



SNS COLLEGE OF TECHNOLOGY

**An Autonomous Institution
Coimbatore – 35**

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Approved by AICTE , New Delhi and Affiliated to Anna University , Chennai.

DEPARTMENT OF AEROSPACE ENGINEERING

19ASO301 BASICS OF AERONAUTICAL ENGINEERING

UNIT 2 – AERODYNAMICS



UNIT 2 – AERODYNAMICS



- *Aerodynamic Forces*
- *Drag*
- *Mach Number*
- *Center of Pressure & Aerodynamic Center*
- *Components of Airplane*



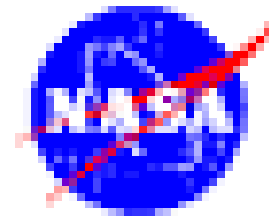
TEXT BOOK



- ***Anderson. J D, “Introduction to Flight”, McGraw-Hill, 1995***
- ***Richard S. Shevel, “Fundamentals of Flight”, Prentice Hall, 2010***

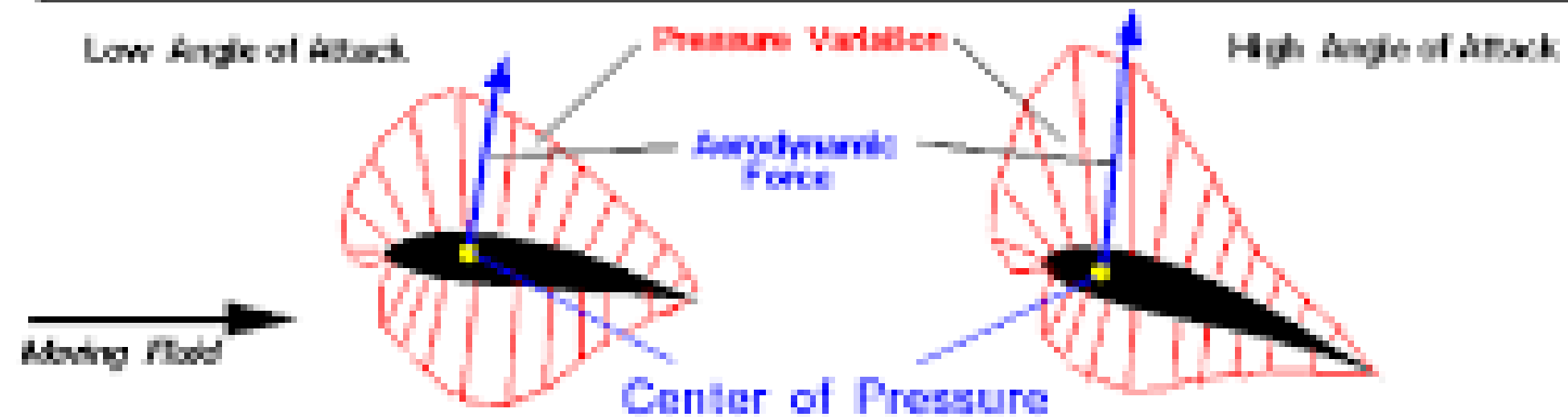


Center of Pressure



Center of Pressure – cp

Glenn
Research
Center



Center of Pressure is the average location of the pressure.
Pressure varies around the surface of an object. $P = P(x)$

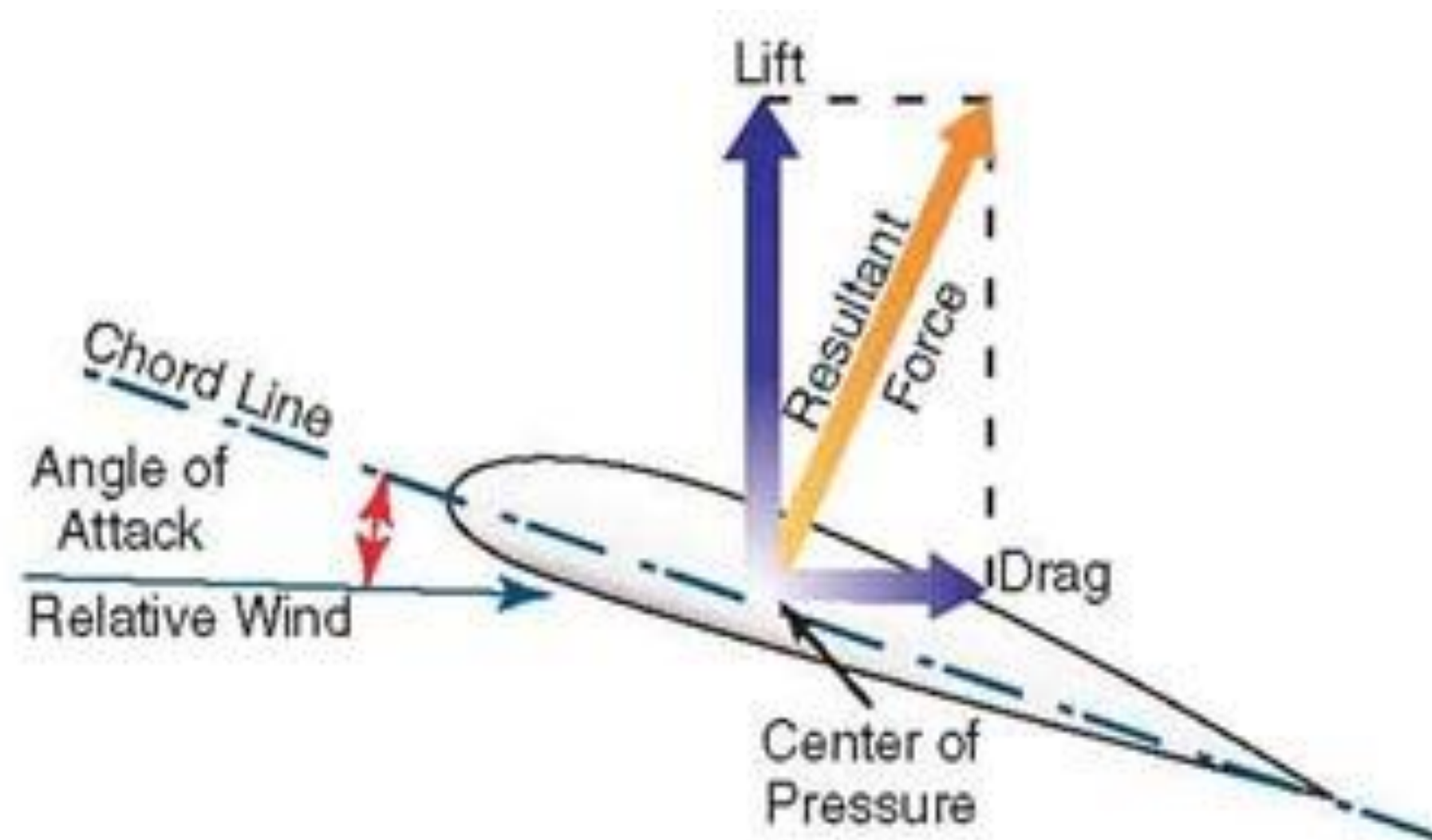
$$cp = \frac{\int x p(x) dx}{\int p(x) dx}$$

Aerodynamic force acts through the center of pressure.
Center of pressure moves with angle of attack.



Center of Pressure

The resultant aerodynamic force acts along the Center of Pressure, about which the moment is zero.





Center of Pressure



Center of Pressure

- *Location of Center of Pressure of airfoil shifts with:-*
 - *Camber*
 - *Change in AoA*

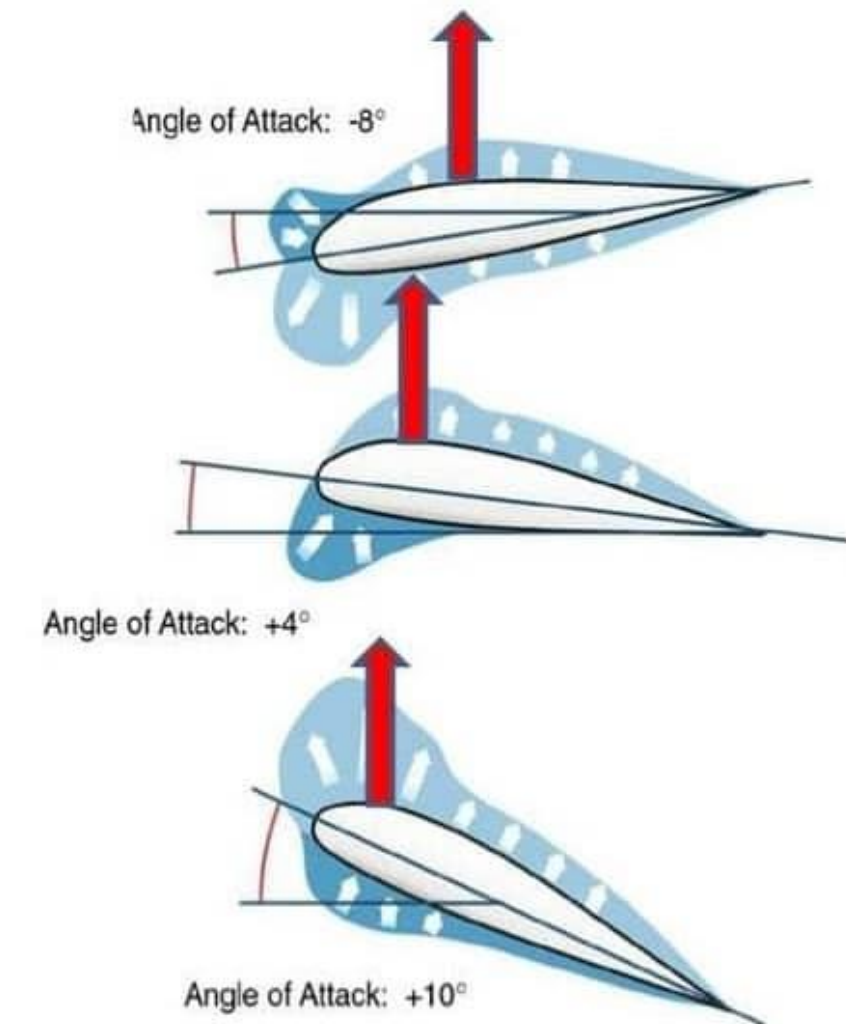


FIG 03-06
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Guided Flight Discovery Private Pilot Manual

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Aerodynamic Center

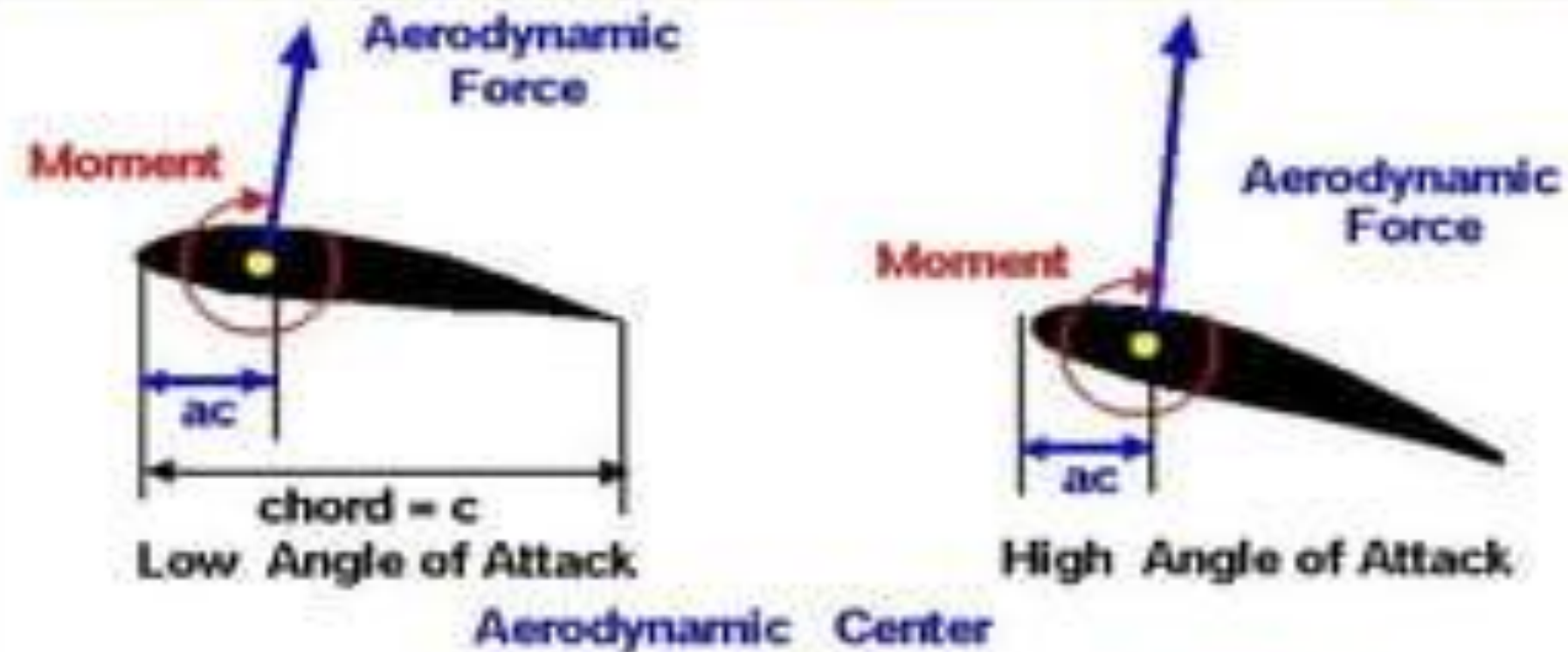


- *The Aerodynamic center is a point on an airfoil, where pitching moments do not change with the Angle of Attack. This holds true for symmetrical airfoil.*
- *The point moves forward a bit for cambered asymmetric airfoil (like most wings), when AoA increases. This is where, tail feathers (flaps) help.*
- *Center of Pressure is the effective balance point on the airfoil with no pitching moment. The aerodynamic center is a fixed point, where the moment is constant and independent of lift.*



Center of Pressure

AERODYNAMIC CENTER



For low speed, thin airfoils (flat plate) : $ac = \frac{c}{4}$

Moment about the aerodynamic center is constant with angle.

Aerodynamic center does not move with angle.



Components of Airplane

