AMA
ACADEMY OF MODEL AERONAUTICS

ADVENTURE TAKES FLIGHT

AMA Junior CAMP

WHAT HAVE WE LEARNED DURING AMA JR. CAMP?

PROJECT Nº 1
Paper Plane

We were introduced to the concept of model aviation and learned how precise building can lead to a more successful flight.

PROJECT Nº 2
FPJ-9

We were introduced to the history behind the AMA's nationally recognized project and learned that control surfaces can greatly impact the duration and distance of a flight.

PROJECT Nº 3
Rocket Mouse

We learned about the history of animals in space and the concepts of simple rocketry.

PROJECT Nº 4
Paper Kite

We learned more about the four forces of flight and how they impact kites a little differently than they do airplanes.

PROJECT Nº 5
BSV Rocket

We built on the concepts we learned when we built Rocket Mouse and utilized them in a more complex project that involved documentation, chemistry, and mathematics.

BONUS PROJECT

AMA Alpha

AUTHORIZED AMA
STE(A)M PROGRAM

BONUS PROJECT
AMA Alpha

AMA ALPHA

Using everything we learned throughout the week, we can now embark on a free flight model airplane build! Free Flight is the oldest discipline of model aviation, and in the case of the AMA Alpha, utilizes a rubber band motor in order to fly.

The name "Free Flight" comes from the fact that you have no control over the airplane once it leaves your hands; It is free to fly anywhere at all! The AMA Alpha flies best outdoors on a clear day, or perhaps with a slight breeze.

Determine which direction the wind is blowing and experiment with flying the AMA Alpha both into the wind and with the wind. Which method results in a longer flight?

Winding the motor will make your airplane fly–but how far, and for how long? Experiment with the number of winds on the motor when you fly your AMA Alpha to see what works best.

CURRICULUM INFO FOR PARENTS:

4.PS.1 Investigate transportation systems and devices that operate on or in land, water, air, and space and recognize the forces (lift, drag, friction, thrust, and gravity) that affect their motion.

4.PS.2 Investigate the relationship of the speed of an object to the energy of that object.

4.PS.4 Describe and investigate the different ways in which energy can be generated and/or converted from one form of energy to another form of energy.

4.DA.1 Formulate questions that can be addressed with data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, and bar graphs.

GOALS & OBJECTIVES

Question: *What will children know and be able to do as a result of this project?*

Answer: Follow written and spoken instructions.

Parents have the option of either guiding their child through the project themselves, or completing the project with the aid of live AMA instruction.

ENGAGE WITH BOTH FINE & GROSS MOTOR SKILLS

Fine Motor Skills: Children will be able to refine their use of simple building methods through the construction of the AMA Alpha.

Gross Motor Skills: Children will be able to refine their object control skills through the act of winding up and flying the AMA Alpha in a controlled and calculated manner.

DETERMINE CAUSE & EFFECT

Children will have the opportunity to better understand how small changes in the number of winds and control surfaces determine the AMA Alphas success as a flying object.

Question: *What prior knowledge do children need to have to successfully complete this project?*

Answer: It would be helpful, but not required, if:

1. The child has some prior exposure to arts and crafts of some kind.
2. The child has some prior knowledge of airplanes.
3. The child has some prior understanding of flight.

Question: *What are some guiding questions for this project?*

Answer: Guiding questions will help your child think creatively as they pursue this activity and encourage them to explore the topic further in the future.

1. What do you think makes airplanes fly?
2. What is the difference between an AMA Alpha and a full-scale airplane?
3. What would you change about the AMA Alpha to make it fly further?
4. Do you think the AMA Alpha would fly better indoors or outdoors?
5. Do you think the AMA Alpha would fly better if it's windy or when the air is still?

A BRIEF HISTORY OF FREE FLIGHT

Free Flight is one of the earliest forms of "aeromodeling" or model aviation. Free Flight means that the pilot (you) has no control over the aircraft once it takes off from the ground or your hands.

When Free Flight first "took off," the standard way of judging the competitions was to figure out how far the airplane flew. You can try this method by counting your steps or using a pedometer app on a smartphone.

Later on, aeromodelers decided that duration was more important than distance–that is, how long the airplane flew rather than how far. You can try this method by using a stopwatch or timer.

HOW TO BUILD YOUR AMA ALPHA

Build instructions are located inside the AMA Alpha box. To watch a build video, please visit ***amaflightschool.org/alpha***

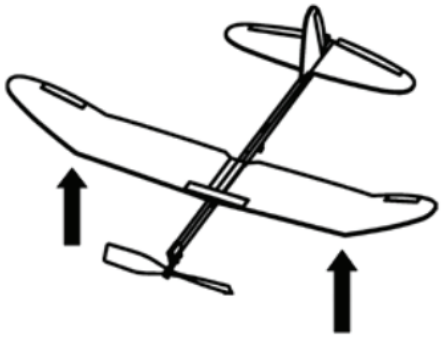
Center Of Gravity Lesson

SUPPLIES NEEDED

AMA ALPHA (ASSEMBLED)
STOPWATCH
STUDENT HANDOUT
PENCIL OR PEN

INFO ABOUT CG:

The center of gravity (CG) of an airplane is the point at which it can be balanced. By balancing the wing on your fingertips on the point shown in the illustration below, you can find the airplane's center of gravity.



Pilots of full-scale airplanes as well as model aircraft must correctly determine the CG before flight to ensure that the airplane is balanced.

To fly any aircraft safely, flight control surfaces (ailerons, elevators, rudder) must be capable of providing effective control of a carefully balanced airplane in order to maintain level flight.

In the case of models, the CG can be adjusted by placing clay or other weight on the nose or tail of the aircraft.

Placing weight on the nose moves the CG forward, causing the airplane to be more stable and fly in a straight and level manner.

Moving the CG to the rear has the effect of making the airplane less stable.

Between these two extremes is an appropriate location for the CG to maximize duration and distance, typically ¼ of the way back from the leading (front) edge of the wing. The AMA ALPHA comes with a unique design system that allows you to move the wing back and forth on the fuselage to change the location of the CG rather than adding weight to the nose or tail. Experiment with different wing placement, adjusting the CG, to maximize duration or distance.

Moving the wing is just one way to change the CG of an aircraft. If the wing could not be moved, how else might you change the CG? If you have some clay (Play-Doh works great!), you can experiment with adding some weight to the nose of the AMA ALPHA to see how that impacts your flight!

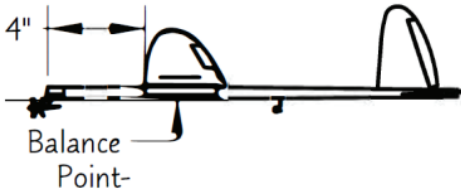
Before starting the Center of Gravity Activity, practice winding the rubber motor and launching the aircraft together so you and your family have a good idea on how to fly the AMA Alpha. Winding the rubber motor works best when one person holds the airplane and the other person winds the motor. Instructions for how to do this are included in the AMA Alpha box.

You can also view building and winding instructions here: http://amaflightschool.org/alpha

We recommend flying the AMA Alpha outside on a nice, sunny day!

INSTRUCTIONS

1. As shown in the illustration below, position the front of the wing about 4 inches behind the propeller assembly and place an "original CG" mark on the fuselage.



2. Use your fingers to support your airplane at the end of each wing. Doing this will give you a good starting point.
3. How does your model balance now when you hold it by its wings?
   Check one:
   _____ Nose pointed up.
   _____ Airplane is level and balanced.
   _____ Nose pointed down.
4. Move the wing clip forward a little and try again. Which way did the nose move? Is the airplane nose-heavy or tail-heavy? Move the wing clip back a little and try again. Notice how this changes the way the nose moves. Make small adjustments until the airplane rests level on your fingertips.
5. Wind the rubber motor the same number of times for each trial (recommend 35 full turns of the 20:1 winder). Launch the airplane and time its flight. Repeat this procedure two more times and record your data in the table on the reverse of this sheet.
6. Calculate the average time aloft (time the airplane spends in the air). To do this, add the three trial times together, and divide the result by three.

7. Move the wing slightly forward so that it is positioned ahead of the CG. How does your airplane behave during flight? Draw and explain.

8. Move the wing slightly back so that it is positioned behind the CG. How does your airplane behave during flight? Draw and explain.

9. Which wing placement results in the greatest average time aloft?

10. Check one:
    ____ Positioned slightly ahead of the CG.
    ____ Positioned directly on the CG.
    ____ Positioned slightly behind the CG.

11. Mark the location of the optimal CG carefully on the aircraft with a pen or marker. That way when you assemble it another day, you know where to start!

	FLIGHT 1		FLIGHT 2		FLIGHT 3	
	TIME	DISTANCE	TIME	DISTANCE	TIME	DISTANCE
NEUTRAL CG						
FORWARD ORIGINAL CG MARK						
BEHIND ORIGINAL CG MARK						

WHICH JUDGING METHOD DO YOU PREFER, DISTANCE OR TIME?