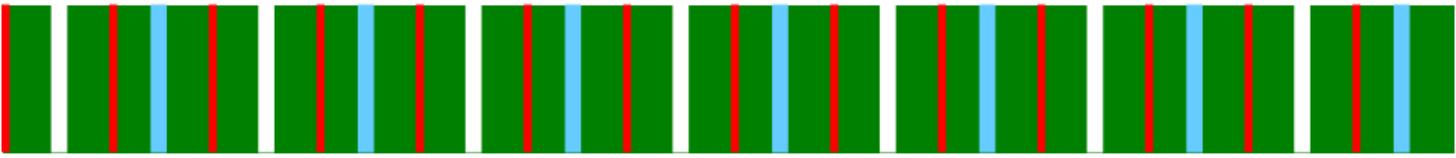


# MAKEngineering Kit: Make Your Idea Fly

Inspired by *What Do You Do With an Idea?* By Kobi Yamada



This engineering kit would not have been possible without funding and support from the National Science Foundation.

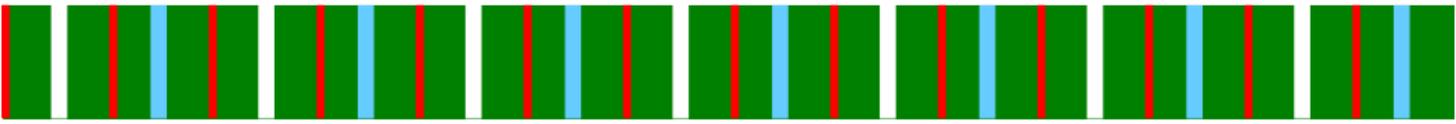


# ENGINEERING TASK

Read the book, *What Do You Do with an Idea*.

In the story, a child got an idea and did not know what to do with it. Have you ever had an idea? What was it? What did you do with it? Did you share it, hide it, protect it? Did anyone ever tell you that your ideas were silly? The idea in the story taught the child to think outside the box and at the end, the idea changed, spread its wings and took flight.

Your **engineering task** is to build something that will make your idea (a ping pong ball) fly.



# DID YOU KNOW...?



There are jobs in which people design and build machines that fly. They are called aerospace engineers.

Watch the following video to learn more:

<https://youtu.be/ivjURbkjUyM>

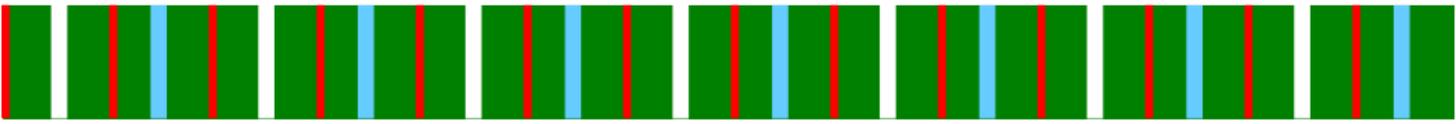
What other things do you think aerospace engineers design and build? What about balloons? Or kites?

# MATERIALS IN KIT

Let's check the materials in the kit. Will you help me count?

- ◇ 1 Ping-Pong Ball
- ◇ 10 Craft sticks
- ◇ 5 Rubber bands
- ◇ 4 Paper plates
- ◇ 10 Paper clips
- ◇ 5 Pipe cleaners
- ◇ 5 Straws
- ◇ 1 Roll of Tape
- ◇ 1 Glue Stick

We will also need recyclable materials (e.g., egg cartons, paper towel rolls, food boxes), scissors, paper, and pencil.

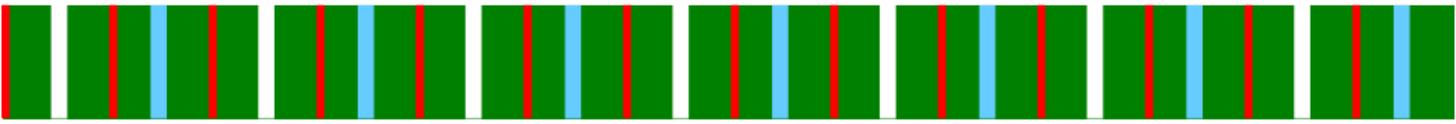


# STEP 1—RESEARCH

Have you ever seen something flying? What do you think makes these things fly? Find pictures and/or videos of things that fly (birds, planes, kites, etc.).

Questions to Pose:

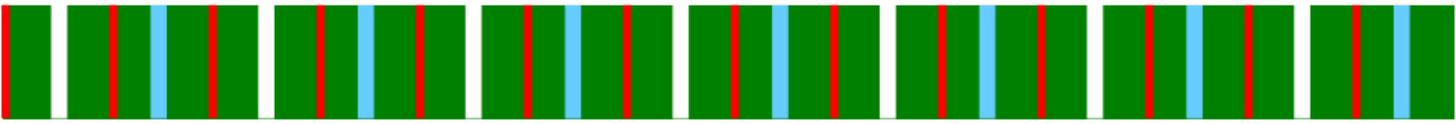
- ◇ What do you notice about the wings or the tail? What about the body?
- ◇ Which one of those things could carry your idea?
- ◇ What material do you think we could use to build something that will carry your idea?



# STEP 1—SUPPORT

Optional ideas to explore to excite your engineer:

- ◇ Draw a face on the ping-pong ball.
- ◇ Ask open-ended questions starting with “I wonder ...” (e.g., I wonder how we might add a propeller. What do you think?)
- ◇ Watch videos that explain how things fly.  
Example 1: <https://youtu.be/zLOviPA9hC4>  
Example 2: [https://youtu.be/JqD3HN5F\\_q4](https://youtu.be/JqD3HN5F_q4)
- ◇ Sketch a plane or a bird. Sketching helps with breaking a whole into parts. (<https://youtu.be/ullENvkeKmw>)



## STEP 2—PLAN

Based on your research, design/sketch 3-4 flying machines and make a list of materials for each design. What makes each of your designs unique? What other ways can you make your idea fly?

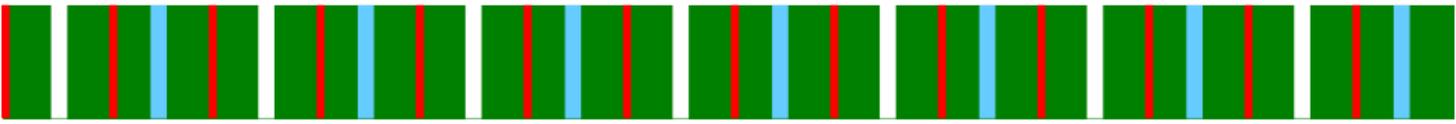


## STEP 2—SUPPORT

Encourage your child to think outside the box.

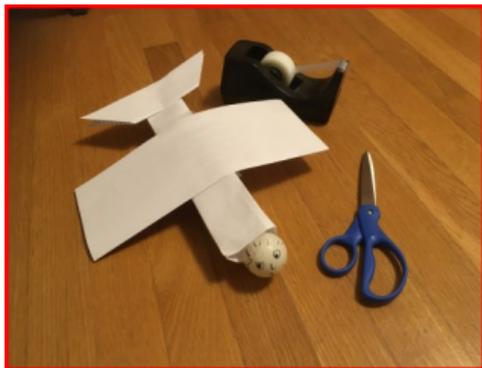
Optional questions to ask:

- ◇ I think we should name each of the designs. What did you name this one? Why?
- ◇ What were you thinking when designing or sketching the different flying machines?
- ◇ Is there a way to not use so much tape? How might we use the rubber bands or pipe cleaners?
- ◇ I wonder if there are other ways we can make things fly like a catapult or a sling shot?



## STEP 3—CREATE

Pick one of your designs from Step 2. Build something that will fly your idea.



Try different materials as your building materials—paper, paper tubes, tissues, fabric, and aluminum foil. What other material in your home might you use? Predict which material will work best. Why?

## STEP 4—TEST

Will your flying machine carry your idea? How high and how far will it go?

Place your idea (or ball) inside the flying machine. Make your machine go. Did your flying machine make your 'idea' fly? Did your 'idea' stay safe?

How far did your 'idea' fly?

What objects might we use to measure the distance? How might we use our feet or paper clips?

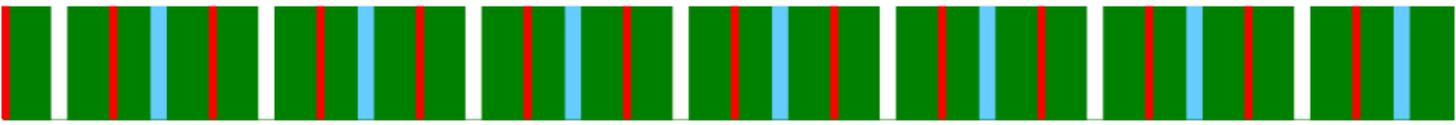


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## STEP 4—SUPPORT

Normalize failure and encourage a growth mindset. Use the power of “not yet.” Optional questions to ask:

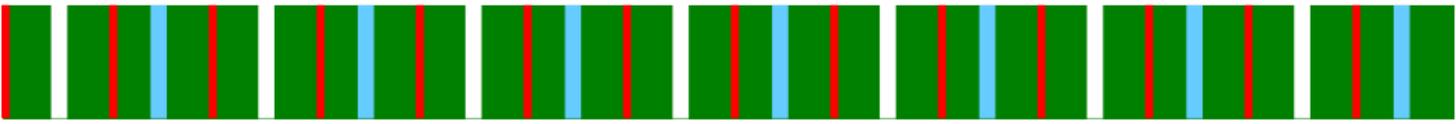
- ◇ Would you consider this test a success or failure? Tell me why.
- ◇ What change(s) should we make in the next step (i.e., redesign)? What happened in the test that makes you think this?
- ◇ Let's try the test from different sitting and standing positions to see how it works. What do you notice?
- ◇ Illustrate a different way to “fly” the prototype. And be intentional with failure moments.



## STEP 5—IMPROVE

Based on the test, what changes should we make to the flying machine? Why? Should we use different material? Tell me more.

Make these changes to your flying machine. Keep testing and redesigning the until you are satisfied. This is what we call iteration.



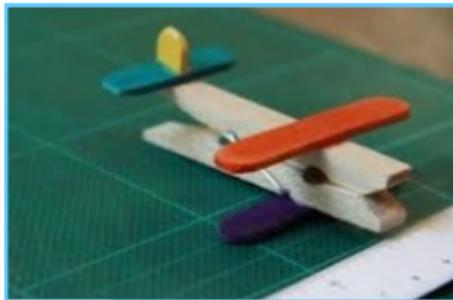
# STEP 6—PARALLEL PROTOTYPE



Try additional designs from Step 1. Do each step again—Build, Test, and Improve.

We also have a few challenges for you to consider:

- ◇ no tape
- ◇ use other household objects.
- ◇ no wings

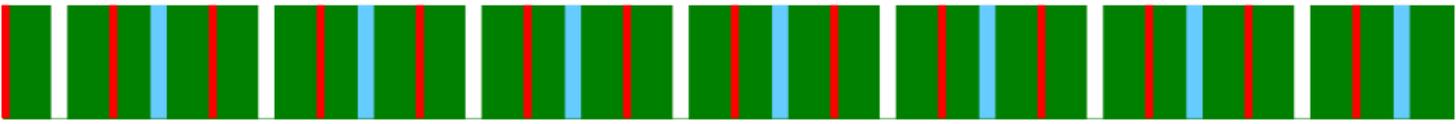


# COMMUNICATE

Engineers have to be able to talk about their process and their prototype to a wider audience.

Here are a few questions to talk through:

1. What makes your flying machine unique?
2. Explain how well (or not so well) your flying machines carried your idea.
3. If you could go back in time, would you use different materials? Why or why not? If yes, what materials would you use?



## DID YOU KNOW...

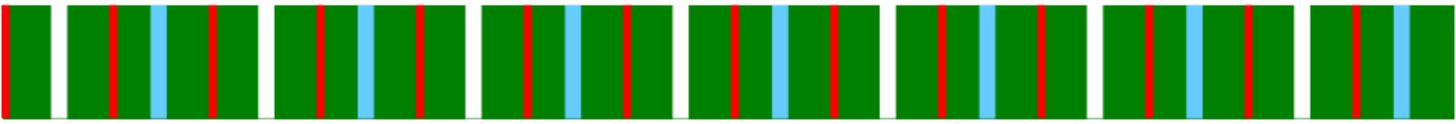
People have been building flying machines for a very long time. We have included videos below to explore more about people's struggles of building flying machines.

Video 1: <https://youtu.be/75okexRzWMk>

Video 2: <https://youtu.be/byj1Y6xiNAo>

Video 3: [https://youtu.be/Y0\\_htkvCVpE](https://youtu.be/Y0_htkvCVpE)

Video 4: <https://youtu.be/lzTIA-co7Fk>



# SHARE THE FUN AND PASS IT ON!

Thank you for participating.

When you are done with this project, gift the book and the directions to your friend to make the idea of engineering fly.

