Vertical Flight Society

The Vertical Flight Society is the world's oldest and largest technical society dedicated to enhancing the understanding of vertical flight technology. Since it was founded in 1943, just as the first US helicopter was being put into service, the Society has been the primary forum for interchange of information on vertical flight.

vtol.org

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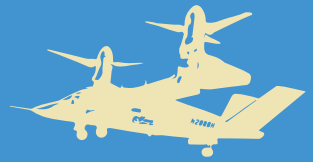
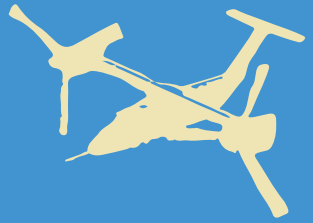
What happens to the helicopter when the engine fails in flight?

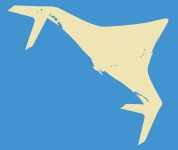




More VTOL facts on stem.vtol.org

THE ENGINE powers the rotor, but the spinning rotor blades are responsible for creating lift to keep the helicopter in the air. When the engine fails, the helicopter is now in the ***autorotation*** state, where the rotor is driven solely by the upward flowing air. Through good engineering design and skillful piloting, it is still possible for the helicopter to land quickly and safely.

Learn more at stem.vtol.org



Who is the world record holder for the highest autorotation landing? Visit our online database Vertipedia to find out!

vertipedia.vtol.org

Vertical Flight
Society

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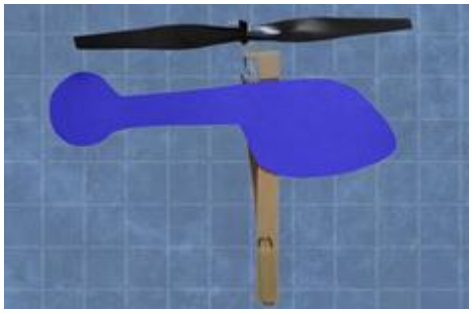
Rubber Band Helicopters

Adapted slightly from: http://www.instructables.com/id/Rubberband-Helicopters-step-by-step/
A project from The Workshop for Young Engineers (http://thewye.com)



The rubber band-powered helicopter is easy to construct, and with a little practice it can be flown 20+ feet into the air!

How It Works:

1. Elastic potential energy is stored in the rubber band by winding the propeller.
2. When flown, the rubber band rapidly transforms its potential energy into kinetic energy for the propeller by unwinding, which turns both the propeller blade and the paper cutout.
3. The paper cutout pushes against the surrounding air, which creates horizontal air resistance, or 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 is much easier to turn. In this way, the paper acts like the rear rotor of a real helicopter
4. As the propeller spins rapidly, it begins to create lift by pushing air downward. With enough energy, the helicopter will fly in whatever direction it is pointing.

Step 1: Materials

6" hook nose propellers
Craft sticks
Paperclips
Rubber bands
4x6 Index Cards
Masking tape
Scissors

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Step 2: Propeller

Put a craft stick into the hook propeller.

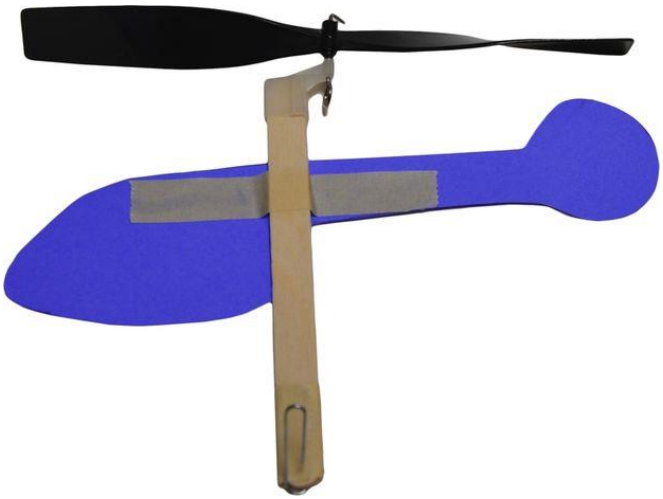
(These propellers can be found at www.kelvin.com.)

Step 3: Paperclip

Bend a paperclip open, as shown to the right. Then, put one side below the end of the craft stick (notice the hook on the propeller is up).

Tightly wrap a piece of masking tape around the paper clip to secure it to craft stick.

Step 4: Paper cutout



Cut out one of the helicopter templates and tape it to the craft stick on the opposite side of the hook, as shown to the right.

The paper cutout is crucial; it's what make the copter work. If it's too small, then it won't create enough lateral drag, and too much of the energy in the rubber band will be diverted to the craft stick. If the cutout is huge, it'll simply be too heavy.

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Step 5: Attach rubber bands

A rubber band should easily slip into the propeller hook and paper clip, as shown to the right. You can use more than one rubber band.

Step 6: How to fly

The helicopter must be wound up. To do this, students must spin the propeller to twist the rubber band. The number of turns depends on the rubber band you use.

Once the rubber band has be wound, hold the top of the propeller and the bottom of the craft stick near the paper clip. For a stable and high-reaching flight, you must let go of the top first and then the bottom within half of a second of each other. This can be difficult for young students to coordinate, so tell them to verbally say "tick tock." As they say “tick” they should let go of the top and “tock” let go of the bottom of the helicopter.

You can also fly the helicopter sideways following the same procedure.

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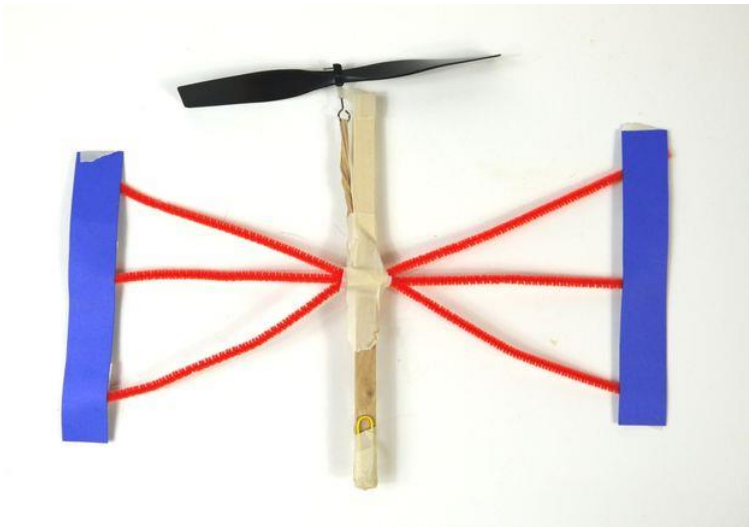
Step 7: Advanced Ideas



Step 8: Safety, tips and troubleshooting

- Students should pay close attention to their helicopter while winding it. If they're winding it absentmindedly, sometimes their hand will slip away from the propeller, allowing it to spin prematurely. They will naturally move their hand closer to the propeller to continue winding, and the spinning propeller may cut their hand.
- Spinning propellers can get caught in long hair.
- The number one reason helicopters fail to fly is due to simply not winding the rubber band enough.
- The second biggest reason is caused by letting go of the whole helicopter at once. Remind them to say "top-bottom" as they let go. It really helps.
- Cutouts which span less than 3" typically do not perform well.
- With a little practice, students can throw the helicopter as it is being released for additional height
- Stay far away from buildings, trees and fences!