

8.1 Purpose of High-Lift Devices

- High-lift devices are fitted to aircraft to reduce takeoff and landing distances by increasing the wing's maximum lift coefficient ($C_{L_{max}}$). This allows the aircraft to fly at lower speeds, which is essential for safe takeoffs and landings on reasonably short runways.

8.2 Trailing Edge Flaps

- Flaps are hinged portions of the wing's trailing edge that deflect downwards to increase the wing's effective camber and, in some cases, its area.
- ☐ Plain Flap: A simple hinged section of the trailing edge. It provides a good increase in $C_{L_{max}}$.
- ☐ Split Flap: Hinged from the lower surface only, leaving the upper surface contour unaffected. It produces about the same lift increase as a plain flap but with more drag.
- ☐ Slotted Flap: When lowered, a slot opens between the wing and the flap. This slot directs high-pressure air from the lower surface over the flap, re-energizing the boundary layer and delaying flow separation. This provides a greater increase in $C_{L_{max}}$ with less drag than a plain split flap.
- ☐ Fowler Flap: This flap moves rearwards on tracks to increase the wing area before deflecting downwards to increase camber. It gives the greatest increase in lift and is often multi-slotted on large transport aircraft.

8.3 Effects of Flaps

- ☐ $C_{L_{max}}$ and Stall Angle: Lowering flaps increases $C_{L_{max}}$ but reduces the stalling angle of attack.
- ☐ Drag: Flaps significantly increase drag, especially at large deflection angles. Split flaps produce the most drag, while Fowler flaps produce the least for a given lift increase. This high drag is beneficial for landing as it allows for a steeper approach path.
- ☐ Lift/Drag Ratio: Since flaps increase drag more than they increase lift proportionally, they

Join live classes for guided practice and doubt clearing.

- reduce the maximum L/D ratio. This reduces the aircraft's climb angle and glide range.
- ☐ Pitching Moment: Lowering flaps typically moves the center of pressure rearwards, creating
- a nose-down pitching moment. However, the increased downwash over the tailplane creates a
- nose-up pitching moment. The overall pitch change depends on which effect is dominant for
- a particular aircraft design. 188188188188

8.4 Leading Edge High-Lift Devices

- These devices are used on wings with sharp leading edges (common on high-speed aircraft)
- to delay flow separation at high angles of attack.
- ☐ Leading Edge Flaps: These are simple hinged sections of the leading edge that droop
- downwards to increase the leading edge camber.
- Krueger Flaps: A type of leading edge flap that hinges forward from the lower surface of the
- wing. They are often used on the inboard section of swept wings to promote a root stall.
- ☐ Slats and Slots:
- A slot is a fixed gap in the leading edge that allows high-pressure air from below the wing to
- flow to the upper surface, re-energizing the boundary layer.
- A slat is a movable aerofoil section that forms part of the leading edge. When deployed, it
- moves forward and down, opening a slot. This is the most effective type of leading edge
- device, significantly increasing the stalling angle and $C_{L_{max}}$.

© Ghost Aviator · Technical General for Aviators · Ghost Aviator