ANGLE OF ATTACK (A of A)

The angle at which the airfoil meets the relative wind is called the Angle of Attack.

CENTER OF PRESSURE (C of P)

If we consider all the distributed pressures to be equivalent to a single force, this force will act through a straight line. The point where this line cuts the chord of an airfoil is called the Center of Pressure. As the angle of attack is increased lift and drag increase and the Center of Pressure moves forward. This situation continues until the stall is reached. Beyond this point, it will move back. The movement of the Center of Pressure causes an airplane to be unstable.

THE BOUNDARY LAYER

The boundary layer is a very thin sheet of air lying over the surface of the wing and all other surfaces of the airplane. Because air has viscosity, this layer tends to stick to the wing. As the wing moves forward through the air the boundary layer at first flows smoothly over streamlined shape of the airfoil. Here the flow is called the Laminar Layer.

As the boundary layer approaches the center of the wing it begins to lose speed due to skin friction and it becomes thicker and turbulent (turbulent layer). The point at which the boundary layer changes from laminar to turbulent is called the Transition Point. Where the boundary layer becomes turbulent, drag due to skin friction is relatively high.

AIRFOIL DESIGNS

There are many different airfoil designs. The type of operation for which an airplane is intended has a direct influence on the design and shape of the wing for that airplane.

Basically an airplane designed for slow speed uses a thick airfoil and a thin airfoil is best for high speed.

TYPES OF AIRFOILS

Conventional Airfoils

- Are thick for better structure and lower weight for better stall characteristics. The camber is maintained farther rearward which increases lifting capability over more of the airfoil and decreases drag. The thickest part of the airfoil is at 25% chord.

Laminar Flow Airfoils

- Were originally developed for the purpose of making an airplane fly faster. The laminar flow wing is usually thin. The leading edge is more pointed and its upper and lower surfaces are nearly symmetrical. The thickest part of a laminar wing occurs at 50% chord.

ANGLE OF INCIDENCE

The angle of incidence is the angle at which the wing is permanently inclined to the longitudinal axis of the airplane or the angle at which the wing is attached to the fuselage.

WASH-IN /WASH-OUT

Reduces the tendency of the wing to stall suddenly. The wing is slightly twisted so that the wing root has a greater angle of incidence. Therefore, the wing root will stall first. The ailerons will still be effective even though part of the wing is stalled. Wash-in is increasing the angle of incidence, hence, increasing lift while wash-out is decreasing the angle of incidence, hence, decreasing the lift.

FLAPS

Flaps are high lift devices that, in effect, increase the camber of the wing. Flaps will give you:

- Better Take-off Performance
- Steeper Approach Angles
- Lower Approach/Landing Speeds

SPOILERS/DIVEBRAKES

Spoilers and divebrakes are devices fitted into the wing that increase drag decrease lift. Spoilers are on top part of the wing and divebrakes are on bottom.

WING FENCES

Wing Fences are fin like surfaces attached to the upper surface of the wing and are used to control the airflow. They provide better slow speed handling and stall characteristics

SLATS AND SLOTS

Slats are auxiliary airfoils fitted to the leading edge of the wing. As angle of attack increases the slats pull out of the wing and go back in with a decrease in angle of attack. They help to improve the lateral control.

Slots are passageways built into the leading edge of the wing a short distance from the leading edge of the wing. At high angles of attack air flows through the holes smoothing out the turbulence caused by eddies