

## EDUCATOR'S GUIDE

# Control Surfaces

## Preparation

### Overview and Objectives

This lesson is geared toward students in grades 3-8.

Participants will be able to identify the major control surfaces on an airplane and their effect on airplane movement. They will explore pitch, yaw and roll through a movement exercise and then create gliders to have hands-on experience affecting control surfaces.

This lesson includes a [slideshow](#) in which an instructor can lead participants through the control surfaces and their coinciding airplane rotations.

### Standards

Next Generation  
Science Standards  
3-PS2.A  
MS-PS2.A

### Instructional Modalities

This activity was designed for both synchronous or asynchronous instruction.

For **synchronous instruction**, we recommend a platform that allows both for whole class discussion and for students to interact in small groups.

For **asynchronous adaptations**, we provide suggestions for teachers to provide additional support for the activities and for students to share their work with each other.

### Materials

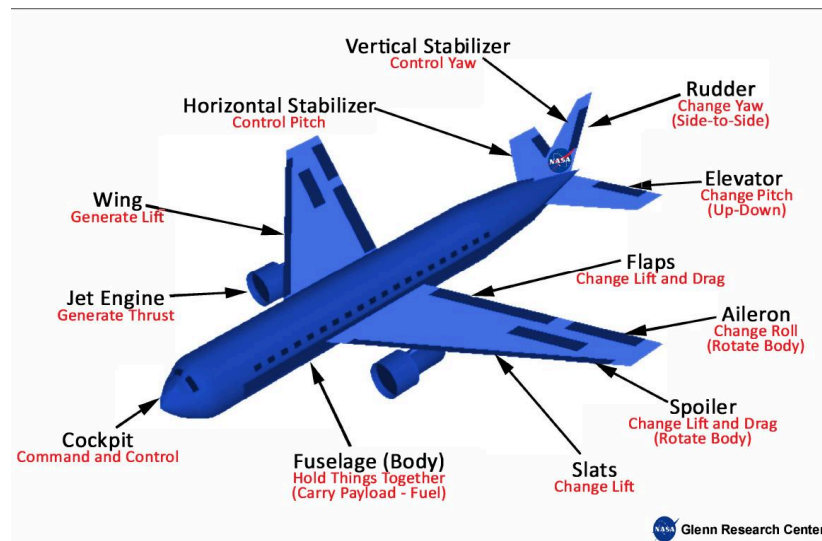
- [Control Surfaces Slideshow](#)
- [Glider visual instructions](#)
- [Control Surfaces Glider template](#)
- Paper clips
- Scissors

## Lesson

### 1. Introductory Activity

- Participants will look at slides 4 and 5 and answer the following questions:
  - **What are control surfaces?**
  - **Why are control surfaces necessary?**

Control surfaces are devices on an aircraft that allow a pilot to move the vehicle in different directions. The three primary control surfaces on an airplane are the ailerons, elevators and rudder. The ailerons are located on the wings of the airplane, the elevators are located on the horizontal stabilizer and the rudder is located on the vertical stabilizer.



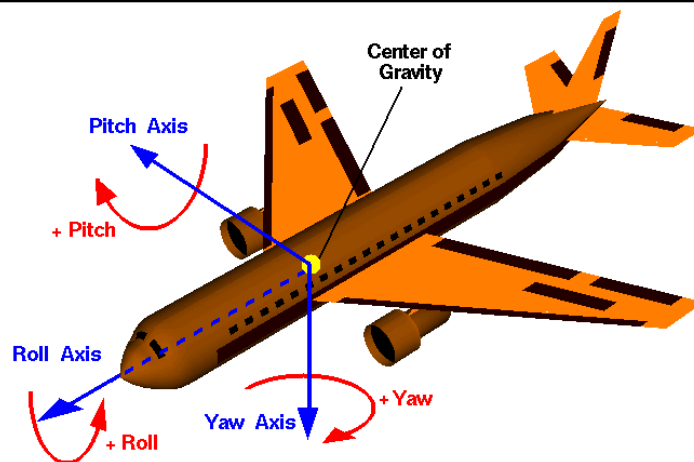
- Participants will watch a 90 second video describing the main three control surfaces.
  - **How do control surfaces help pilots steer an aircraft?**
  - **What might each control surface cause an airplane to do?**

When a pilot moves each of the control surfaces, it causes the airplane to move in different directions. The ailerons control the roll of the plane, or a rotation of the wings in a circular motion. The elevators control the pitch of the plane, or a rotation of the nose up and down. The rudder controls the yaw of the plane, or a rotation of the nose side to side.



## Aircraft Rotations Body Axes

Glenn  
Research  
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### 2. Core Activity

- Participants will watch a 2 minute video showing three airplane yoga moves. Then move through slides 11, 12 and 13 to review each movement. While on each slide, have participants perform the appropriate yoga move. Discuss the following questions:
  - **What control surface does a pilot use when they are taking off and landing?**
  - **What control surface might a pilot use if they wanted to turn around?**
- Participants will create their own yoga routine using the airplane yoga moves. Remind participants that airplanes do not always use just one control surface at a time. They often combine movements to go in the direction they want. Encourage participants to combine yoga moves to create new ones in their routine.

### 3. Wrap-up Activity

Use [visual instructions](#) to cut and fold [gliders](#).

- Print out the glider template on cardstock and cut out the airplane.
- Fold on the dotted lines. Cut on the small solid lines.
- Place a paperclip on the nose of the plane to keep the fold in place.
- Have participants fold the rudder, elevators and ailerons of their glider and experiment with its movement.
- Challenge participants to make the glider fly straight, up or down, left or right, through a hula hoop.

## Asynchronous Adaptation

Participants will move through [slides](#) by themselves and create their [glider](#) by themselves. Ask participants to respond to reflection questions.

## Extension Activities

To deepen student engagement with this content, you may choose to add the following activities :

### **Paper Airplane Challenge**

Build a basic dart paper airplane as a group. Once finished, challenge students to make modifications to the airplane design to make it fly as far as possible. Set up a competition to see whose airplane design flies the farthest.

## Additional Resources/ References

### **Background Information on**

The forces behind flight:

<https://www.grc.nasa.gov/www/k-12/UEET/StudentSite/dynamicsofflight.html>

**The Museum is deeply grateful to the funders that make our education programs possible:**



*This project was made possible in part by the  
Institute of Museum and Library Services, Award ID:  
CAGML-247144-OMLS-20*