

## Engineering an Airplane

**Topic(s):** Engineering Design

**Best for students in grades 4-7**

### Summary

In this activity, you will learn how to be an engineer by designing and building a model plane. You'll also test out your plane and make improvements so that your plane can fly farther.

### Goals and Objectives

1. Design, test and modify an airplane prototype to fly as far as possible
2. Explain the role of an engineer

### What you need:

**Need:** computer, cardboard (shoebox, egg carton), scissors or boxcutter, tape, pencil, ruler, a penny or nickel

**Optional:** paper, markers, glitter, string, paper clips, straws, glue

### Facilitator Resources

**Article:** [Four Forces on an Airplane](#)

**Video:** [Aerodynamics of Flight](#)

### Learner Resources

**Video:** [How Engineers Test Ideas](#)

**Video:** [STEM Chat- Iker from NASA](#)

**Picture:** [Different types of airplanes](#)

### Key Vocab

**Aeronautical engineer-** An engineer who designs aircrafts such as airplanes and helicopters.

## Activity Guide

### Discuss[20-25 min]

Encourage brainstorming about airplane making and provide background knowledge for an engineer's career

#### Facilitator Actions

Begin a discussion about airplanes with the students.  
Ask questions such as:

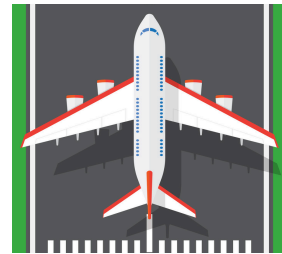
- What do you know about airplanes?
- What are the parts of an airplane?
- How do you think airplanes are built?
- Who designs and builds airplanes?

Explain that someone who builds airplanes for a living is an *aeronautical engineer*.

**Optional:** Show video: [STEM Chat- Iker from NASA](#)

#### Learner Actions

Participate in group discussion and brainstorm ideas about how an airplane is built

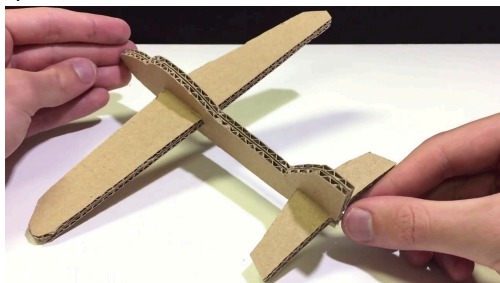



### Make [25-30min]

Students build airplanes and test their designs by flying them


#### Facilitator Actions

#### Learner Actions

<p>1. Show students the <a href="#">How Engineers Test Ideas</a> video. Explain that today, the students will be engineers building their very own planes, and the goal is to build a plane that flies as far as possible. Show students the <a href="#">different types of airplanes</a> image to inspire ideas. <a href="#">Review instructions</a> with students and pass out materials for plane construction</p> <p><b>Alternative:</b> If paper airplanes are more desirable, use this video to make a paper airplane: <a href="#">How to Fold a Paper Airplane That Flies Far</a> or this <a href="#">graphic of how to fold a paper airplane</a></p>	<p>1. Work as partners or individuals to build the frame of their plane following the instructions. Once the frame is complete, students can add in extra features they think will help their plane fly farther. Decorating is optional.</p> 
<p>2. Measure each students' throw, ensuring each student/group gets three safe turns</p>	<p>2. Take 3 turns testing their airplanes by throwing them from a fixed line and recording the length of their throw.</p> 

### Discuss [10min]

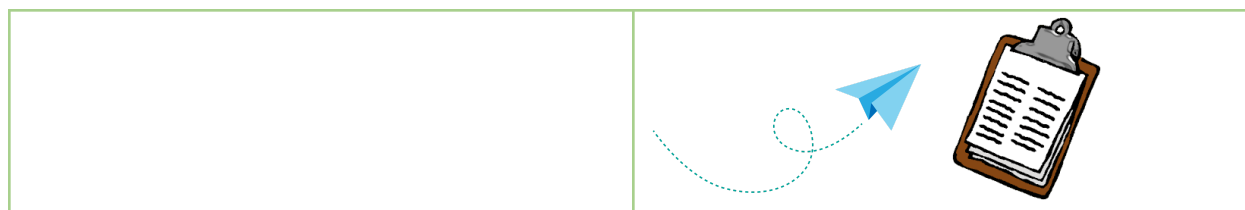
Trial 1: Students will test out their airplanes and reflect on what worked in their plane and what needs to be improved

Facilitator Actions	Learner Actions
<p>Facilitate a whole group discussion about the first trial. Questions to ask could be:</p> <ul style="list-style-type: none"> <li>• Why did some planes fly further than others?</li> <li>• What could you improve on your plane so that it flies further?</li> <li>• What did you learn about being an engineer?</li> <li>• What did you do when building the plane was hard?</li> </ul>	<p>Think about and discuss what worked well in their planes and what could be improved on for it to fly further.</p> 

### Make [10-15min]

Trial 2: Students make improvements on their designs and test fly again

Facilitator Actions	Learner Actions
<p>1. Reiterate that students tested their first design and now they can make improvements so their plane will fly farther, just like an engineer would.</p>	<p>1. Use the same materials to make adjustments on their planes or build new ones.</p>
<p>2. Measure each students' throw, ensuring each student/group gets three safe turns</p>	<p>2. Take 3 turns testing their airplanes by throwing them from a fixed line and recording the length of their throw.</p>



### Reflect [8-10min]

Reflective practice led by students. Students can reflect in a manner that best suits them (e.g. writing, drawing, making a poem, etc.)

Facilitator Actions	Learner Actions
<p>Ask students to silently reflect on the day's activity. Some suggested reflection points are:</p> <ul style="list-style-type: none"> <li>• What did I do well on my airplane?</li> <li>• What could I have done better?</li> <li>• What have I learned about engineers, and what do I still want to know?</li> </ul> <p>Ask a few students to share their reflections with the rest of the group.</p> <p>Ask students to review an engineer's job and ask how they were engineers today.</p>	<p>Reflect individually about how the activity went. Include at least one positive and at least one area for growth. Learners can choose their means of reflection (drawing, writing, making, etc.).</p> <p>Share their reflection with the group and listen as their classmates share.</p>

### Extensions

- Read the article: [Four Forces on an Airplane](#)
- Build a paper airplane that flies for a long time using this guiding video: [Best Paper Airplane That Flies Forever](#) and compare it to your airplane that you built for flying long distances
- Watch this video featuring a Boston aeronautical engineer: [STEM Chat- Iker from NASA](#)

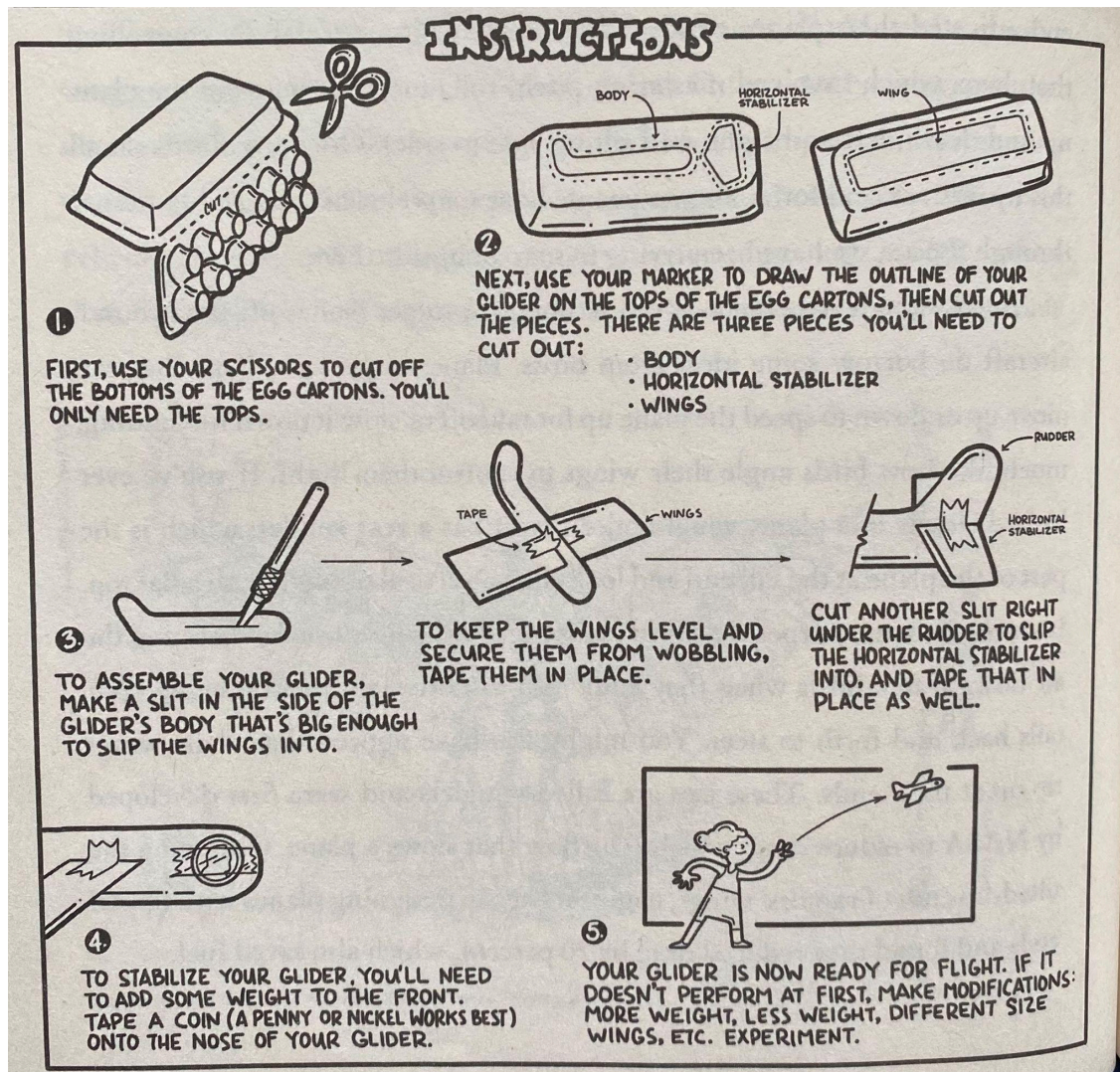
### Standards

**4.3-5-ETS1-3.** Plan and carry out tests of one or more design features of a given model or prototype in which variables are controlled and failure points are considered to identify which features need to be improved. Apply the results of tests to redesign a model or prototype.

**6.MS-ETS1-6(MA).** Communicate a design solution to an intended user, including design features and limitations of the solution.

**7.MS-ETS1-7(MA).** Construct a prototype of a solution to a given design problem.

## Visual Instructions



\*Note: a paperclip can be attached to the front instead of a coin.