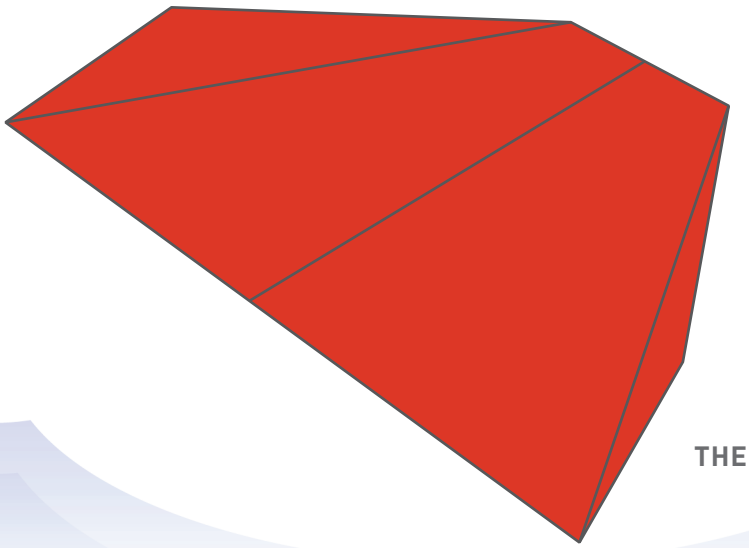
Smithsonian *National Air and Space Museum*

HOW THINGS FLY

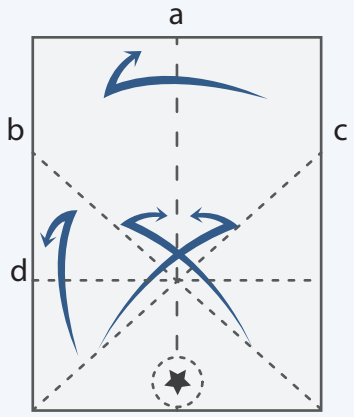
HOW TO BUILD YOUR
PAPER AIRPLANE!



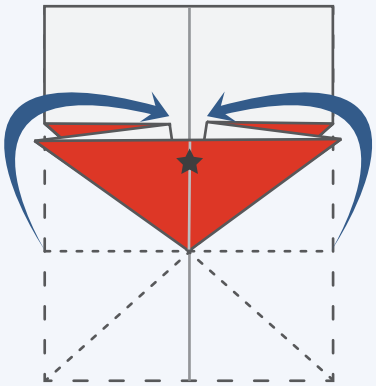
THE "DELTA"

★ Make sure the location of the star on your paper plane print out matches the location of the star in the directions below!

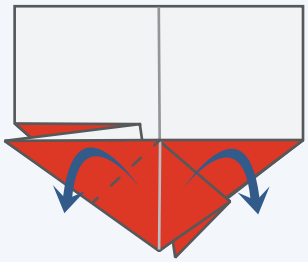
1. Pattern side down, make the creases shown below.



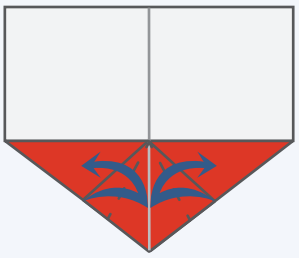
2. Take the edges of the horizontal crease and fold them in to meet at the center crease.



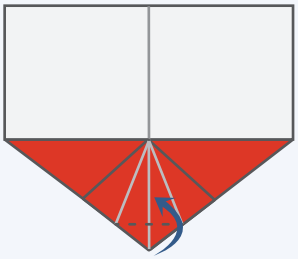
3. Fold front flaps of left and right sides backward so the two outermost corners meet at the tip of the plane.



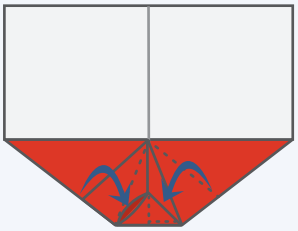
4. Crease left and right flaps in to meet at center line.



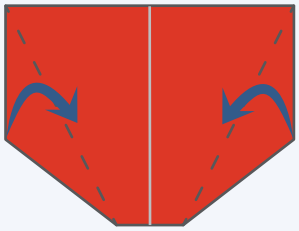
5. Fold tip of plane upward.



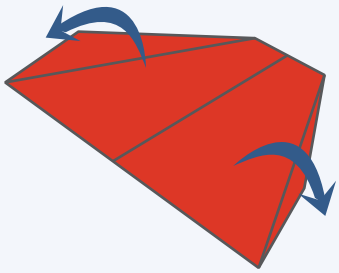
6. Tuck smaller flaps into pockets made by folded tip of the plane. Turn over.



7. Fold the left and right wings so the creases match the dashed lines below.



8. Unfold wings so they are only slightly bent.



YOU'RE READY TO FLY!

PREPARE FOR TAKE OFF!

Think your plane has the stuff to go pro? Check out these tips, tricks, and modifications and put your aircraft to the test!

1. Gently bend up the rear corners of the wings (as shown in diagram). This balances the plane in flight.

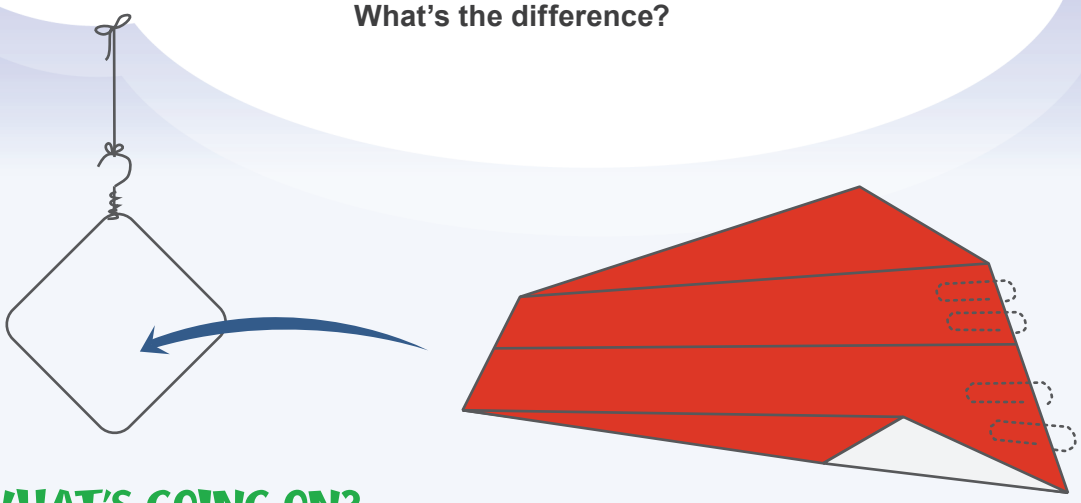
2. Bend a wire coat hanger into a hoop and hang it.

3. Attach three paper clips to the back of the vertical surface (as shown in diagram).

4. Try to fly the plane through the hoop.

5. Now move the paper clips to the front of the plane and try again.

What's the difference?



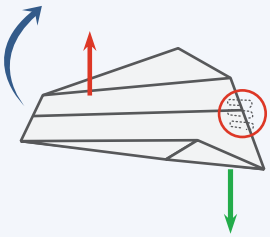
WHAT'S GOING ON?

First, you'll need to know what these three things mean:

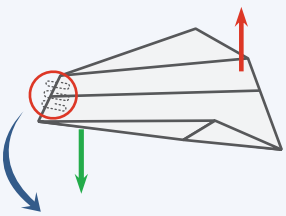
Stability: An airplane's tendency to right itself after it is disturbed.

Center of Lift: The point where all the lifting force is concentrated.

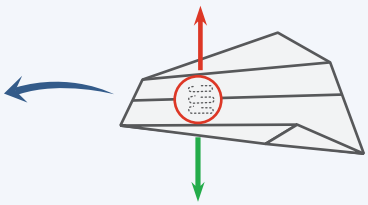
Center of Gravity: The "balancing point" of an airplane. At this point there is just as much mass in front of it as there is behind it. If you put your finger here, the plane will balance on it.



When you put paperclips on the back of the airplane, the center of gravity moved farther back. This extra weight pulls the back of the plane down, while the center of lift pulls the front up. The airplane is unstable!



When you moved the paperclips to the front of the plane, the center of gravity moved in front of the center of lift. Now the weight pulls the front of the plane down. The airplane is still unstable!



So where's the best place to put the weight? If the center of gravity is directly under the center of lift, then they balance each other. So for stable flight, the best place to put the weight is in the middle of the airplane!