STABILITY

Stability is the tendency of an airplane in flight to remain in straight, level, upright flight and to return to this attitude if displaced, without corrective action by the pilot.

STATIC STABILITY:

- Is the initial tendency of an airplane when disturbed to return to its original position.

DYNAMIC STABILITY:

- Is the overall tendency of an airplane to return to its original position, following a series of damped out oscillations.

Stability may be:

Positive - meaning the airplane will develop forces or moments that tend to restore it to its original position.

Neutral - meaning the restoring forces are absent and the airplane will neither return from its disturbed position, nor move further away.

Negative - meaning it will develop forces or moments that tend to move it further away. Negative stability is Instability.

LONGITUDINAL STABILITY

Longitudinal Stability is pitch stability or stability around the lateral axis of the airplane.

Two factors influence longitudinal stability:

The Horizontal Stabilizer

- When a disturbance increases the angle of attack on the wings, the nose goes up and the tail down. As the stabilizer moves down it meets the air at a greater angle of attack, obtains more lift and tends to restore the aircraft to straight and level flight.

Center of Gravity

- C of G is very important in achieving longitudinal stability. If the airplane is loaded with the C of G too far aft, the airplane will have a nose up rather than a nose down attitude. The inherent stability will be lacking and even though putting the elevator down may correct the situation, control of the airplane in the longitudinal plane will be difficult and maybe impossible.

LATERAL STABILITY

- Lateral stability is stability around the longitudinal axis or roll stability.

Lateral stability is achieved through:

Dihedral

- The Dihedral Angle is the angle that each wing makes with the horizontal. When a wing is displaced, a flow of air will strike the down going wing at a higher angle of attack with a resultant increase in lift.

Keel Effect

- Most high wing airplanes are laterally stable simply because the wings are attached in a high position on the fuselage and because the weight is therefore low. When the airplane is disturbed and one wing dips, the weight acts as a pendulum returning the airplane to its original attitude.

Sweepback

- When the aircraft is disturbed and a wing dips, the lower frontward wing is exposed to more airflow. This will result in an increase in lift in the front ward wing.

DIRECTIONAL STABILITY

Directional Stability is stability around the vertical or normal axis. The most important feature that affects directional stability is the vertical tail surface, that is, the fin and rudder.

THE FIN

An airplane has the tendency always to fly head on into the relative wind. If the airplane yaws away from its course, the airflow strikes the vertical tail surface from the side and forces it back to its original line of flight.

AXIS	MOTION	CONTROL	STABILITY
Longitudinal	Rolling	Ailerons	Lateral Stability around the Longitudinal Axis.
Lateral	Pitching	Elevators	Longitudinal Stability around the Lateral Axis.
Normal	Yawing	Rudder	Directional Stability around the Normal Axis.