ADVENTURE TAKES FLIGHT

AMA Junior CAMP

# PROJECT Nº 4

## Rotorcraft

AMA ACADEMY OF MODEL AERONAUTICS

AUTHORIZED AMA
STE(A)M PROGRAM

**AGE GROUP: 5-13 BEGINNER**

# PROJECT Nº 4

## INFO FOR PARENTS:

*The construction of a rubber-powered rotorcraft is simpler than that of a rubber-powered airplane, but the youngest students might still benefit from an adult's help, especially with winding and launching.*

## GOALS & OBJECTIVES

**Fine motor skills:** The building process involves manipulating materials and intricately connecting flexible and solid materials.

**Problem solving:** The presence of torque adds a complicating factor to what students might expect to see during testing and produces a critical thinking challenge.

**Hypothesis:** The open-ended nature of the problem to be solved means students can think creatively and asked to understand what they have learned from the outcome.

## MATERIALS

- Propeller assembly
- Rubber band
- Motorstick
- Paper clip
- Tape
- Foam or card stock

## BACKGROUND INFORMATION

Aircraft that are powered by rotors, such as helicopters, are much more complex than fixed-wing aircraft, such as airplanes. Even so, the physical principles at work are much the same. A rotorcraft still must generate lift to overcome the force of gravity or weight. While an airplane needs to move forward at a fast enough speed for its wings to create that lift from the air flowing over them, a rotorcraft simply spins its rotor blades to create that same force.

This also means that although airplanes can sometimes be unpowered, as in the case of gliders, rotorcraft are much more dependent on a source of power. Rubber bands are an excellent power source for model rotorcraft; in fact, a rubber-powered toy rotorcraft similar to the model we have made is exactly what inspired Orville and Wilbur Wright to begin studying how to build a full-scale flying machine of their own, and the rest is history!

## CREATIVE TIPS

Launching rubber-powered models usually works best when the propeller/rotor is released a second or two before the entire model is launched, and a gentle push in the direction you wish the model to go can be a big help.

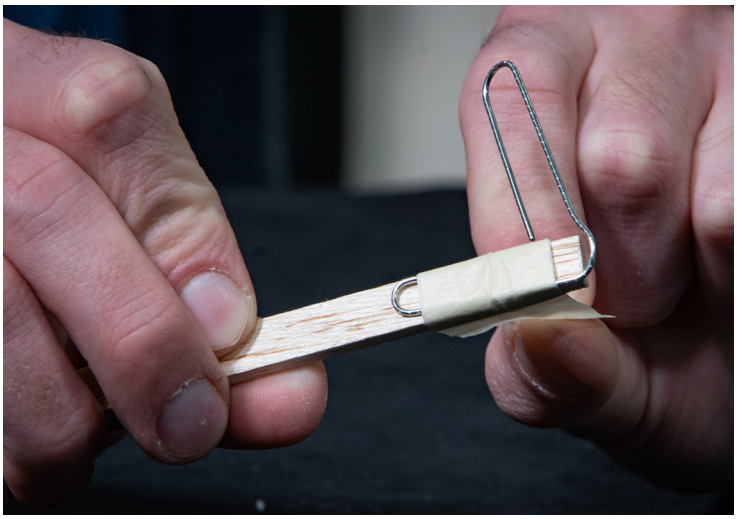
Make sure the rubber band and rotor blades are far away from anything they could get tangled in, such as long hair or electrical cables.

After you have successfully flown your model multiple times, try adding more winds to the rubber. Be careful not to snap it but try to predict the effect that more or fewer winds will have on its performance. Will you need a bigger or smaller stabilizer? Why?

## INSTRUCTIONS

1. Bend a paper clip so that it forms an L-shape when viewed from the side. Do not fully uncurl the large or small loops of the clip.

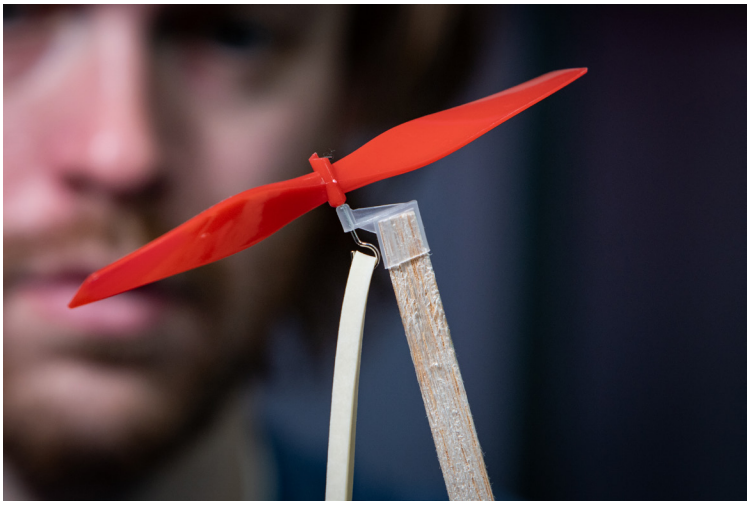
2. Place the small loop of the paper clip against the end of the motorstick and secure it with tape. The large loop of the paper clip will be sticking out at a right angle.

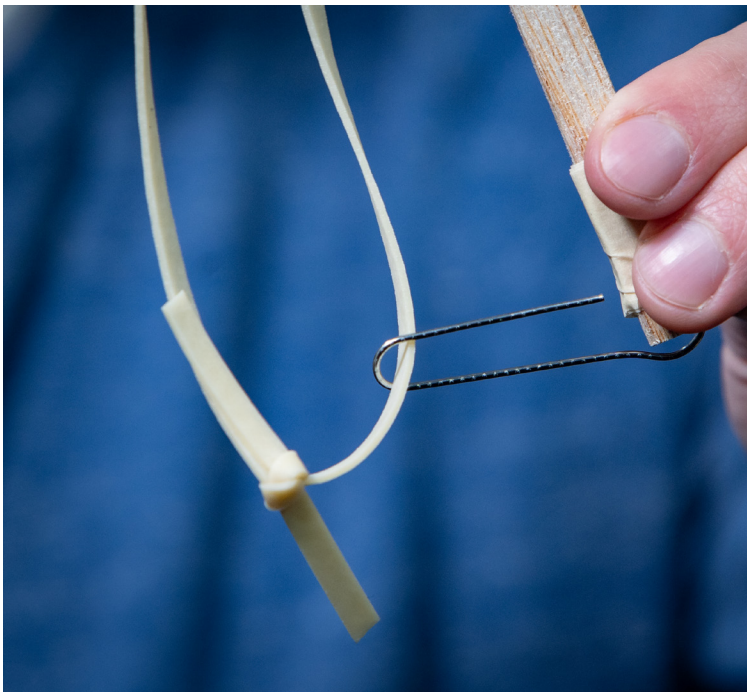


3. Take the propeller assembly and attach it to the other end of the motorstick, so that the hook on the propeller is lined up on the same side of the motorstick as the paper clip loop.

# Rotorcraft

**4.** Attach the rubber band to the hook of the propeller and the paper clip loop. (As the rubber band is wound, it will store more and more energy that will be the power source for our model rotorcraft. When it is released, that energy will be used to spin the propeller and generate lift.)





**5.** Wind the propeller until it is snugly tight between the two hooks. Do not over-wind it, especially for the first flight.

**6.** Hold the motorstick so that the propeller is pointing upward and release! What happens?
*(We have given the propeller a power source, but we have also generated another force called torque. Because every action causes an equal and opposite reaction, when the propeller spins one direction, the stick will naturally spin the other.* ***How can we counteract this force?****)*

**7.** Using either the provided foam or a sheet of card stock, design and cut out a stabilizer for your rotorcraft. Secure it to the stick with tape. Be as creative as you like; you can always cut out a different shape to see how different designs work!

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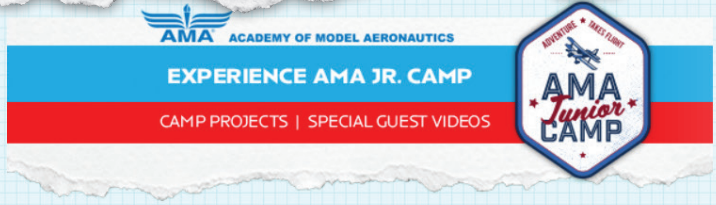



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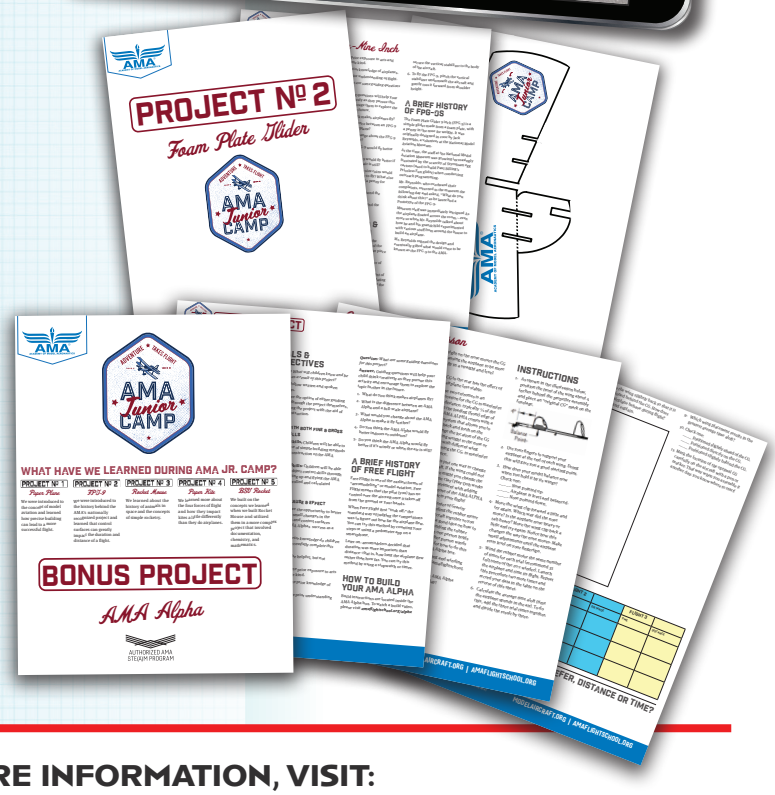


AMA FLIGHT SCHOOL

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**OR CONTACT THE AMA EDUCATION DEPARTMENT:**

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