Out for a Spin

Suggested Grades: 3–8

Activity Overview

Helicopters are amazing aircraft that can fly in ways airplanes cannot. Soon, NASA is going to be sending a helicopter named Ingenuity to Mars to become the first aircraft to fly on another planet! In this activity, you will learn how the size of the Ingenuity's rotor blades are important for it to be able to fly in the lesser atmosphere of Mars.

Time: 30 minutes

Materials:

- 2 Small paperclips
- Scissors
- Paper helicopter templates (the last page of this document)

STEPS

1. Begin by cutting out the two helicopter templates as shown in *Figure 1*.

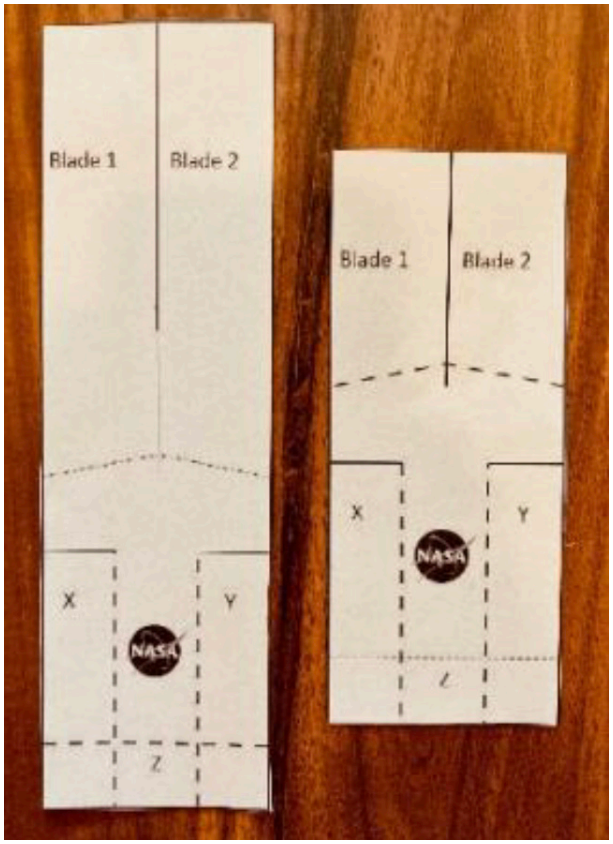


Figure 1: Use tape to hold the straws together.

2. Cut on the three solid lines as shown in *Figure 2*. You need to repeat this step for both the large and small helicopters. Do not cut along the dashed lines!

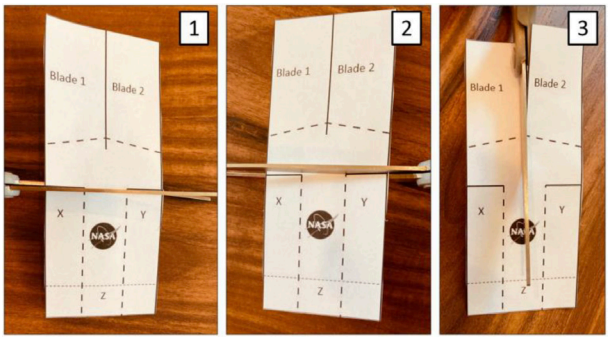


Figure 2. For each helicopter, cut on the three solid lines.

FLIGHT LOG ENDORSEMENT CODE: HELOMOD

3. For each helicopter: Fold the flaps labelled X and Y on the dashed lines toward the back (see *Figure 3*). Run your finger down the fold to make sure it is a tight fold.

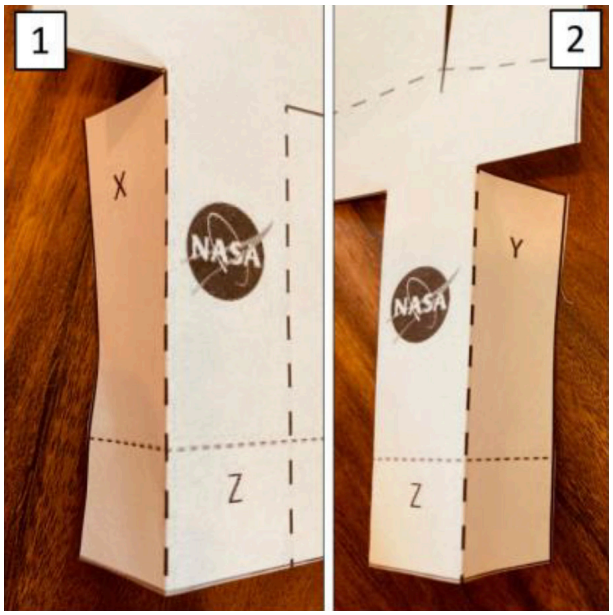


Figure 3. Fold flaps X and Y toward the back of the helicopter.

Your helicopters should now look like *Figure 4*.

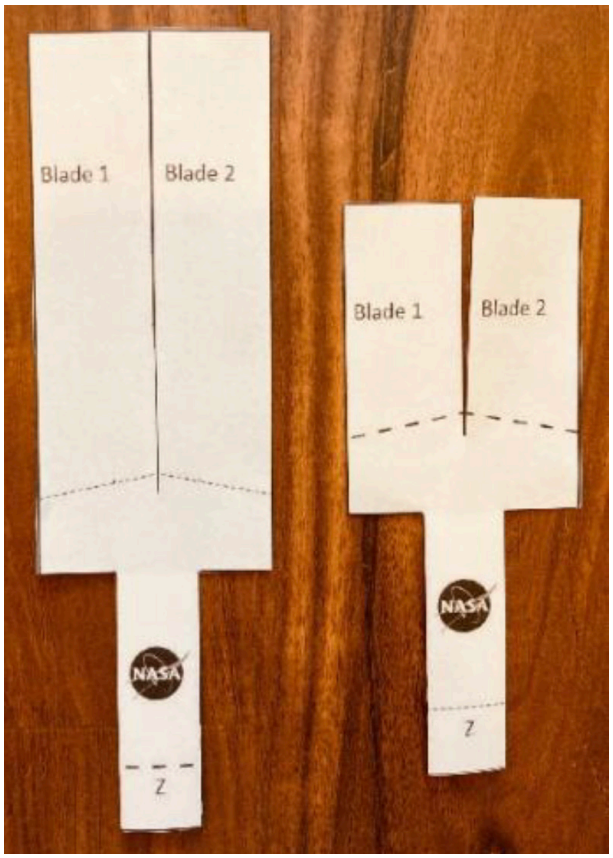


Figure 4. Once the flaps are folded, your helicopters should look like this.

4. For each helicopter: Fold flap Z toward the back as shown in *Figure 5*. Run your finger along the fold to make sure it is a tight fold.

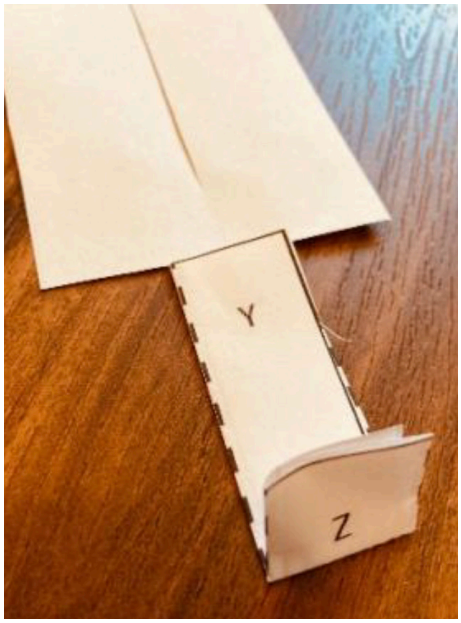


Figure 5. Fold flap Z toward the back of the helicopter.

Your helicopters should now look like the ones shown in *Figure 6*.

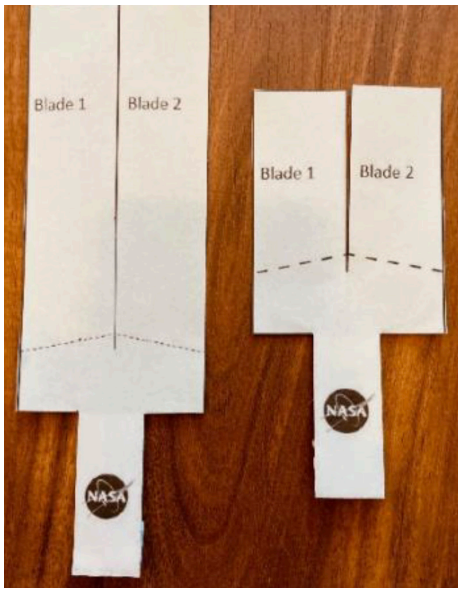


Figure 6. After folding flap Z, each helicopter should look like this.

5. Put a paperclip on the bottom of each helicopter as shown in *Figure 7*.

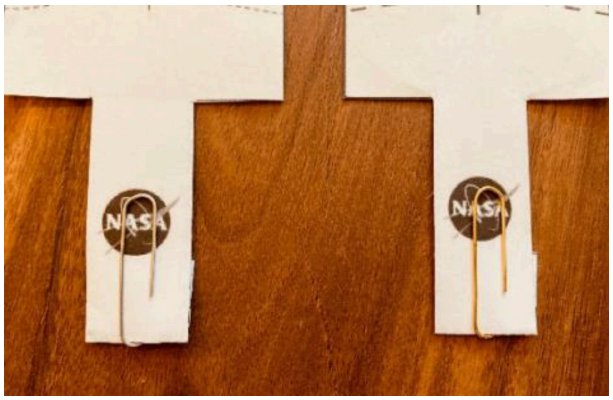


Figure 7. Put a paperclip on the bottom of each helicopter.

6. For each helicopter: Fold Blade 1 down along the dashed line as shown in *Figure 8*.

Figure 8. Fold Blade 1 along the dashed line.

7. For each helicopter: Fold Blade 2 along the dashed line. It should be folded in the direction opposite of Blade 1 (see *Figure 9*). You should see that the words “Blade 1” and the words “Blade 2” face different directions after folding.

Figure 9. Fold Blade 2 in the opposite direction of Blade 1.

8. At this point, the building of both helicopters should be completed and they should look like the ones shown in *Figure 10*.

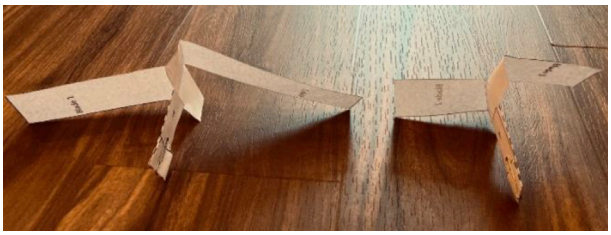


Figure 9. Fold Blade 2 in the opposite direction of Blade 1.

9. To launch a helicopter, you need to hold it between your thumb and forefinger as shown in *Figure 11*.

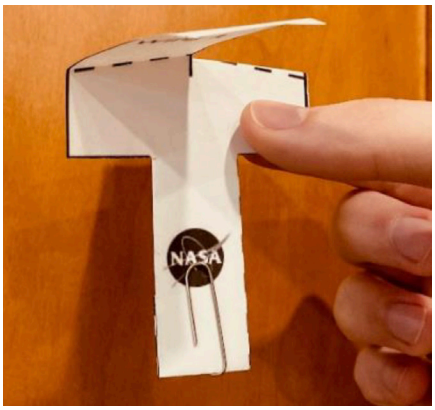


Figure 11. Hold the helicopter on the edge with your thumb and forefinger.

10. Standing upright, hold a helicopter as shown in step 9. You should hold it with your arm extended away from your body and slightly upward. To launch it, let go and pull your hand back. The helicopter should spin as it falls to the ground.

11. The two helicopters you built have different sized blades. We want to experiment to see how the blade size affects the helicopter. To do this, hold one helicopter with each hand. Then, hold them at the same height as shown in *Figure 12* and let them go at the same time. Observe how they each fall.

Figure 12. Hold a helicopter in each hand and let them go at the same time.

You should notice that the helicopter with the longer blades falls more slowly to the ground. As the helicopters fall, the air pushes up on the blades, slowing the helicopters down and causing them to spin. The helicopter with the longer blades has more air hitting it, so it falls more slowly than the helicopter with the shorter blades.

Background Information

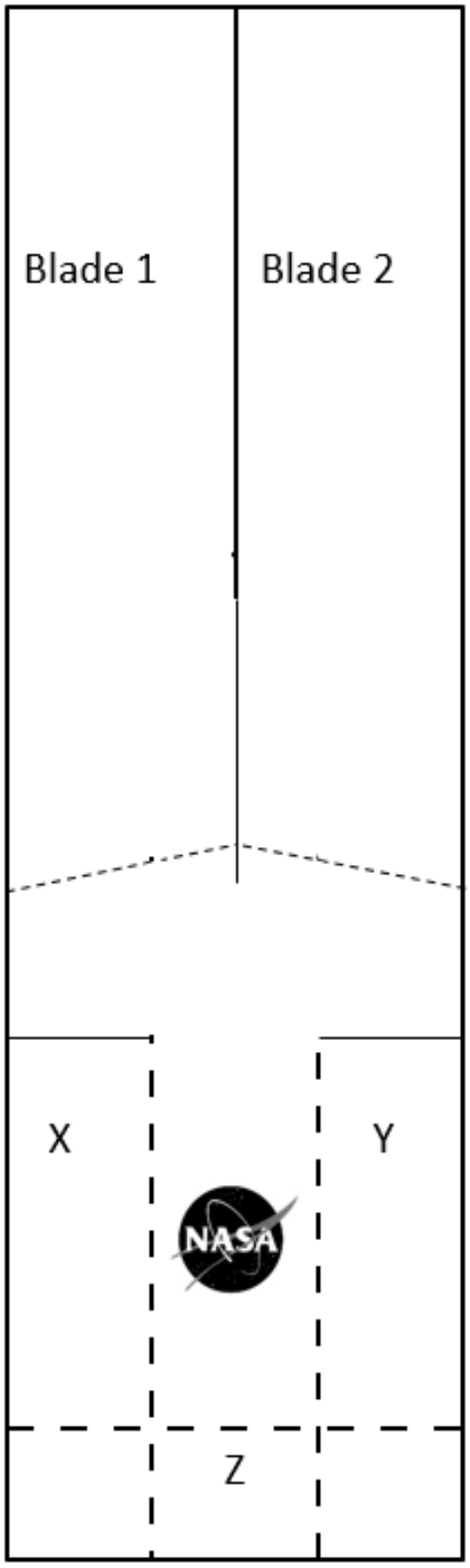
Figure 13. Ingenuity has long rotor blades because of the thin Martian atmosphere. Credit: NASA

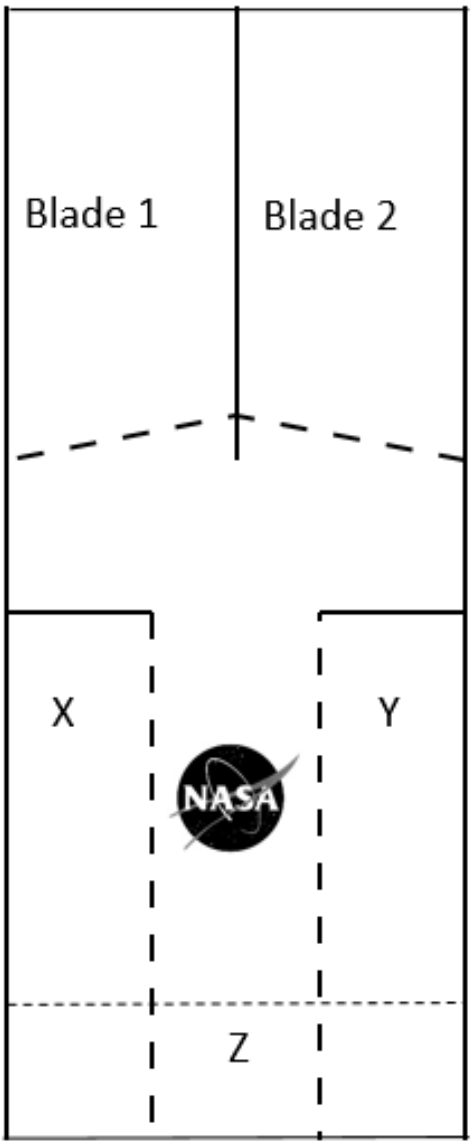
NASA's helicopter, Ingenuity, is designed to fly in the Martian atmosphere. This atmosphere has less air than Earth's atmosphere. As a result, Ingenuity needs very long rotor blades to create enough lift for it to fly.

The fuselage, which is the portion of Ingenuity that contains the batteries, cameras, and other sensors, is a small box which is only about 8 inches on each side. The entire helicopter only weighs about 4 pounds! Despite its relatively small size, the rotor blades for Ingenuity are 4 feet long - and there are two of them. Without such long blades, the helicopter would be unable to fly in the Martian atmosphere.

Do you want to learn more about Ingenuity? Take a look at our site: https://mars.nasa.gov/technology/helicopter/.

Cut on solid lines and fold on dashed lines





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