

CORE SUBJECTS: AERODYNAMICS, MECHANICS, ENGINEERING

FLIGHT CONTROLS OF AN AIRPLANE

are surprisingly simple and, although the systems may get more complex on larger airplanes, the basic principles are the same for anything from a trainer aircraft to the largest of airliners.

You may have wondered why airplanes bank (lean to one side) as they turn. The reason is that airplanes turn by directing the lift of their wings more to one side or the other. This is done by moving control surfaces on the wings known as ailerons. When you turn the control wheel (also known as the yoke), the aileron on one wing deflects upward, while the aileron on the other wing goes down. This increases and decreases lift on the wings.

Climbing and descending is directed through use of movable control surfaces on the horizontal portion of the tail. Appropriately enough, they are called eleva-

tors and are activated by pushing the control wheel forward or pulling it back.

The third basic control for flying an airplane is the rudder. Contrary to what you might expect, the rudder alone does not steer the airplane but rather serves the purpose of properly aligning the airplane in flight. The pilot controls the rudder's movement with rudder pedals on the floor of the airplane and also uses them to steer the airplane's nosewheel or tailwheel when on the ground.

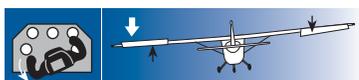
Note: adapted from "You Can Fly!" by Gregory N. Brown and Laurel Lippert



A typical cockpit in a single-engine aircraft.

FLIGHT CONTROLS OF AN AIRPLANE

YOKE CONTROLS



When you turn the yoke left, the left aileron goes up, the right aileron goes down (black arrows), the left wing goes down (white arrow), and the airplane banks left.



When you turn the yoke right, the right aileron goes up, the left aileron goes down (black arrows), the right wing goes down (white arrow), and the airplane banks right.

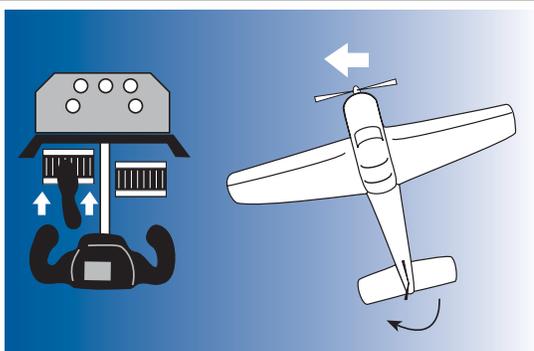


When you push the yoke forward, the elevator goes down (black arrow), forcing the tail up, and the nose goes down (white arrow).

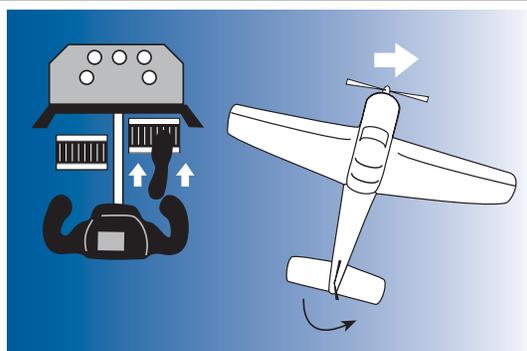


When you pull the yoke back, the elevator goes up (black arrow), forcing the tail down, and the nose goes up (white arrow).

RUDDER PEDAL CONTROLS



Push the left rudder pedal and the rudder on the tail moves left (black arrow), forcing the tail to the right and the nose moves left (white arrow).



Push the right rudder pedal and the rudder on the tail moves right (black arrow), forcing the tail to the left and the nose moves right (white arrow).

ACTIVITY: Building a glider

Photocopy this activity for classroom use.
Go to www.aopa.org/path for student worksheets.

TEACHERS:

From this activity, students will learn how control surfaces—the moving parts on the wing and tail—control which way an airplane turns and moves through the air.

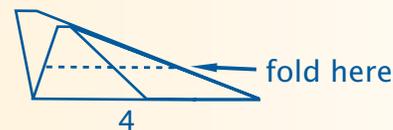
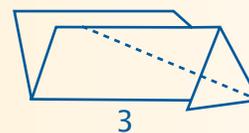
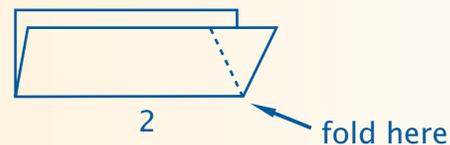
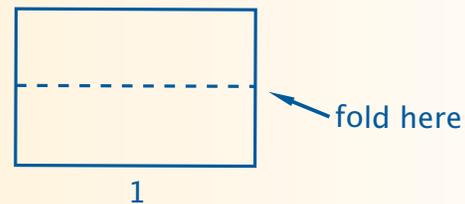
MATERIALS:

Sheet of paper
Paper clips
Room to throw

TO DO IT:**Folded Paper Glider**

1. Fold paper in half lengthwise and crease.
2. Fold down the corner of one side so the edge is even with the folded side of your original crease. Flip paper over and repeat to form a point.
3. Fold down the angled edge on one side so it is even with your original fold. Flip and repeat. You should now have a more narrow point.
4. Make a third fold that brings your new top edge even with the bottom of your original fold.
5. Push up the wings so they are perpendicular to the body of your airplane. Try launching your airplane

(Tip: If it seems "nose heavy" use paperclips near the rear of the airplane to add weight and help keep the nose up. You may need 2-3 paperclips)



ACTIVITY: Building a glider

Control Surfaces – Up and Down

Once you have gotten your airplane to fly relatively straight, gently tear the back edge of each wing to create elevators. One-half to three-quarters of an inch should be enough.

Bend your elevators up slightly and see what impact it has on the flight path. Bend them down and try again.

(Tip: Down position should cause the nose to go down faster. Up should help your airplane ascend or stay aloft longer.)

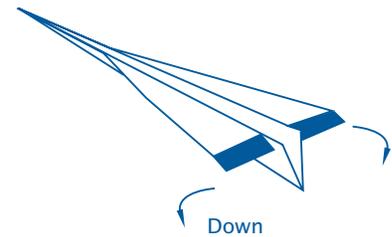
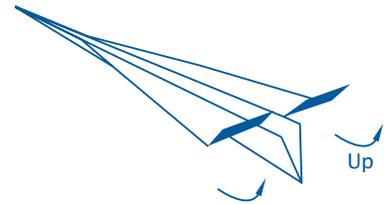
Look for modest changes in float direction. The average paper airplane only stays aloft for a few seconds.

When the pilot wants the airplane to climb, he moves the airplane controls so that the elevators tilt up in the same way that you folded back the edges of your glider. The air hitting the elevators pushes the tail of the airplane down, tilting the nose upward, so the airplane can climb.

Control Surfaces – Right and left

Now try the rudder or vertical fin. Tearing your elevators should have left you with a 1/2 - 3/4 inch portion of your airplane's body that can be folded left or right. Try folding it slightly left or right and test the impact on your airplane's flight path. Left or right folds should send your airplane left or right, respectively.

UP AND DOWN



RIGHT AND LEFT

