

3.1 The Aerofoil 5555

- An aerofoil is a specially shaped body, like a wing or propeller blade, designed to generate an aerodynamic force (primarily lift) when it moves through the air. 56565656
- ☐ How Lift is Generated: The curved upper surface of a typical aerofoil forces the air to travel a longer distance than the air flowing under the flatter bottom surface. According to the Principle of Continuity, the air on top must speed up. According to Bernoulli's Theorem, this increase in velocity leads to a decrease in static pressure. The pressure on the upper surface is therefore lower than the pressure on the bottom surface. This pressure differential results in an upward force, which we call lift.
- ☐ Streamlines and Streamtubes:
 - A streamline is the path traced by a single particle of air in a steady airflow.
 - A streamtube is an imaginary tube made up of many streamlines. No air flows through the "walls" of a streamtube.

3.2 Key Aerofoil Terminology

- ☐ Chord Line: A straight line joining the center of curvature of the leading and trailing edges.
- ☐ Chord: The distance between the leading and trailing edges, measured along the chord line.
- ☐ Angle of Incidence: The fixed angle between the wing's chord line and the aircraft's longitudinal axis.
- ☐ Camber: The curvature of the aerofoil's surfaces.
 - Maximum Camber is the greatest distance of the mean camber line from the chord line, expressed as a percentage of the chord.
 - A symmetrical aerofoil has no camber; its mean camber line and chord line are the same.

- ☐ Thickness/Chord Ratio: The maximum thickness of the aerofoil expressed as a percentage of the chord. This greatly influences airflow characteristics.
- ☐ Leading Edge Radius: The radius of the leading edge's curvature. A smaller radius means a sharper leading edge.

3.3 Defining Aerodynamic Forces

- ☐ Relative Air Flow (RAF): The direction of the airflow with respect to the wing. It is parallel and opposite to the aircraft's flight path. Its magnitude is the True Air Speed (TAS).
- ☐ Total Reaction: The resultant of all aerodynamic forces acting on the aerofoil.
- ☐ Centre of Pressure (CP): The point on the chord line through which the total lift force is considered to act.
- ☐ Lift: The component of the Total Reaction that acts perpendicular to the Relative Air Flow.
- ☐ Drag: The component of the Total Reaction that acts parallel to the Relative Air Flow.
- ☐ Angle of Attack (α): Also called Aerodynamic Incidence, it is the crucial angle between the chord line and the Relative Air Flow.

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