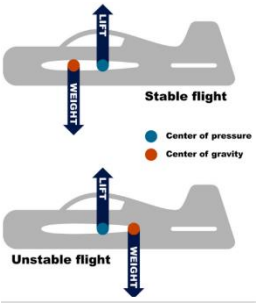
A.D. HENDERSON &
FAU HIGH SCHOOL

777 GLADES ROAD
BLDG #26
BOCA RATON, FL 33431

THE CANE INSTITUTE FOR ADVANCED TECHNOLOGIES

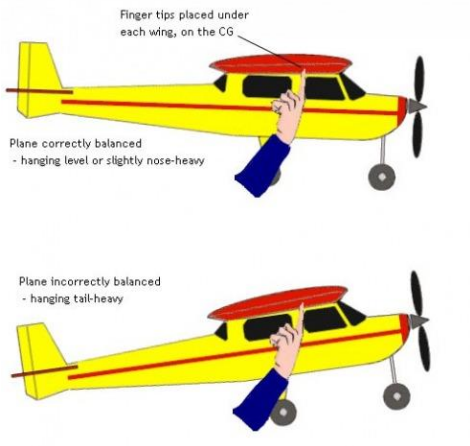
Hello ADHUS and FAUHS Students (and Parents)!

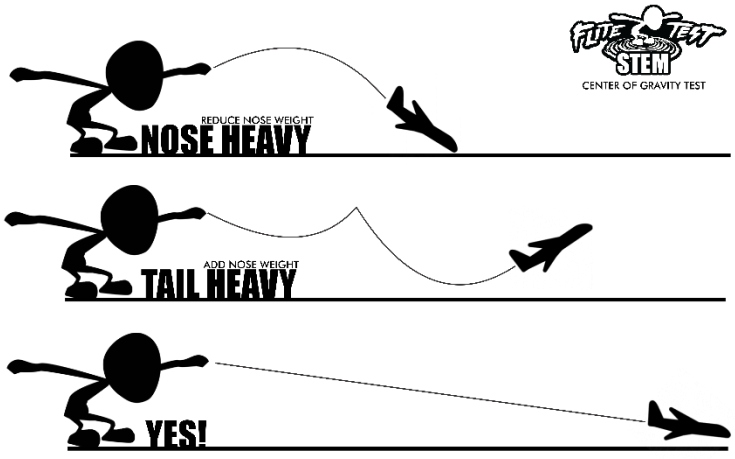
The Cane Institute is excited to provide your fifth TCI STEM@Home mailer. This mailer is designed to teach you a little about the concepts of aerodynamics and energy!



Background: The center of gravity (CG) of an aircraft is the point over which the aircraft would balance. The center of gravity affects the stability of the aircraft. When the CG is out of range (either too far forward or too far aft) serious control problems occur. For stable flight, it is important to have the center of gravity slightly forward of the center of lift.

Adjusting your Plane: You can adjust the CG of your rubber-band powered balsa plane by sliding the wings forward and aft until the plane will balance on your two fingertips when placed under the wings. If the tail is too heavy, slide the wing backwards. If the nose is too heavy, slide the wing forward. You may also need to slide the wing to the left or right to help the plane fly straight. If the plane dives to the left, slide the wing a little to the left before trying another flight. If the plane dives to the right, slide the wing to the right to provide a little extra lift on that side.





Launching your Plane: Please use the safety glasses you received in the last TCI STEM@Home mailer when winding the plane's propeller. Wind up the propeller clockwise up to 150 times. Do not throw the plane. Use a gentle technique. Release the propeller, then release the plane one second after. If it climbs too much, move the wing back slightly, if it doesn't climb at all, move the wing forward. If it stabilizes quickly to a gentle climb then the wing is in the right position. If the plane dives, then you either do not have enough winding, or the wing is too far forward. Move the wing back some and try again. If the plane climbs excessively and then falls back, then it is stalling, and the wing must be moved forward.

Getting your plane to fly straight is challenging without control surfaces on the trailing edge of the wings. If you cannot get it to fly straight, then replace distance for time in the following experiment and time how long your plane stays in the air.

Experiment: Test the effects of changing an airplane's Center of Gravity (CG) by adding a passenger (President Lincoln) in the form of a penny.

AS A GLIDER:

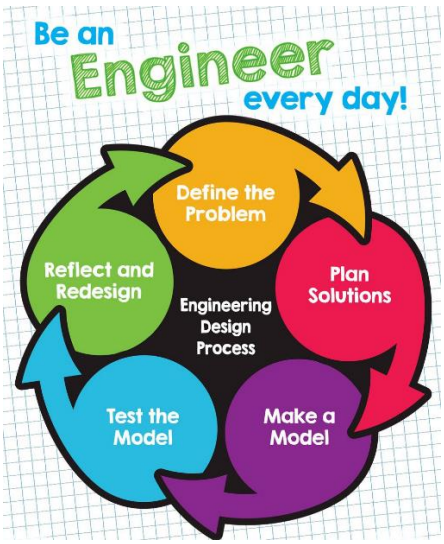
- Without the propeller and rubber band, try to fly the plane.
- Add one passenger (President Lincoln AKA a penny) to the nose of the plane using a piece of cellophane (Scotch) tape. Test your plane. Measure the distance (or time) of your flight in centimeters. Record your results.
- Move the passenger to different locations on the plane to vary the plane's CG. You can even remove the balsawood pilot and wedge the penny in the slot for the pilot. Test your plane with the passenger at different locations. Measure the distance (or time) of your flight in centimeters. Record your results.
- At what location does the penny help the plane fly farthest or stay in the air the longest? At what location(s) does the penny create a stall and cause the plane to crash tail first?

AS A POWERED PLANE:

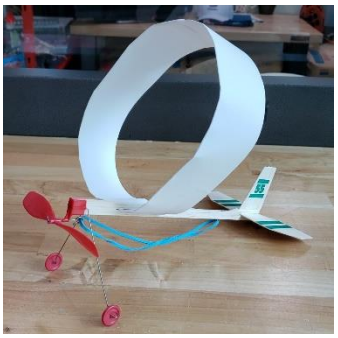
- Add the propeller and rubber band to your plane.
- Add one passenger (the penny) near the nose of the plane (in-between the propeller and the wing). Secure your passenger with some tape.
- Wind the propeller clockwise 150 times before each launch. **When winding the propeller, make sure you have on the safety glasses provided in the Alka-Rocket activity kit.**
- Test your plane. Measure the distance (or time) of your flight in centimeters. Record your results.
- Move the passenger to different locations on the plane to vary the plane's CG. You can even remove the balsawood pilot and wedge the penny in the slot for the pilot. Test your plane with the passenger at different locations. Measure the distance (or time) of your flight in centimeters. Record your results.
- At what location does the penny help the plane fly farthest or stay in the air the longest? At what location(s) does the penny create a stall and cause the plane to crash tail first? Did the added energy from the rubber band make your plane fly farther?

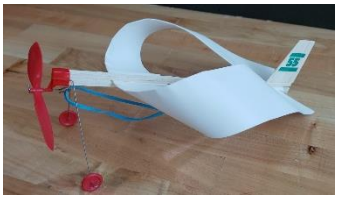
Use the attached data sheet to help you on your scientific quest to collect data while you are using your airplane. Remember, scientists take a lot of notes about their observations! Remember to write down your predictions BEFORE you test your beads. Did any of your results surprise you?

Will it Fly??? You Be the Engineer!



Use the **Engineering Design Process** to modify your plane and create a new, innovative design. Use lightweight, rigid materials from around the house to create new wings and tail for your plane. You might look for note cards, cardboard, Styrofoam cups, cereal box material, etc. Try a delta wing like a jet airplane, a biplane by copying the balsa plane wing out of cereal box material and adding it above your plane, or even a circle wing plane like the one on the right. See if you can create a cool, new airplane that actually flies! Share your unique creations on social media and tag the FAU Cane Institute on Facebook or Twitter!





We want to hear from you! Are you enjoying your TCI STEM@Home kits? Please let us know! Remember to share your photos on social media and tag @FAUCaneInstitute on Facebook or Twitter. Feel free to email us at aphipps@fau.edu.

YOU BE THE SCIENTIST!

GLIDER Prediction: Which		Flight #1 Distance Traveled (cm)	Flight #2 Distance Traveled (cm)	Flight #3 Distance Traveled (cm)	AVERAGE Flight Distance Traveled (cm)	OBSERVATIONS AND NOTES:
GLIDER (No Passengers)						
GLIDER (Passengers at **FRONT** of plane)						
GLIDER (Passengers at **MIDDLE** of plane)						
GLIDER (Passengers at **BACK** of plane)						
POWERED FLIGHT		Flight #1 Distance Traveled (cm)	Flight #2 Distance Traveled (cm)	Flight #3 Distance Traveled (cm)	AVERAGE Flight Distance Traveled (cm)	OBSERVATIONS AND NOTES:
PROPELLER PLANE (No Passengers)						
PROPELLER PLANE (Passengers at **FRONT** of plane)						
PROPELLER PLANE (Passengers in **MIDDLE** of plane)						
PROPELLER PLANE (Passengers in **BACK** of plane)						

What conclusions can you draw from the data you collected regarding the location of the center of gravity and stable flight?