

॥ नमस्ते ॥

HIGH LIFT DEVICES - FLAPS







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Aileron

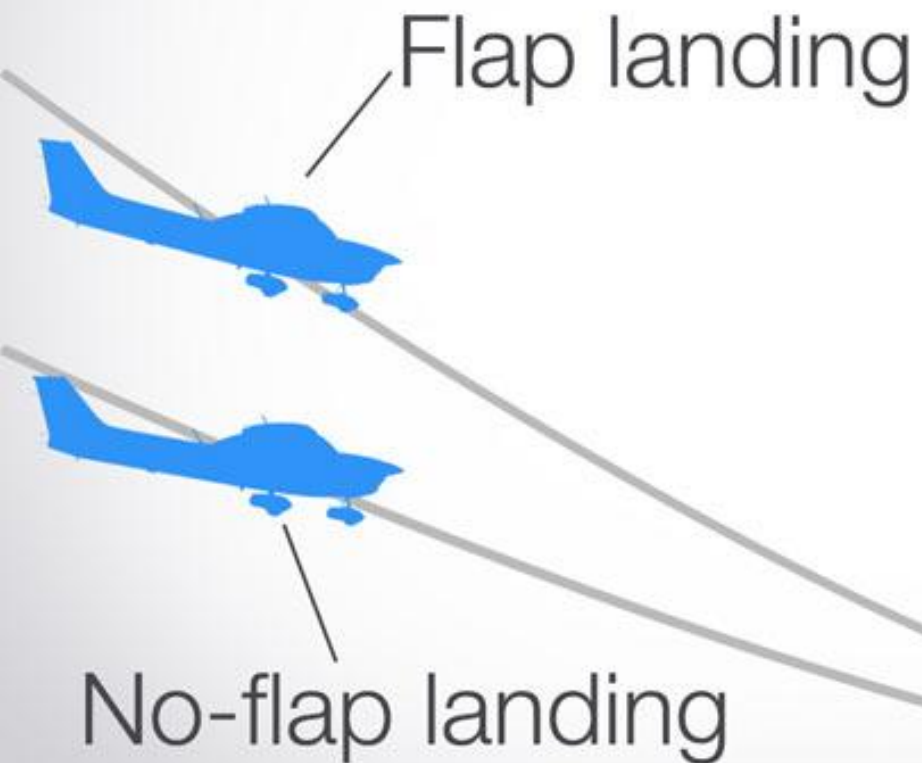
Trailing Edge
Flaps

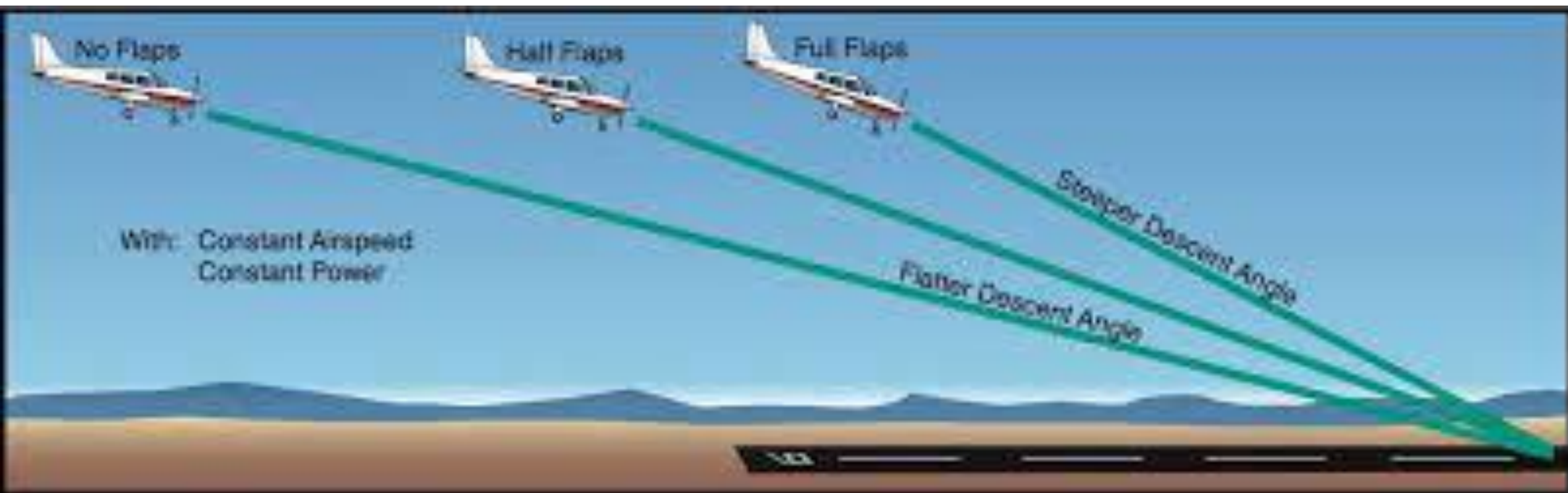
Aileron

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Image: [https://commons.wikimedia.org/wiki/File:UntitledCessna_182T_Skylane_RA-67703_\(4251354810\).jpg](https://commons.wikimedia.org/wiki/File:UntitledCessna_182T_Skylane_RA-67703_(4251354810).jpg)

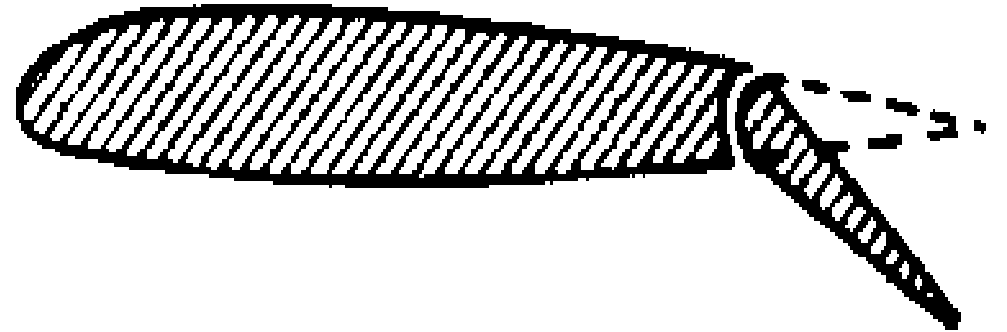
Flap vs. No-Flap Landing





1. PLAIN FLAP

- **PLAIN FLAP** (maximum increment in Lift coefficient occurs at 80° deflection angle)
- **Geometry Alteration effect:** Increases the effective camber of the airfoil.
- **Boundary Layer Control:** There is no effect over the behavior of the boundary layer.



Flaps Up - Camber

Camber Line



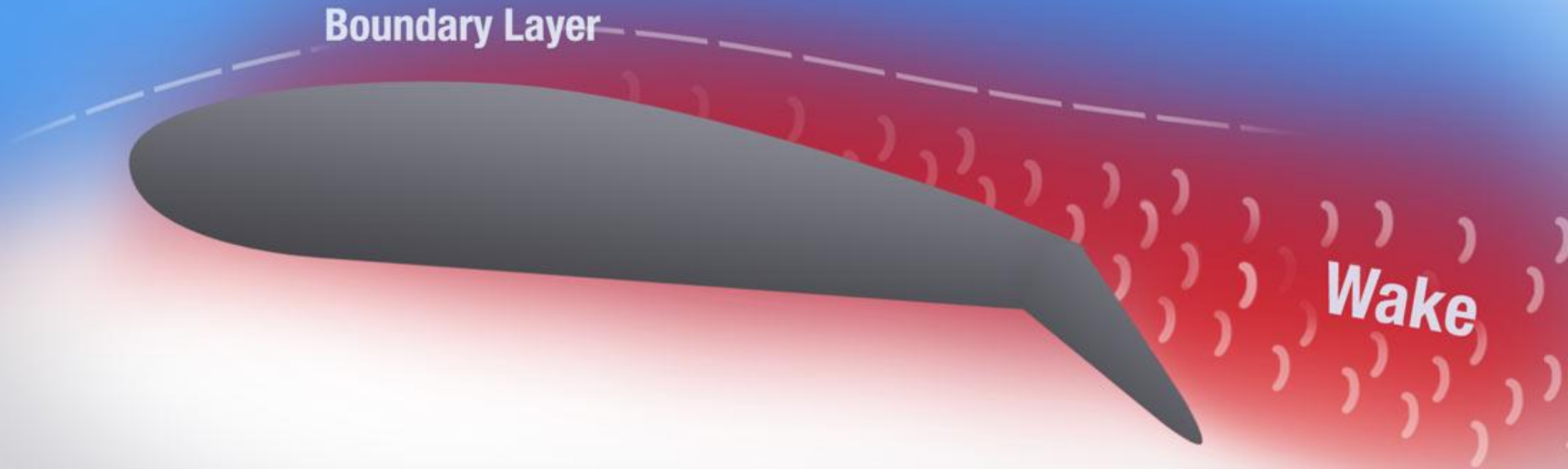
Flaps Down - Camber

Camber Line



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Flaps - Extended



SYS[™]

Simulation

INDUSTRIE-TECHN

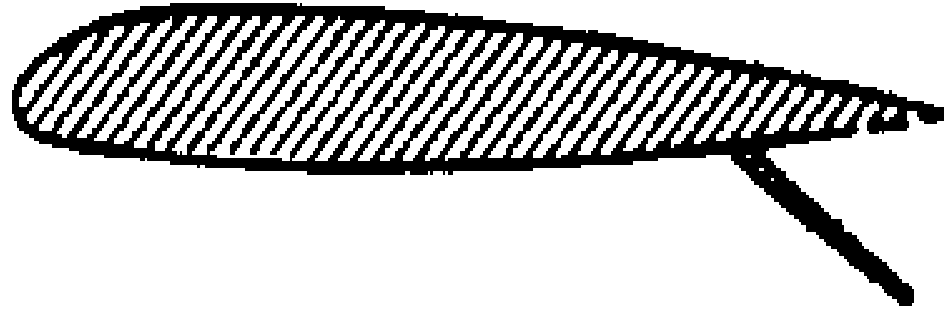
Plain flap



EFFECTS

- Reduces the zero lift angle of attack to a much lower point increases the coefficient of lift compared to unflapped airfoil. $C_{L_{max}}$ is obtained at much lower angle of attack.
- Reduction in the stall angle of incidence helps in low nose up attitude flight during landing and take-off maneuver advantageous in pilot's perspective for he can have a good visibility.
- Coefficient of Pressure is varied in the presence of flap effecting an aft movement of the center of pressure, causing a nose down moment requiring adjustment by the pilot. (for pressure plot look at Aerodynamics by L J Clancy)

2.SPLIT FLAP

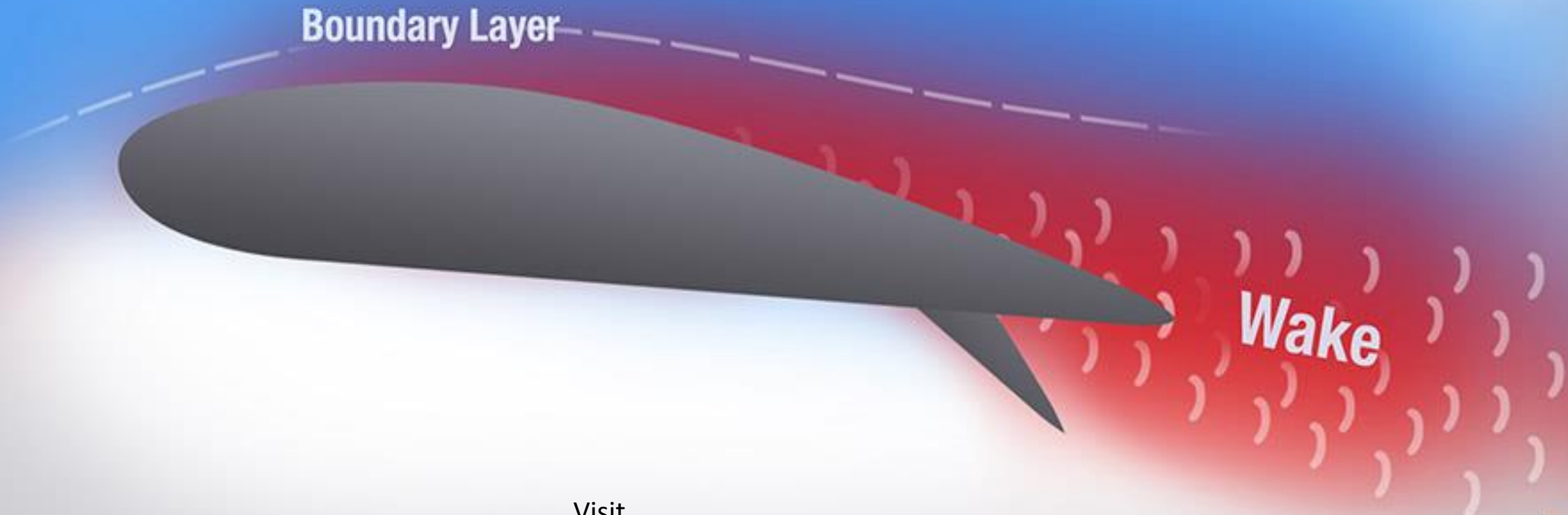


- **Geometry Alteration effect:** Increases the effective camber of the airfoil as plain flap.
- **Boundary Layer Control:** No special effect.
- To overcome the separation effect in the plain flap a split flap is adapted with curvature of the airfoil being unaffected even at the time of deflection of the flap.

EFFECTS

- The lift slope curve is slightly increased, because the flap performs better at high than at low incidence
- The zero lift angle is reduced, but not by quite so much as is the case with a plain flap.
- The stalling angle is less than with flap neutral, but higher than the corresponding value for a plain flap.
- The increment in maximum lift coefficient is bigger than with a plain flap.
- The effect on pitching moment is similar but less marked.
- Bigger Increase in drag than with a plain flap because of the large wake.

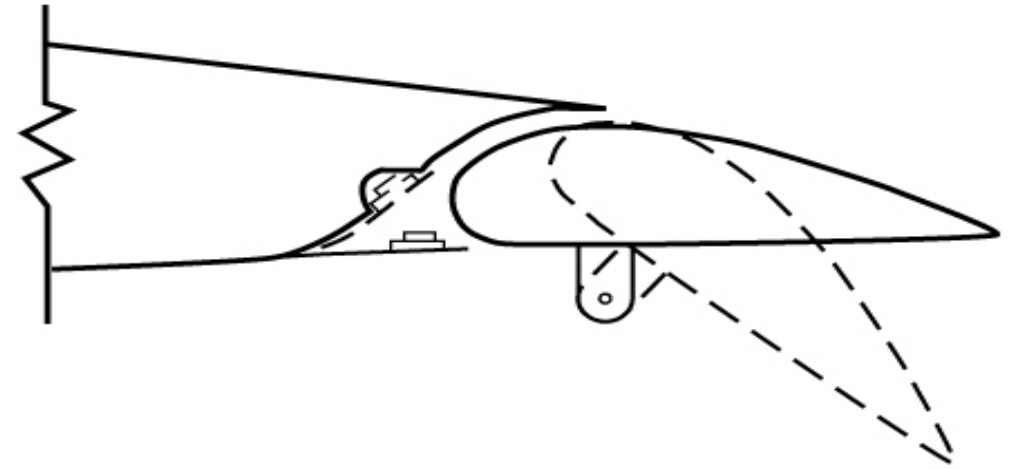
Split Flaps - Extended



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3.THE SLOTTED FLAP



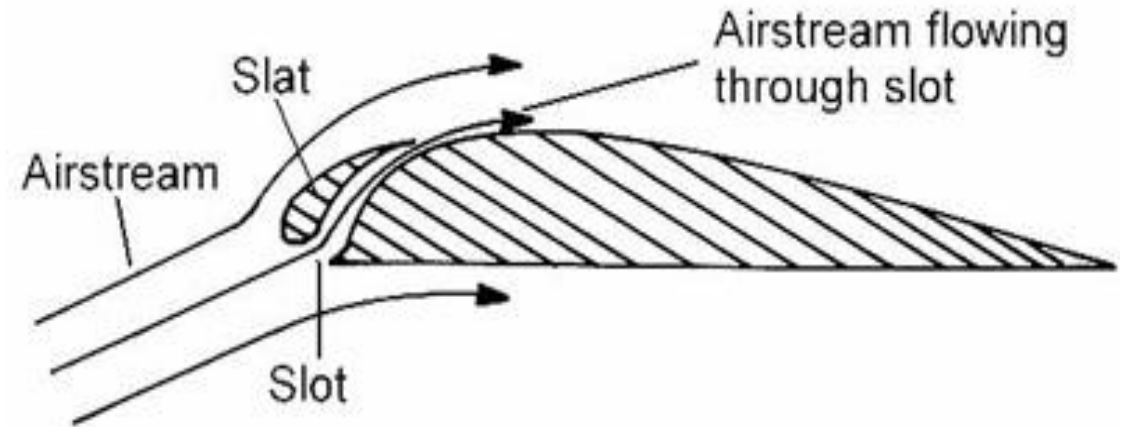
Geometry: Increases the effective camber of the airfoil.

BL Control: The air passing through the slot re-energizes the boundary layer and prevents separation.

EFFECT:

- Zero lift angle is still reduced. Maximum lift coefficient is appreciably bigger than that in the previous cases
- Drag is much lesser since it prevents separation. (Pressure drag is reduced)
- Moment is still large.

4. LEADING EDGE SLOT



LEADING EDGE SLOT

Geometry alteration: Negligible or unnoticed alteration in the geometry of the airfoil.

B L Control: The BL is re-energized by the air flow.

EFFECTS:

The stall angle is increased from, say, 15 to 25 degree

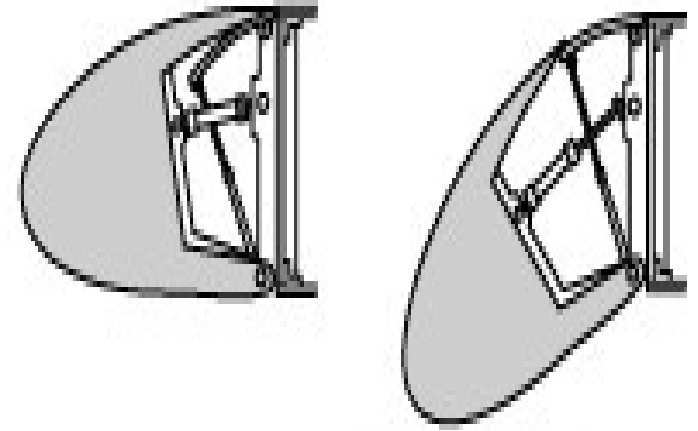
The maximum lift coefficient is increased by about 60%.

At low incidence slat ahead of the airfoil affects the flow over the rest of the wing and there is an appreciable increase in drag coefficient. Thus this device gives increase in the drag at wrong end of the speed range.

Maximum lift coefficient is obtained only at high incidence, so requires high nose up attitude at take-off and landing affecting the visibility of the pilot.

Drag at low speed is reduced which is again a disadvantage during landing where L/D should be too low as possible.

5.LEADING EDGE FLAP (DROOP SNOOT)



Another device which produces lift increments by helping to prevent flow separation is the leading edge flap, often colloquially referred to as the 'droop-snoot'.

EFFECTS:

Same as that of the leading edge slot.

Effective at low speeds, though the objective or design point is high speed purpose.

Lift curve is similar to that of the leading edge slot, but there is a small camber effect as well, and this causes the reduction in the zero lift angle (though not too large).

6.FOWLER FLAP

Geometry Alteration: Increases the camber, and also the effective area by deflecting backwards and downwards.

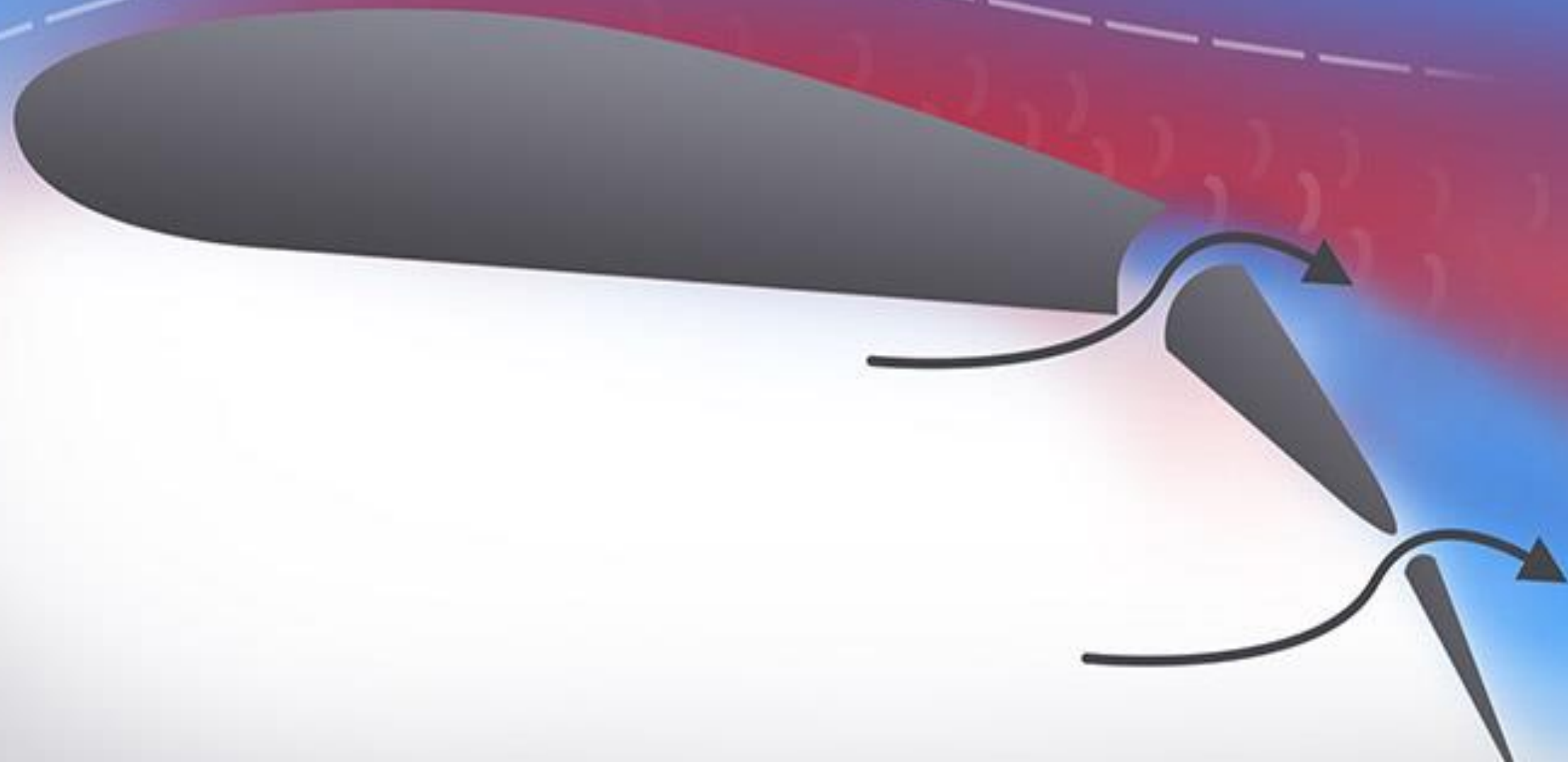
BL Control: B L is re-energized as in the case of slotted flap.

EFFECTS

- **High lift increment compared to any of the flap considered.**
- **Reduction in the effective chord to thickness ratio, making the wing to stall earlier.**
- **Moment effect is large, because of high contribution of the flap,**
- **Drag Increment is small because of the slot effect and reduces t/c ratio.**

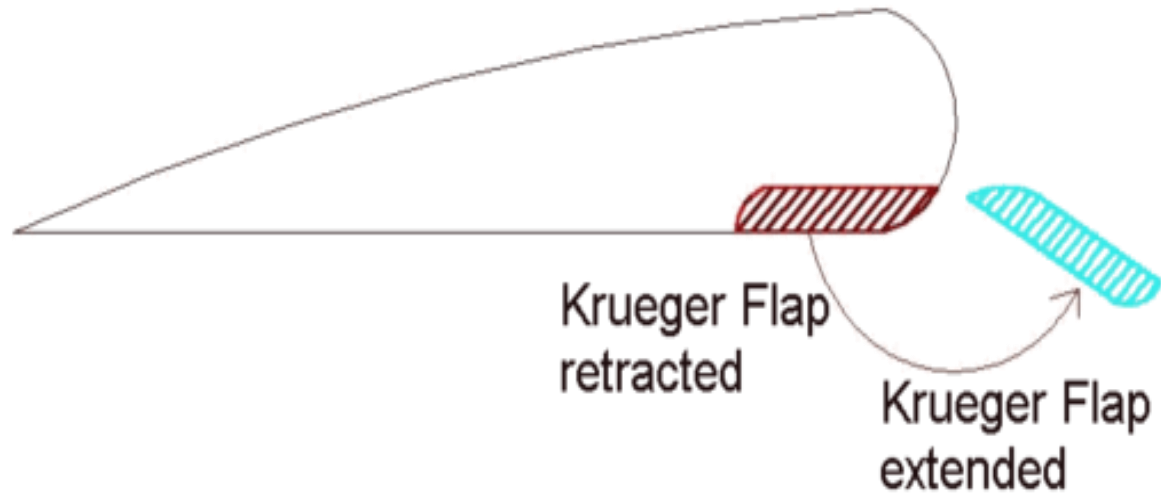
Fowler Flaps - Extended

Boundary Layer



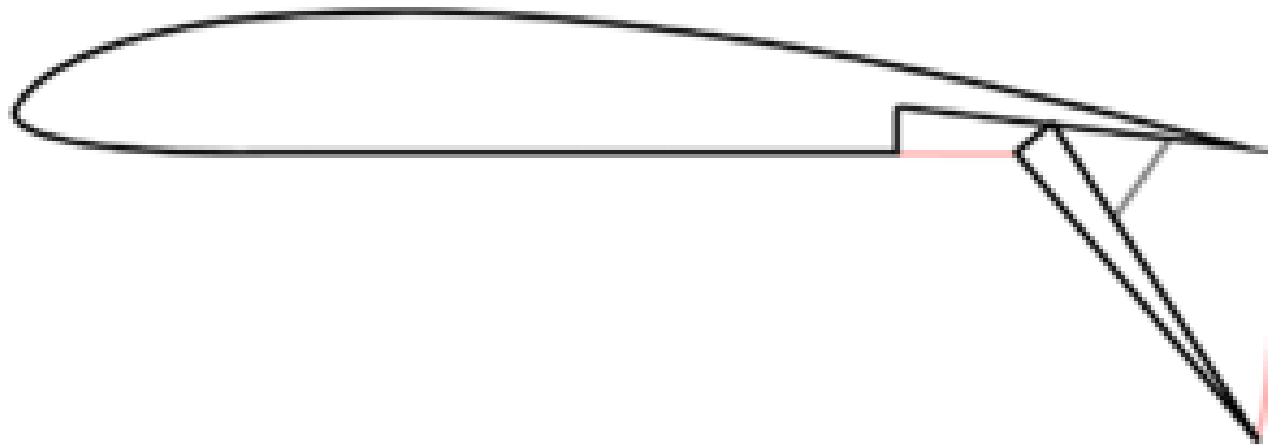
7.KRURGER FLAP

- **Krueger flaps are high lift devices that are fitted to all or part of the leading edge of the wings of some aircraft types.**
- **The aerodynamic effect of Krueger flaps is similar to that of slats; however, they are deployed differently.**
- **Krueger flaps are mounted on the bottom surface of the wing and are hinged at their leading edges.**
- **Actuators extend the flap down and forwards from the under surface of the wing thus increasing the wing camber which, in turn, increases lift.**

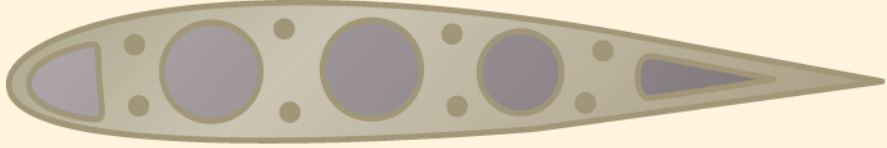


8.ZAP FLAP

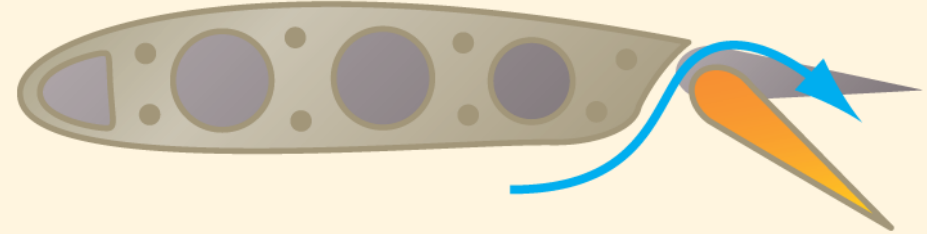
- Flaps on the trailing edges of the wings. These increase the camber as well as the effective wing area.
- This results in much higher the maximum lift and drag values than with camber or split flaps. Also called as zap flap



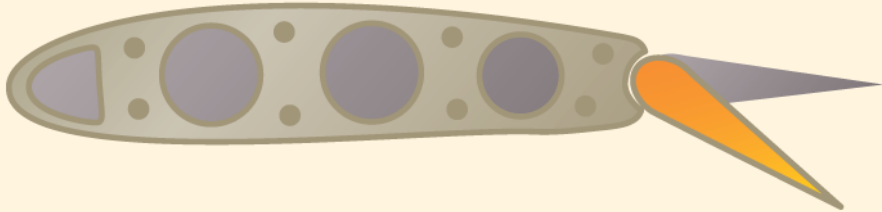
Basic section



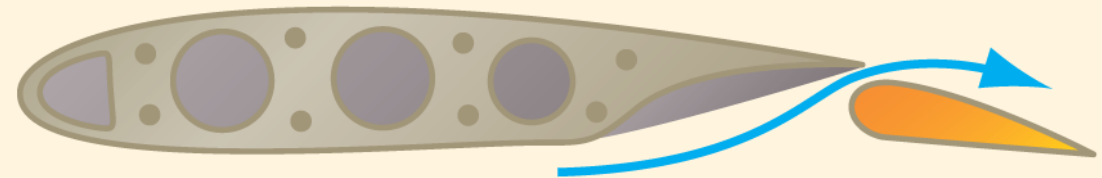
Slotted flap



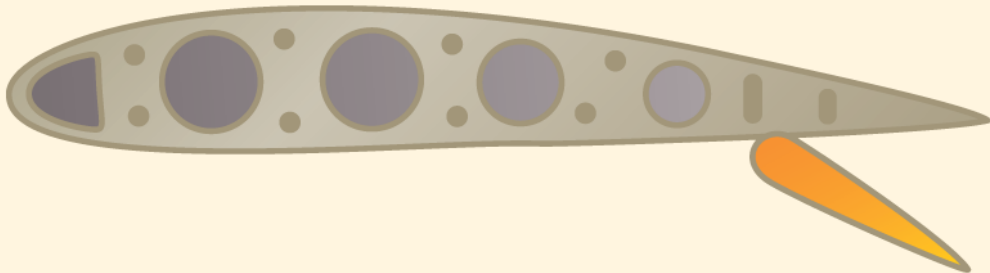
Plain flap



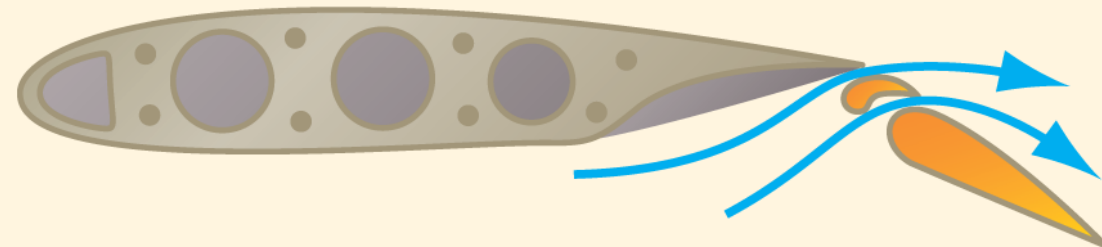
Fowler flap



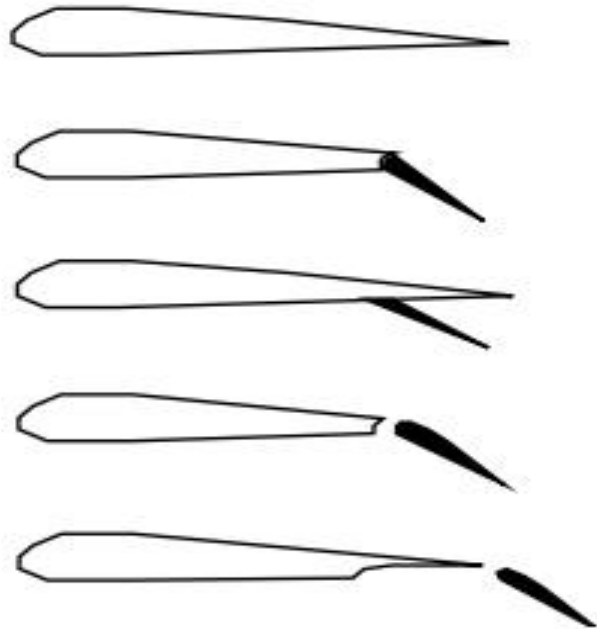
Split flap



Slotted Fowler flap



CL vs angle of attack



Basic section

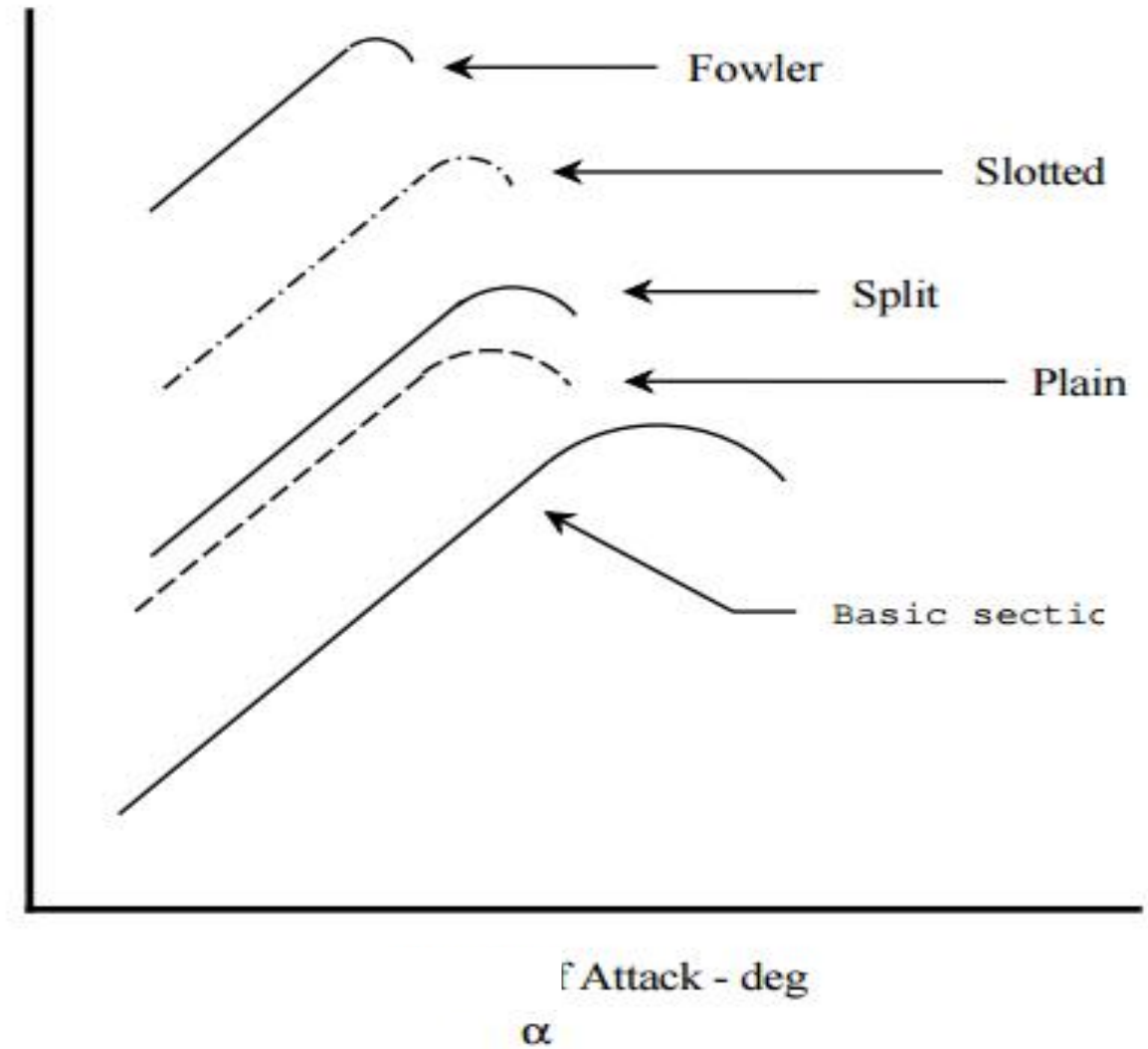
Plain

Split

Slotted

Fowler


Lift Coefficient
 C_L



[CLICK HERE TO ASK](#)



Today's Amazing Fact???????



Only Rafael fighter can carry Brahmos Missile.



ધાન્યવાદ

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