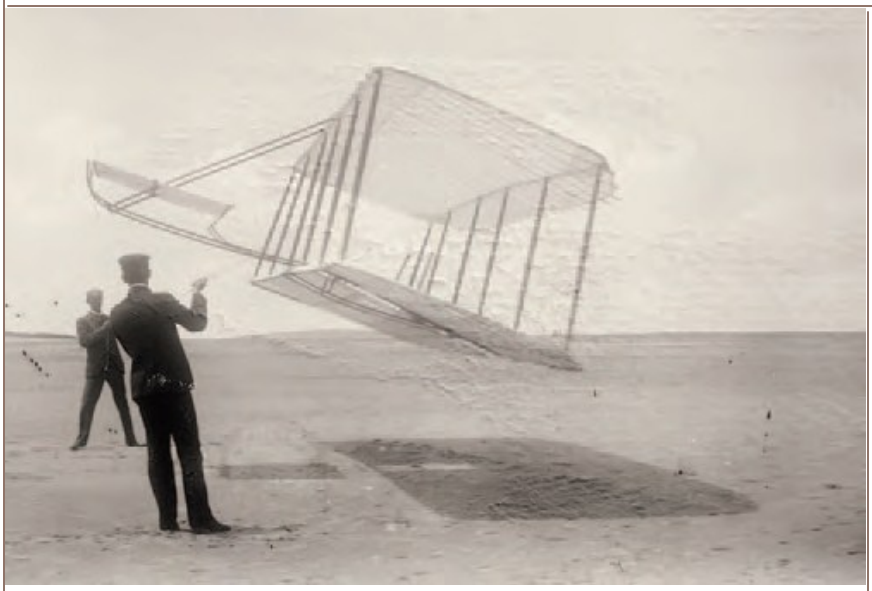
Students will:

- explain that **lift** describes what happens when the push of air on an object overcomes the object's weight and pushes it up.
- continue to develop the idea that
  - pushing or pulling can change the position and motion of objects.
  - the size of the change in motion is related to the strength of the push or pull.
- explain that models are tools used for communicating ideas about objects, events, and processes, including flight. Models do some things well but have limitations.

You Will Need

- Student Handouts
  - Flight Research Card Box Kite
  - Box Kite directions
- Thread/string
- Scissors
- Clear or masking tape
- Pencil
- Electric fan

Indoor Paper Box Kite Model



The photograph above shows the Wright Brothers at Kitty Hawk, North Carolina, with their 1901 Glider being flown as a kite. It weighed 98 pounds and had a wingspan of 22 feet. The kite appears to be floating in the air, but it is actually being held motionless because the forces that are acting on it are "balanced."

PHOTO COURTESY OF NASA

Background

People around the world have used kites for hundreds of years for military observation and even to look for fish from a vessel at sea. The Wright brothers used a kite to learn how to control an aircraft. When air moves against the surface of a kite, it exerts a force. When the force of the moving air is greater than the weight of the kite, the kite lifts off the ground and flies. The kite—because it is being pulled with an attached string—exerts an equal but opposite force against the moving air. When the force due to the moving air and the force exerted by the kite string are equal, the kite stays aloft.

NASA Website for Students: The Beginner's Guide to Kites

www.grc.nasa.gov/WWW/K-12/airplane/bgk.html

Teaches basic math and physics that govern the design and flight of kites.

NASA Website for Teachers: Courage to Soar

nasa.gov/audience/foreducators/topnav/materials/listbytype/The_Courage_to_Soar.html

An integrated unit of scientific experiments, aircraft models, and research topics about aviation.

Literature Connection

Mayer, Mercer. Shibumi and the Kite-maker. New York: Marshall Cavendish, 1999. After seeing the disparity between the conditions of her father's palace and the city beyond its walls, the emperor's daughter has the royal kite maker build a huge kite to take her away from it all.

Michael, David. Making Kites. New York: Kingfisher Books, 1993. Provides a step-by-step introduction to kite construction and directions for making various kinds of kites, including a two-stick kite, box kite, super stunter, and wind sock.

Focus Question:

How can air make an object lift off the ground?

1. Ask students how air can make an object lift up from the ground. Record their ideas on the board or a flip chart.
2. Remind students of their findings from Experience 1: that air is matter and that it exerts a **force** on objects. Remind students that they observed that air can slow down falling objects by pushing up on them, which means that air can change the motion of objects. Have students list things that can be blown up into air by the movement of air (e.g., leaves or feathers). Discuss with your class the difference between a falling object being slowed down by air and an object being lifted off of the ground by moving air.
3. Remind students that **weight** is the force an object pulled by **gravity**. Gravity is the force that pulls objects toward the Earth's surface. For flight to be possible, the force of an object's weight must be overcome by a stronger force. Let students know that they will explore how to use moving air to cause a **kite** to fly.

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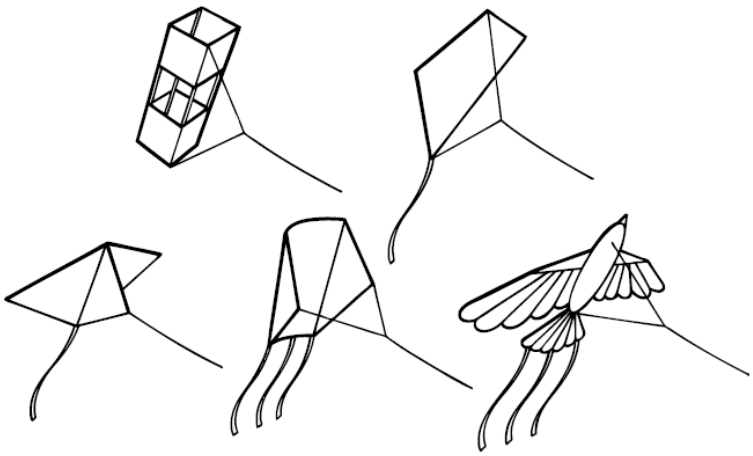
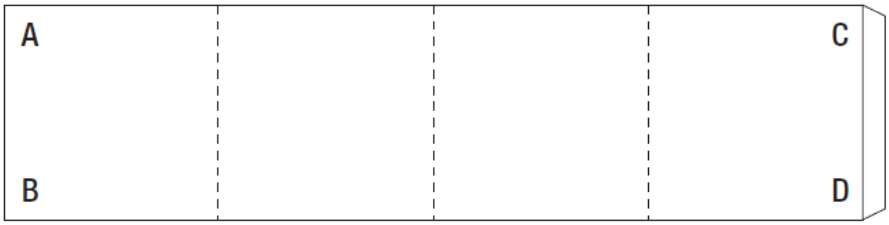
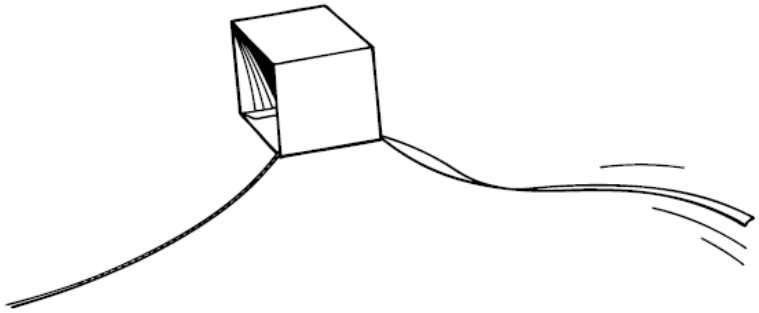


4. Tell the students that there are many different types of kites. Some kites, like the Chinese and Japanese designs, come from hundreds of years of research and flying. Modern kites are made with special materials for special purposes. Regardless of size or type, all kites **lift** into the sky because of the push of moving air. Ask students: What force must be overcome to cause a kite to fly?





5. Building the Paper Box Kite: Distribute the student handouts for the box kite. Instruct students to follow the steps on the handout to build the box kite.

a. Cut out the two parts of the box kite.
b. Cut out the box kite pattern along the solid lines.
c. Fold down along the dash lines so edge A-B touches edge C-D.
d. Apply a piece of tape to the TAB to join edge A -B to edge C-D.
e. Cut out the tail.
f. Tape one end of the tail to the kite at corner B-D.
g. Tape the end of the thread to corner A-C.
h. Adjust the edges of the kite to form a box.

Teacher Tip: Box Kite Flight Problems and Solutions	
Flight Path	**Correction**
Flies straight and smooth	Do not make any changes
Does not fly	Shorten tail
Bobs up and down	Lengthen tail

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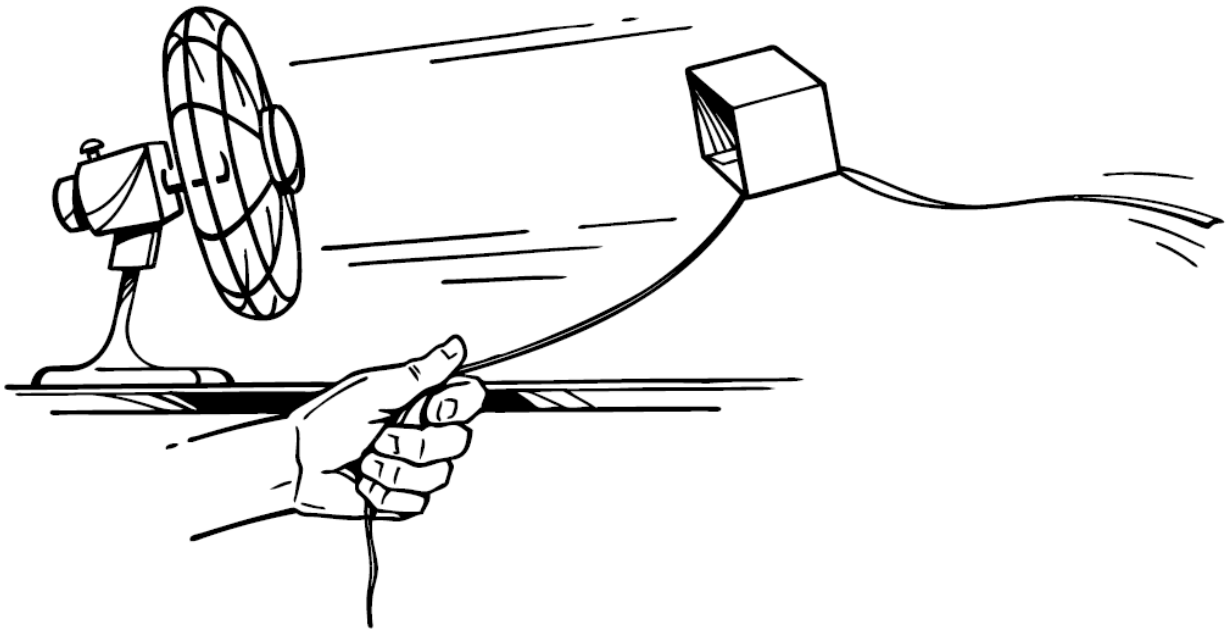

1. **Flying the Box Kite:** The paper box kite is complete and ready to fly. In the classroom, instruct students to launch the model gently in front of a fan to observe lift. Outdoors, students can run to launch the kites in a gentle wind.

2. Testing the Box Kite: Once students have flown the box kite, ask them to make one of the following changes and fly the kite again. They should record how the kite behaves on their Flight Research Card for each trial.

a. Change where the tail is connected to the box kite.
b. Add an additional tail.
c. Shorten or lengthen the tail.
d. Change the speed of the fan.
e. Change the length of the kite string.
f. Make a larger box kite.

Sense-Making Discussion and Questions

Ask students to predict what is needed to make a heavier kite fly into the air. *Students should understand that the push of air from the fan lifts the kite. The pushing force and the angle of the air moving on the kite create lift. Two things can be changed to make a heavier kite fly: stronger wind (faster wind speed) or greater air surface.*

Ask students: How did the model you made help you understand how things fly? How was the model not helpful?

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Student Handout: Flight Research Card

Name: _____ Date: _____

Follow the steps on the student handout to build the box kite. Materials: pattern, scissors, tape, thread

1. Cut out the two parts of the box kite in the student handout.
2. Cut out the box kite pattern along the solid lines.
3. Fold down along the dash lines on the kite so edge A-B touches edge C-D.
4. Apply a piece of tape to the TAB to join edge A-B to edge C-D.
5. Cut out the tail.
6. Tape one end of the tail to the kite at corner B-D.
7. Tape the end of the thread to corner A-C.
8. Adjust the edges of the kite to form a box.

Trials and Changes		Describe How the Box Kite Flies
Trial 1 **First Flight**	Draw tail position	
Trial 2 **Change the position of the tail**	Draw tail position	
Trial 3 **Add another tail**	Draw tail position	
Trial 4 **Shorten the tail**	_____ Measure change in inches or centimeters	
Trial 5 **Lengthen the tail**	_____ Measure change in inches or centimeters	
Trial 6 **Another change**		

Using the data you have collected, explain how moving air causes a kite to fly by overcoming its weight.

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