PLTW Flight and Space Virtual Learning

8th Grade/Balancing Lift and Weight with Paper Airplanes

April 23, 2020

8th Grade/Flight and Space
Lesson: April 23, 2020

Objective/Learning Target:
Students will utilize their knowledge of lift and weight to design the best paper airplane wings.

Warm-Ups:

Quick Write on Cornell Notes: Explain the forces of Lift and Weight. What effects do they have on an airplane's ability to fly?

Lesson Introduction/Background Information:

Flight pioneers prior to the Wright brothers would crash after barely getting up in the air. One of the major problems was a lack of balance in their aircraft. Balance is affected by the airplane's weight and lift distribution. For an aircraft to be correctly balanced for flight, its **center of gravity must be near or at its center of lift**. Weight is the force of gravity on the airplane. **The center of gravity is the point where all weight is concentrated.** If an airplane is hung by a piece of string from its center of gravity, it will balance in the correct flying position. The **center of lift is the point where all lift is concentrated**. All of the lift force concentrated on this point has the same effect as the distributed lift forces.

Practice:

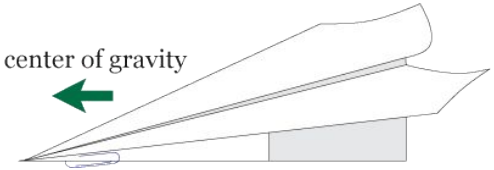
In this experiment, you will use the **Floating Wing Glider** paper airplane to learn about balancing lift and weight (force of gravity.)

First you'll need to make your Glider. Get directions for Floating Wing Glider here.

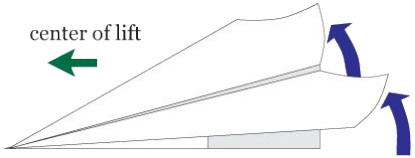
Practice:

Make a test

Make a **Floating Wing Glider** for testing. Move the center of lift forward by curling the wing tips up higher. How does the plane fly?



What happened? Moving the center of lift forward causes the plane to fly nose up and stall. Try correcting this by adding weight to the plane's nose with a paper clip or a small bit of clay. Experiment until the plane flies level. Why was balance restored when you moved the center of gravity forward?

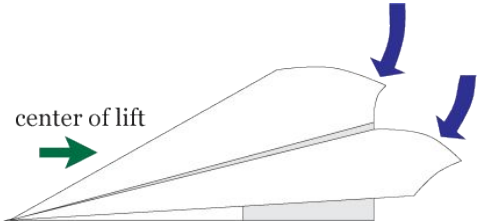


Explanation: For a plane to be in balance, the center of gravity and center of lift must be near or at the same point. Moving the center of lift forward had destroyed balance, so you needed to move the center of gravity forward to restore it.

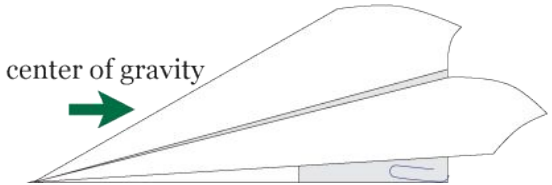
Practice:

Make another test

Move the center of lift backward by curling the wing tips down. How does the plane fly?



What happened? Moving the center of lift backward causes the plane to fly nose down and crash. Try to correct this by adding weight to the plane's tail. A couple of paper clips, one on each side of the tail, will usually bring the nose back up. What did adding weight do?



Explanation: Adding weight to the tail moved the center of gravity backward. Since you had moved the center of lift backward, this restored the plane's balance.

Self-Assessment:

Explain in your notes where the center of gravity and the center of lift should be in relationship to each other.

What happens if the center of lift is in front of the center of gravity?

What happens if the center of lift is behind the center of gravity?

Extend Your Learning/Continued Practice:

Explore balancing points in the **Halloween Mobile** craft project.

Check out how pilots balance weight on planes.