National Aeronautics and Space Administration

Gliders in Nature

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Lesson 1: Gliders in Nature

Birds fly, and so do some small mammals. However, a much larger number of organisms, including plant seeds, glide. In this module, children will first compare common seeds that glide, and determine **what physical characteristics make them good gliders**, as well as **why gliding is advantageous**. Children will then be read The Dandelion Seed to categorize seeds within the book as gliders or non-gliders based upon their physical characteristics. These concepts help prepare young students to understand form and function. By learning about the characteristics of a good glider, children will also learn how humans have long attempted to fly by copying ideas from nature, often referred to as biomimicry.

Focus Storybook

The Dandelion Seed
By Joseph Anthony, illustrated by Cris Arbo

Dawn Publications

Learning Goals

Language	• Vocabulary: Fly, Glide. • Writing: Write "F" and "G."
Math	• Count the twists as a paper "seed" glides down. • Measure distance of a blown seed (near/far).
Science / Engineering	• Explain what characteristics make for a good glider, and why gliding is important (biology). • Design a seed that takes the longest time to fall (physics).
Fine Motor Skills	• Cut a straight line.

Key Q's

What kinds of things fly or glide? What makes them able to fly or glide? Why is it good to be able to fly or glide?

Primary Materials

Images of animals and plant seeds that fly/ glide.

Maple seeds (fresh or dry, enough for each student to have 2-3).

Seed samples – multiple examples of seeds that glide (maple, elm, dandelion, milkweed, etc.) and seeds that don't (coconut, acorns, hitchhikers, seeds found in fleshy fruits, etc.)

Whirly-bird template

Paper Clips

Scissors

Crepe/streamers

Resources

High Flyers e-Book

Science / Engineering: Pre-Reading Activities

Investigation: Flyers and Gliders in Nature

Perhaps one of the best examples of the intersection between biology and engineering to which small children can relate is the study of flight. Children's books often focus on topics such as plants and animals and things that "go" (i.e. cars, trucks, and planes), but the relationship between these topics is often overlooked.

1. Begin a discussion of flight by helping students to identify some flyers in nature. Children will most likely think of:
   - Birds
   - Insects (butterflies, bees, etc.)
   - Bats

   However, not all things that travel by air actually fly. Generally, flyers power their own motion (typically by flapping), while gliders simply let themselves be carried by the wind. Gliders include a variety of seeds that get dispersed by the wind, baby spiders that "balloon" away from their place of birth, and many fish, mollusks, amphibians, and mammals that use gliding to stay aloft when jumping, or to slow themselves down as they fall.

2. Provide students with books and printed/projected images of animals that fly or glide, and those that do not (see the following pages for images).

3. Discuss how flyers and gliders look.
   - They have wings (flyers/gliders), or extra skin that acts as a parachute (gliders).
   - They have big wings for their size.
   - They have thin (aerodynamic) bodies.

4. Discuss why it might be beneficial to animals and plants to be able to fly or glide.
   - It is faster than walking.
   - It is easier to get away from danger.
   - It is easier to cross forests/rivers/oceans/mountains, etc.
   - It allows animals to have access to a much larger area for food and shelter.
   - It allows plant seeds to get spread over a much larger area so that they have a better chance of survival and reproduction.

Birds that Fly / Glide

Bald Eagle, Photo Credit: USFWS

Mallard Duck, Photo Credit: USFWS

Birds that DO NOT Glide

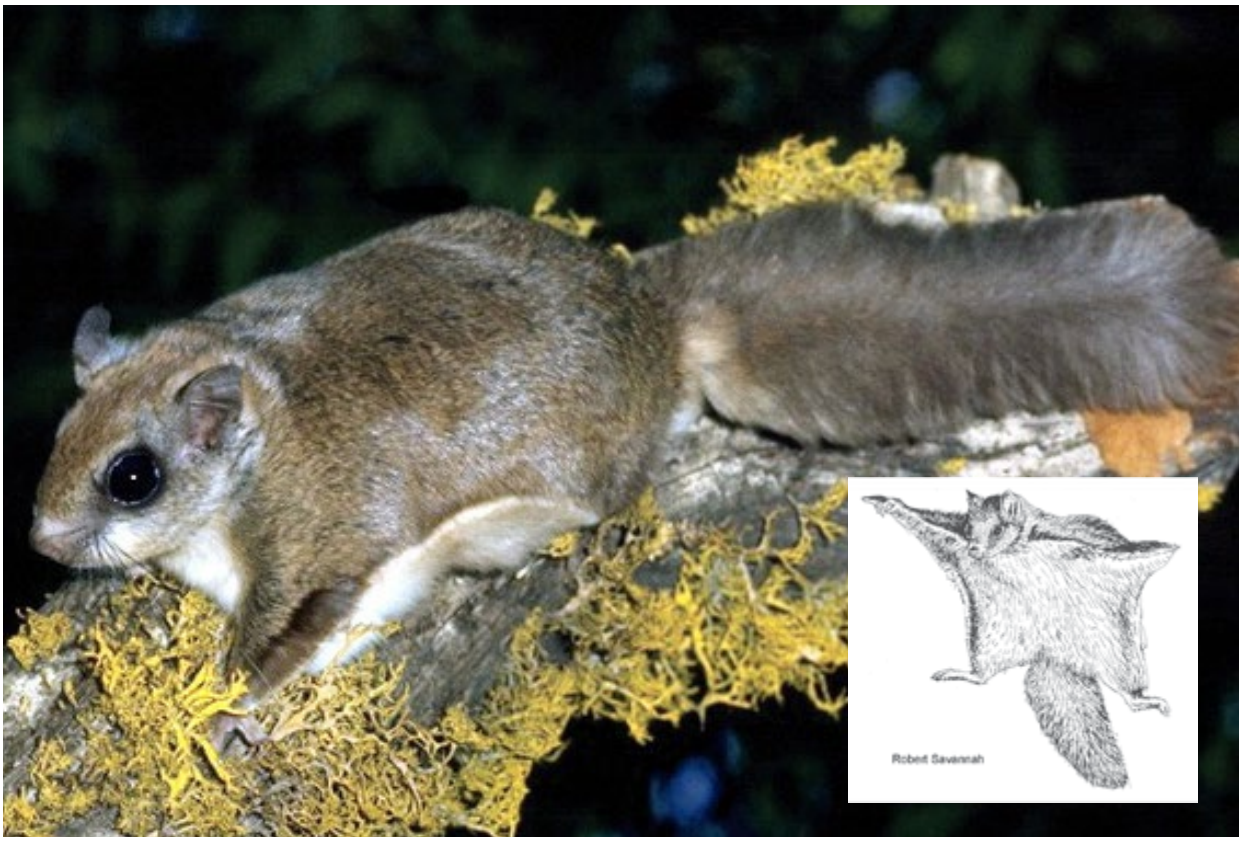
Penguins, Photo Credit: NSF

Attwater's Prairie Chicken, Photo Credit: USFWS

Other Gliding Animals

Mexican Long-Tongued Bat, Photo Credit: USFWS

Flying Fish, Photo Credit: NOAA



West Virginia Northern Flying Squirrel, Photos Credits: USFWS

Some examples of flyers and gliders include:

- Birds (most) - FLYING
- Mammals (some)
  - Gliding squirrel (as can be seen in NASA Aeronautics' mascot!) – GLIDING
  - Possums – GLIDING
  - Lemurs - GLIDING
  - Bats - FLYING
- Amphibians (some) – Flying frog – GLIDING
- Reptiles (some)
  - Lizards – GLIDING
  - Geckos – GLIDING
- Fish (some) – Flying fish - GLIDING
- Mollusks (some) – Flying squid - GLIDING
- Arthropods (most)
  - Insects – FLYING
  - Spiders – BALLOONING
- Pterosaurs (extinct) – FLYING

Although birds are often the first thing children think about when asked what kinds of animals fly, not all birds are capable of flying or gliding. After discussing what makes an animal a good glider, ask students to look at a variety of images of birds that can and can't fly, to see if they all have the traits necessary for gliding. Consider looking at the following:

- Birds – Look at bird feathers or images of different types. See some examples you might want to discuss below:
- Which kinds of birds glide?
  - Eagle – YES
  - Chicken – NO
  - Duck – YES
  - Ostrich – NO
  - Penguin - NO
- What is the difference between birds that glide/fly and birds that don't?
  - Gliders typically have streamlined bodies and large wings for their weight. These birds tend to need to fly long distances without stopping (migratory birds, sea birds).
  - Non-gliders do not necessarily have streamlined bodies or large wings. These birds are often land-bound, and are able to eat their prey and protect themselves without the need for flight.

Color Orville the Flying Squirrel, NASA Aeronautics' new mascot!

Like most other squirrels, flying squirrels live high up in the treetops. What is the benefit of having the extra skin between a flying squirrel's arms and legs?

Although they are called flying squirrels, do flying squirrels actually fly? Explain!

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For a long time, people tried to FLY by making machines or outfits that they hoped people would be able to use to flap. However, gliding is much easier than powered flying. The first people to really be successful at building airplanes first made sure that they understood how to GLIDE before they tried to FLY.

Although gliding and flying are what people have long wanted to do simply because they are fascinated by it both, there is a really important reason for flight – because of travel! In the same way, plant species are most successful at surviving if they can spread their seeds all over, using the wind to disperse.

Reading: The Dandelion Seed

By Joseph Anthony, illustrated by Cris Arbo

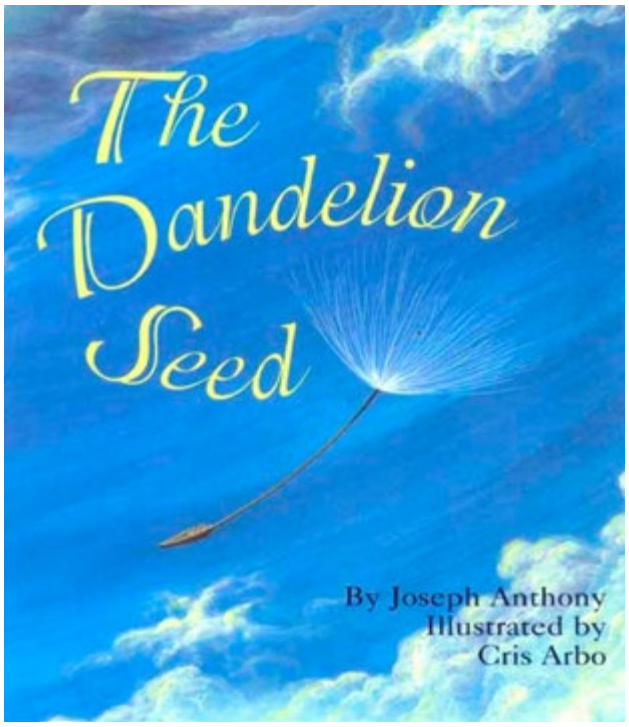



Figure 1: The Dandelion Seed, page 32

Read The Dandelion Seed, a book about the lifecycle of dandelions, from seed to flower to seed. The focus is on the journey the seed can make because of the force of the wind and the tufts that make it glide across the land. As you read, consider using the following strategies to engage the listeners:

- Why would a dandelion plant want its seeds to be carried by the wind?
- What makes a dandelion seed really good at being "caught" by the wind and being blown about?
    - It is very light
    - It has "feather-like" designs
- What would happen to the seed if the weather was bad? (*It might get blown really far away, or it might get wet and not fly at all*).

- What other seeds can be found in the pictures in the book? Have students find at least three other seeds!

Figure 2: The Dandelion Seed, page 12
© Joseph Patrick Anthony and Cris Arbo

Figure 3: The Dandelion Seed, page 5
© Joseph Patrick Anthony and Cris Arbo

- Are the other seeds found in the pictures in the book gliders, or are they not gliders? How do you know?

  Figure 2: *These are examples of plants that dry up before releasing their seeds. The seed capsules either burst and release the seeds, or the seeds simply drop. These seeds ARE NOT gliders.*

  Figure 3: *These grass seeds have "feather-like" ends, much like the dandelion seeds. These seeds ARE gliders!*

  Figure 4: *Acorns are fairly heavy, and the wind cannot blow these seeds around. This seed IS NOT a glider.*

Figure 3: The Dandelion Seed, page 5
© Joseph Patrick Anthony and Cris Arbo

- Dandelion seeds glide really well. Do airplanes look like dandelion seeds? What is similar? What is different? *(Remind students that airplanes FLY with engines or propellers that can take them where they want to go, and that they only sometimes GLIDE. A gliding seed gets pushed around wherever the wind takes it).*

- What happens to gliding seeds when the weather gets bad? How do you think weather affects airplane flight? *(Because airplanes don't want to get pushed around – they might end up in the wrong place – airplanes usually won't fly in really bad weather).*

Science / Engineering: Book-Based Activities

Discovery Learning: Seed Classification

Look at a collection of seeds of different types. Maple seeds, milkweed seeds, and dandelion seeds are some common gliding seeds found in North America. Ask students to classify the seeds as "gliders" or "not gliders," and to explain how they classified them as they did.

See some more examples that you might want to bring into the classroom below:

Seeds that Glide

milkweed

American elm

green ash

linden/beech

maple

Typically, gliding seeds have wings or fuzz that help them to get captured and carried by the wind. Coconuts float, and therefore are spread by water, while hitchhikers have hooks that can allow them to get picked up by passing animals. Seeds surrounded by fruit (such as apples, grapes, tomatoes, etc.) tend to get eaten by animals, and are then deposited by animals at another location after passing through their digestive system.

Seeds that DO NOT Glide

coconut

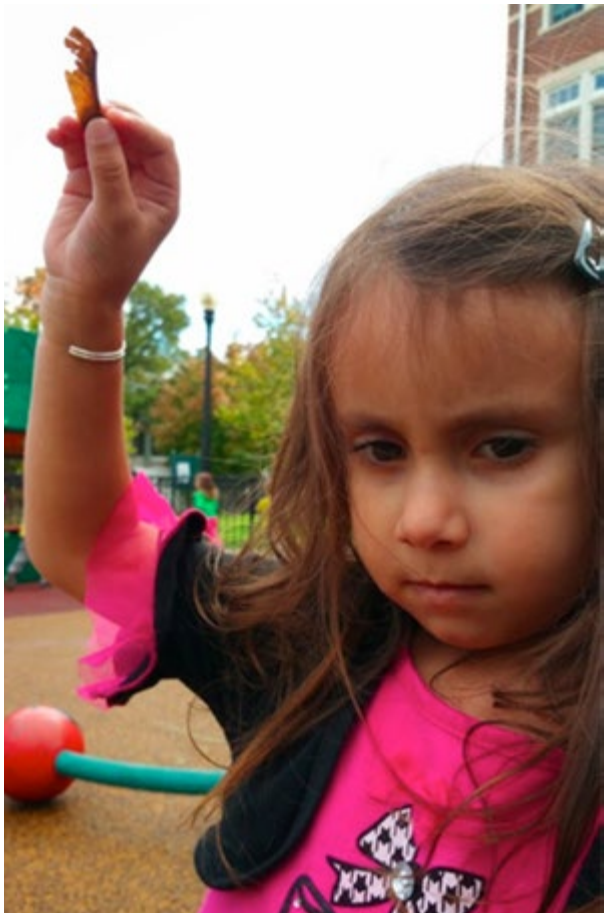
"hitchikers" / burrs

Interactive Demonstration: Maple Seeds

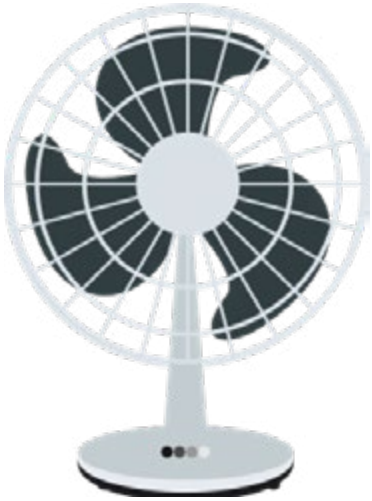
Look at maple seeds, and observe them glide to the ground by spinning. Discuss what benefits this might have to the seeds. *(The wind is more able to catch them and take them flying away from the base of the tree, so they spread out as much as possible, and so they can get their own sunlight as they grow).*

Inquiry Experiment: Wind and Wings

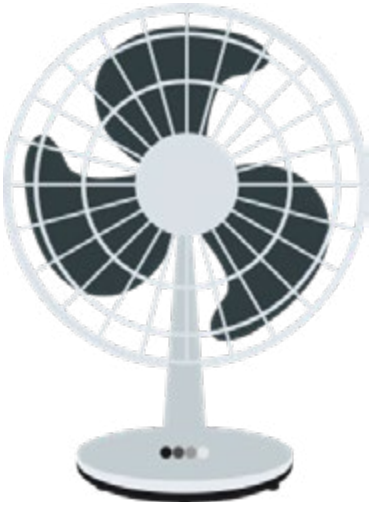
Maple seeds have a "wing" that behaves very much like an airplane or helicopter wing. Have students determine the effect of wind on maple seeds that have wings and those that do not. Prepare sets of maple seeds with and without wings.

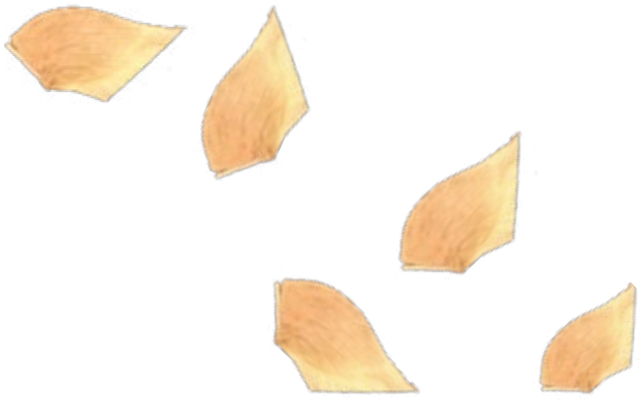


Set up the classroom so that you place a large fan near ground level, so that children can drop maple seeds above the flow of the air. Give each child at least one maple seed (ensure that seed pairs are separated). Ask students to watch how the wind pushes the seeds all around.



Next, have students perform the same activity, but before dropping the maple seed, ask students to break off the wing from the seed capsule. This time, ask students to compare how far the seed capsule fell in comparison to the seed with the wing.





Children should find that by having the wing, the seeds are much more spread out by the wind.

Inquiry Experiment: Paper Whirly-Birds

Make a model "maple seed" glider or whirly-bird. This glider, also known as a whirly-gig, gets slowed down by its wings, much like a parachute, and spins as it falls.

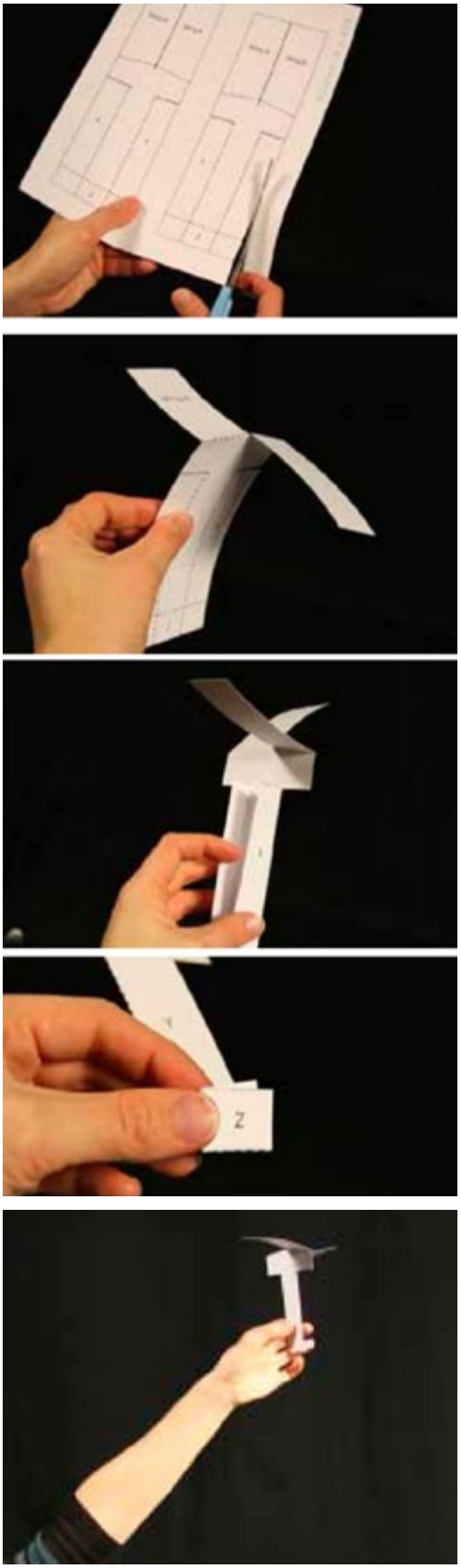
The more times a "maple seed" spins, the more it is slowed down, and, therefore, the longer it can stay airborne! The goal of this activity is to find out what kinds of factors influence the number of spins made by the "maple seed."

Experiment with the whirly-bird by investigating how weight, wing shape/width/length, etc. influences the time of fall or number of total spins that it makes. See NASA's Museum in a Box First Flyer Activity for more information: https://www.nasa.gov/wp-content/uploads/2023/06/first-flyers-k-4.pdf

Use the attached template to allow students to practice cutting straight lines. (Consider cutting out the template for each child).

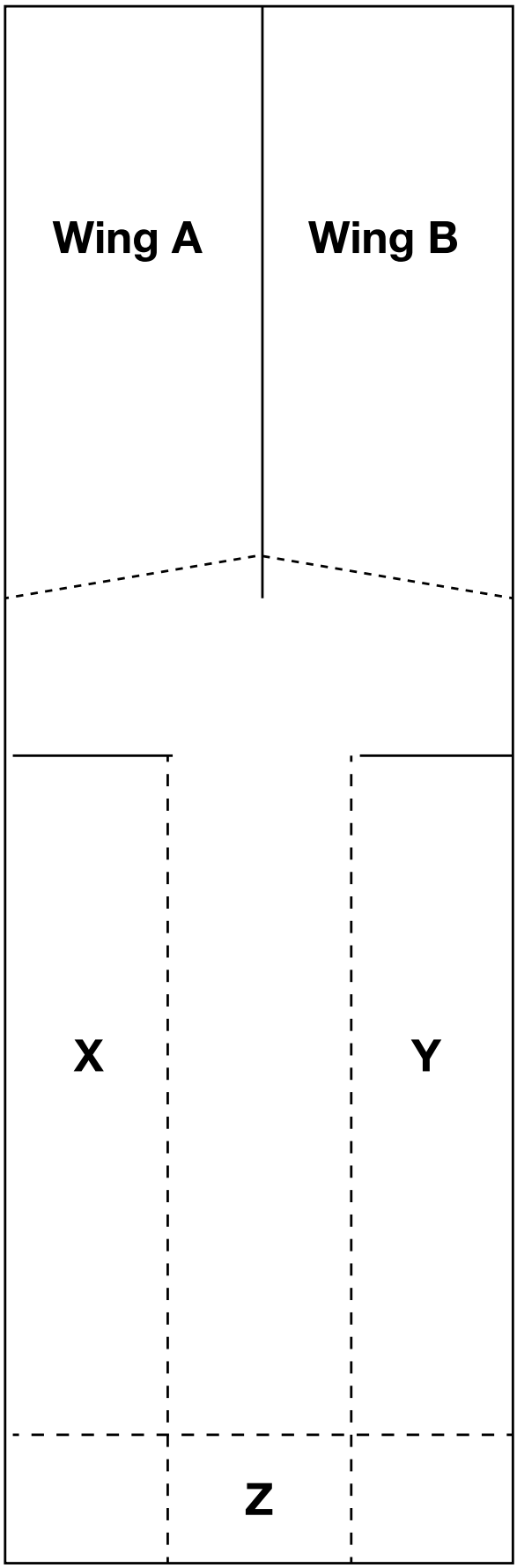
Allow students to cut the two horizontal slits as well as the vertical slit to separate wing A and wing B. (Consider providing children with a cut-out rectangular template, and simply highlighting the lines that they should cut.)

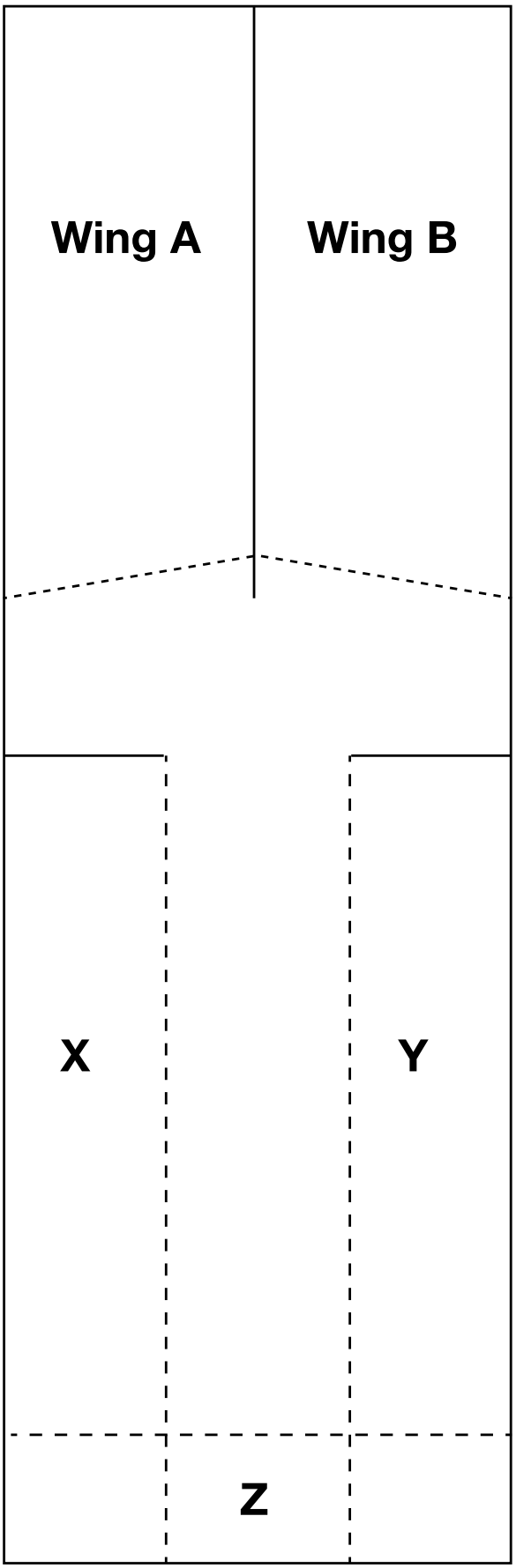
Assist children with bending the propellers and folding in the base. If necessary, attach a paper clip to the bottom of the propeller's body to give it some weight and to keep it folded.



fold

cut





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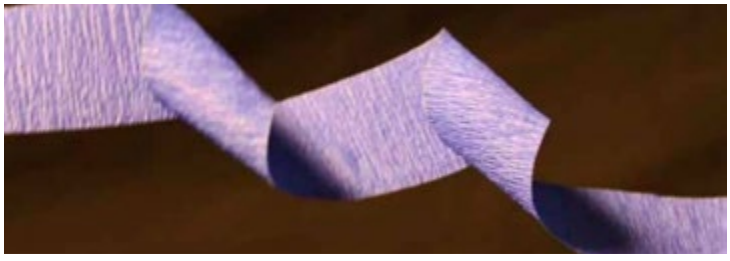
Allow children to practice dropping the paper whirling "seeds."

Children can try to make their seeds take the longest time to fall. Variables that can be changed could include:

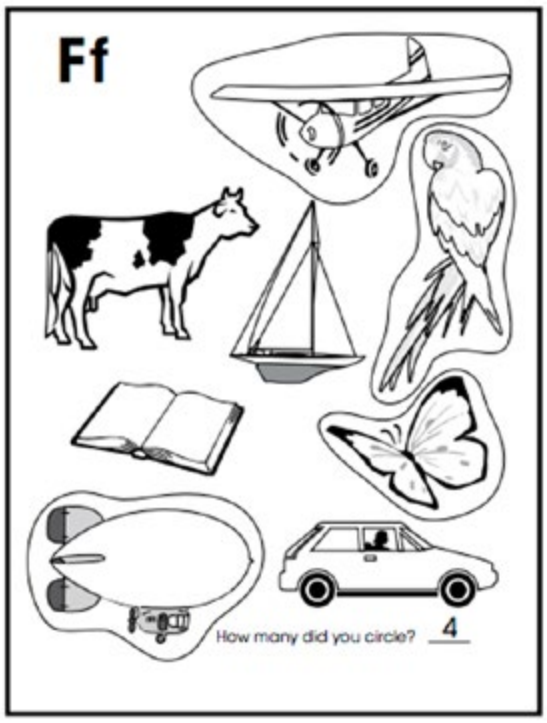
- Adding weight to the base of the seed (by adding paper clips)
- Changing the shape or length of the propellers (folding or cutting them)
- Removing one of the propellers (cutting it off)

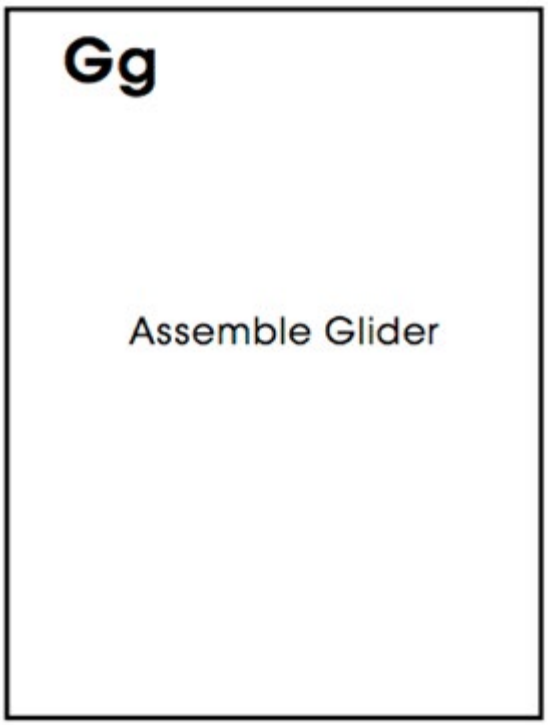
Children could also look for the relationship between variables and the number of twists made by the seed. (Adults should do the dropping, as children are likely too small). To determine the number of twists, attach a piece of crepe (streamer) paper to the bottom of the seed with a piece of tape. The adult should place his/her foot on the flat streamer, then allow the seed to fall. The twists can then be counted by children as they are untwisted.



Writing: “F” and “G”

Practice writing the letters F and G. Use NASA’s High Flyers Alphabet Activity Book.

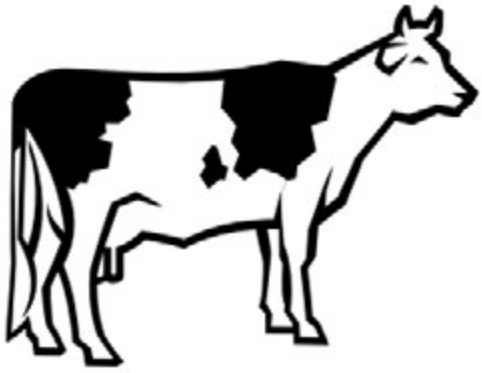


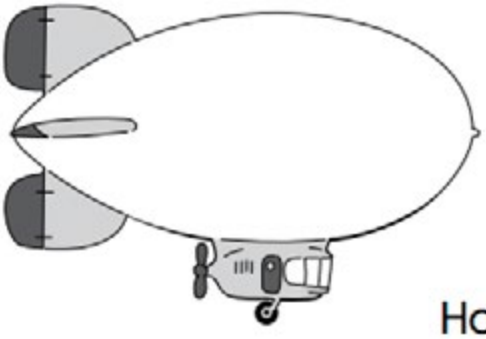


Ff f

fly

Circle the pictures
of the things that fly.





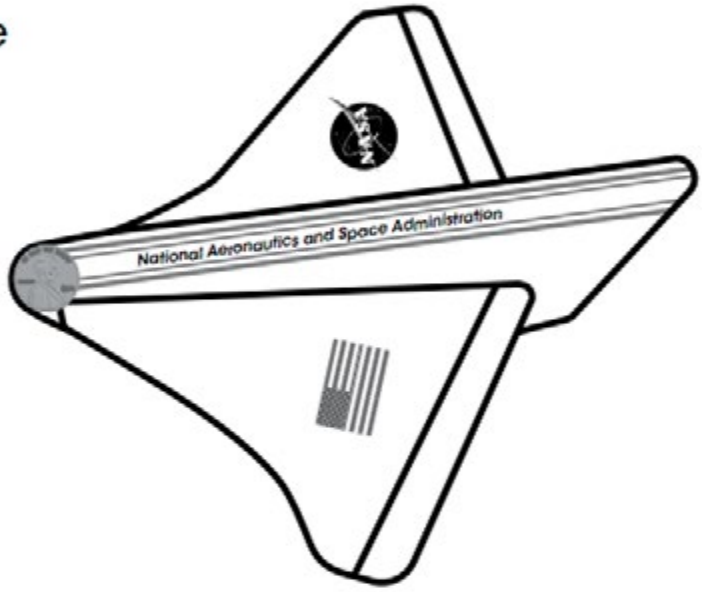
How many did you circle? _____

Gg Gg

glider

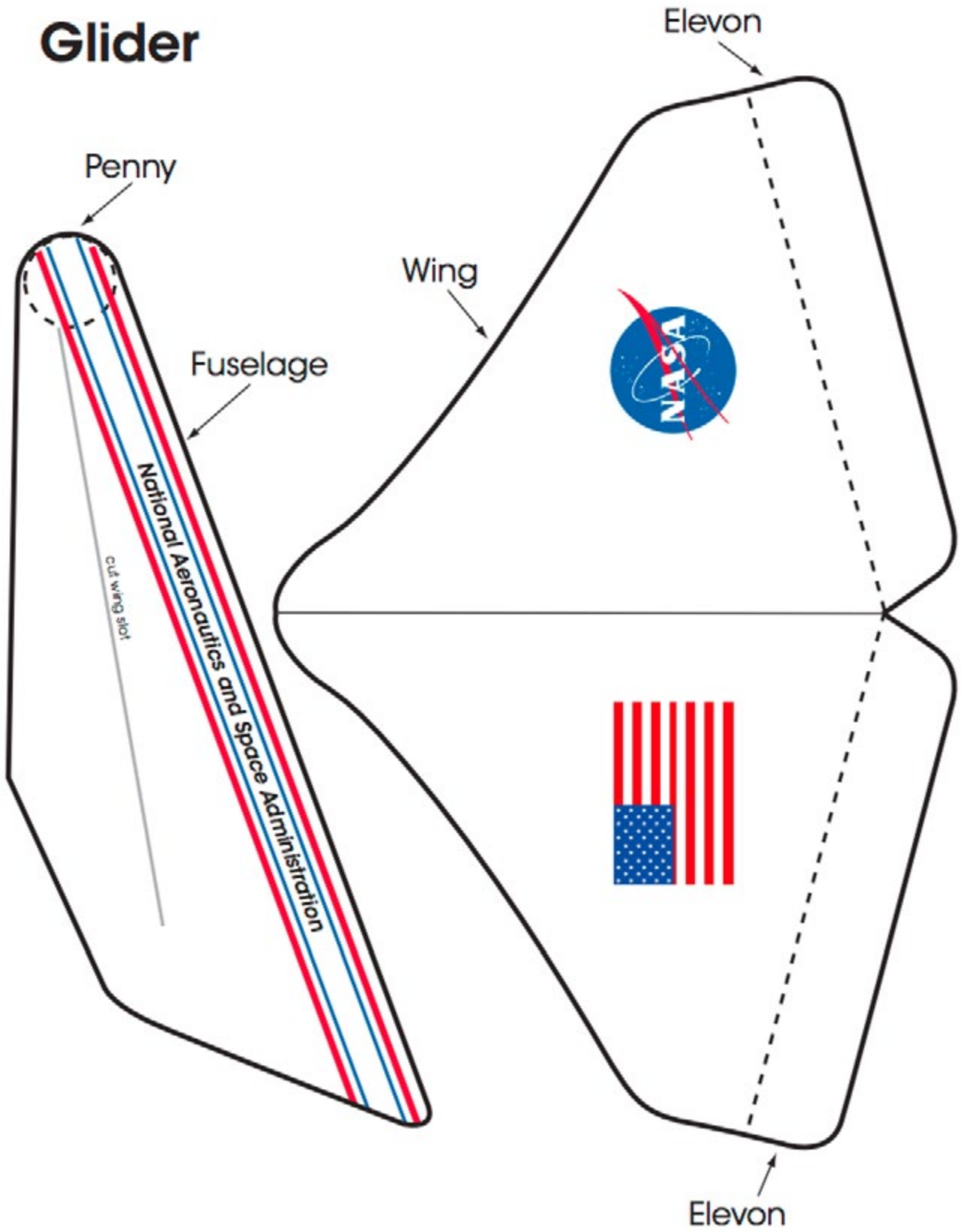
Materials Needed

Scissors
Cellophane tape
One penny



Instructions

1. Cut out the wing and fuselage patterns that can be found on the back cover of this book.
2. Carefully cut on the wing slot line located on the fuselage.
3. Slide the wing into the slot, making sure that the wing center line is within the fuselage.
4. Tape the wing to the fuselage.
5. Tape the penny to the nose of the fuselage for balance.
6. Bend both elevons upward.
7. Gently toss the **glider**.


Glider
Elevon
Penny
Wing
Fuselage
National Aeronautics and Space Administration
cut wing slot
Elevon

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