Aircraft Motion and Control

Objective: Know basic aircraft motion and how it is controlled.

1. Identify the axes of rotation.
2. Identify the effects of ailerons and elevators on flight.
3. Identify the effects of flaps on flight.
4. Identify the effects of the rudder on flight.
5. Identify the effects of spoilers on flight.
Bernoulli Principle

- As the air velocity increases, the pressure decreases; and as the velocity decreases, the pressure increases
The Axes of Rotation

- Longitudinal Axis
- Vertical Axis
- Lateral Axis
- Pitch
- Roll
- Yaw
The Axes of Rotation

- **Longitudinal Axis**
  - Running from the tip of the nose to the tip of the tail. This axis can be thought of as a skewer which turns either right or left and causes everything attached to it to turn.
The Axes of Rotation

- Longitudinal Axis
  - The cause of movement or roll about this axis (roll axis) is the action of the ailerons.
The Axes of Rotation

- **Lateral Axis**
  - An imaginary rod, running from one wing tip through the other wing tip, forms an airplane’s lateral axis.
  - Another name for the lateral axis is the *pitch* axis.
  - The *flaps* and *elevators* can be deflected up or down as the pilot moves the control column backward or forward.
Flaps

- The flaps are attached to the trailing edge of the wing. In cruising flight, the flaps simply continue the streamline shape of the wing’s airfoil.
- When flaps are lowered either partially or fully, lift and drag are increased.
Flaps

- Flaps increase the camber of the wing airfoil for the portion of the wing that it is attached.
  - This causes the air to speed up over the wing section where the most lift is created.
  - On the underside of the wing, dynamic lift is increased.
  - Using flaps when taking off helps the airplane get off the ground in a shorter distance.
The Axes of Rotation

• **Vertical Axis**
  - An imaginary rod or axis which passes through the meeting point of the longitudinal and lateral axes. It is also referred to as the “**yaw**” axis.
  - The airplane turns about this axis in a side-to-side direction.
  - The airplane’s **rudder** is responsible for the movement about this axis.
Rudder

- Located on the Vertical Stabilizer (tail)
- Controls the aircraft’s yaw
- Right Rudder = Right Yaw
- Left Rudder = Left Yaw
Spoilers

- Spoilers work to destroy lift.
- Spoilers are found on various aircraft from the jet airliner to the sailplane.
- On the jet airliners, spoilers are hinged so that their aft portion is tilted upward into the smooth airflow.
So Let's Put It all Together....
Review

Which is **not** a primary axis associated with basic aircraft motion?

A. Longitudinal Axis
B. Lateral Axis
C. Vertical Axis
D. Diagonal Axis
Review

- Affecting movement along the Longitudinal Axis, which basic aircraft control surface results in the aircraft rolling?

A. Ailerons  
B. Flaps  
C. Elevators  
D. Rudder
Review

- True or False? Extending flaps, increases both lift as well as drag?

A. True
B. False

![Diagram showing airflow and control surface]
Review

- If an aircraft rudder was positioned as in the picture below, which direction would the aircraft begin to yaw?

A. Left
B. Right
Aircraft Motion and Control

Objective: Know basic aircraft motion and how it is controlled.

1. Identify the axes of rotation.
2. Identify the effects of ailerons and elevators on flight.
3. Identify the effects of flaps on flight.
4. Identify the effects of the rudder on flight.
5. Identify the effects of spoilers on flight.
OK....got the basics? Good! Out to the Flight Line...