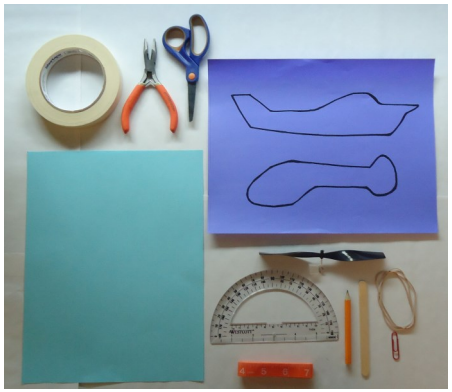
# Rubber Band Helicoptors

Children's Museum of Houston

Can you engineer a helicopter with a craft stick that will lift and fly?

## MATERIALS



- Craft Stick
- Propeller
- Paperclips (coated)
- Helicopter and Airplane Cutout
- 2 Rubber Bands
- Masking Tape
- Scissors

## GET SET UP

1. **Attach the propeller:** Get yourself a craft stick. Attach the propeller to one end of the craft stick using masking tape. Don't cover the loop. You will need to hook a rubber band to that later.
2. **Attach the paper clip:** Pull the smaller, inside loop of a paper clip back to form an L-shape. Tape the larger side of the paper clip onto the bottom end of the craft stick. Make sure that the paper clip is facing the same direction as the propeller loop and the paper clip is directly below the propeller loop. The side of the paper clip that is not taped should resemble an upside down U. You will later adjust it so that it is angled away from the stick.
3. **Add the cutout:** The paper cutout is important— it's what makes the helicopter balance and work. Cut the shape out and attach it to your craft stick about an inch below the propeller and on the opposite side of the stick as the paper clip.
4. **Attach the rubber band:** Loop two rubber bands over the propeller clip (you want to use at least two rubber bands to be able to store more tension). Then stretch the rubber bands down to attach the other sides to the paper clip loop. The rubber bands should fit snug from top to bottom. If it is not snug, adjust the angle of the paper clip making sure that it sits at a rough 45 degree angle.

Get ready to fly your helicopter! You'll need to spin the propeller for a minute or two. Watch the rubber band start to tense up. Once it starts to form knots from top to bottom you're ready to fly! Let go and watch it lift and fly about!

## DID YOU KNOW...

**Aerodynamics** is the study of forces and motion of objects through the air. There are four forces required for flight. They are **lift, drag, gravity (weight),** and **thrust**. In your rubber band helicopter, energy is stored in the rubber band by winding the propeller. That is known as potential energy. When the rubber band unwinds rapidly, it releases its energy. Potential energy becomes kinetic energy and this turns both the propeller blade and the paper cutout helicopter. The paper cutout pushes against the surrounding air, which creates horizontal air resistance, also known as drag. This makes it harder for the cutout to spin. Because the cutout does not spin as easily, more energy from the rubber band is released into the propeller, which makes it easier to turn. In this way, the paper acts like a rear rotor of a real helicopter. As the propeller spins rapidly it begins to create lift by pushing air downward. With enough potential energy the helicopter will fly in whatever direction it is pointed, but ultimately gravity is what brings it back down! Aerospace engineers design, construct, and operate aircraft, aerospace vehicles, and propulsion systems. As an aerospace engineer you might design a plane, a glider, a helicopter, or spacecraft. Aerospace engineers need to understand angles and cardinal directions in order to help them research, develop, and test new materials, engines, body shapes and structures that may increase the speed and strength of airborne vehicles.


## CHALLENGE

1. What forces are used by your rubber band helicopter to enable it to fly?
2. Find a partner. Do you predict the helicopter will fly better or worse if you add another rubber band? Test your hypothesis! What if you add 2 more rubber bands?
3. Why do you think an helicopter is able to hover in space? What two forces is it opposing when it an helicopter hovers?

**STEAM Challenge:** Helicopter blades can spin at a rate of 250—600 rpms (revolutions per minute). A minute is 60 seconds—how may times can they rotate per second? Lets say a helicopter blade is spinning for 43 minutes. How many rpms is this?