SNS COLLEGE OF TECHNOLOGY

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DEPARTMENT OF AEROSPACE ENGINEERING

BASIC AERODYNAMICS

BY

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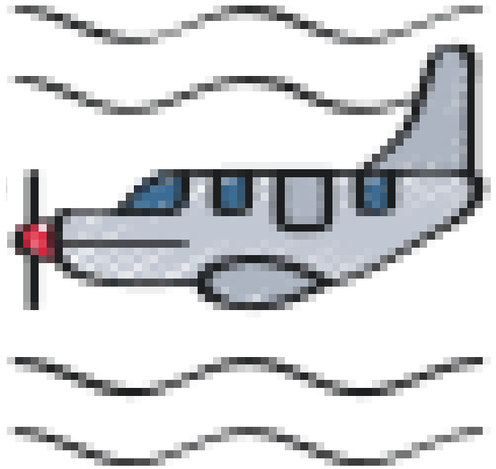
WHAT IS AERODYNAMICS?

- **DEFINITION:**
  - Aerodynamics is the study of how air flows around objects, particularly as it relates to the movement of aircraft through the atmosphere.
- **IMPORTANCE:**
  - Understanding aerodynamics is crucial for designing efficient aircraft and achieving optimal performance during flight.



IMPORTANCE OF AERODYNAMICS

- **EFFICIENT FLIGHT:**

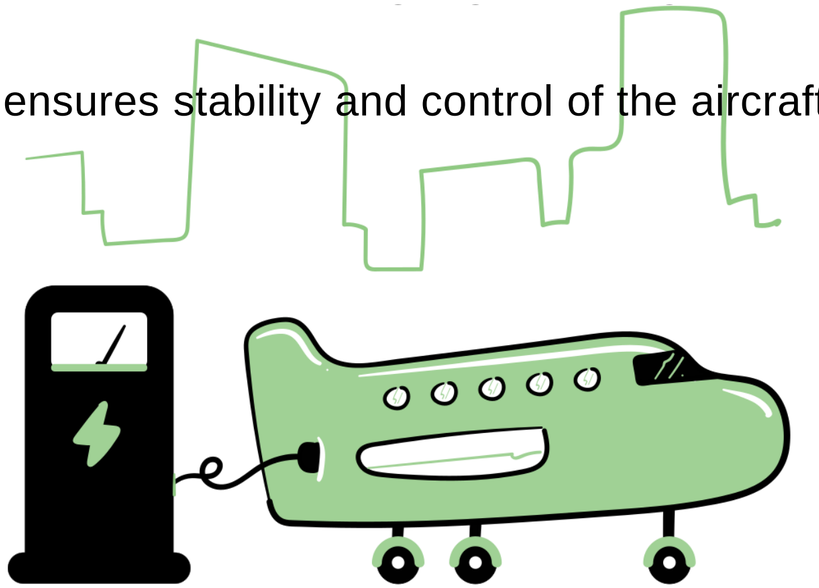
  Aerodynamics helps in achieving efficient flight by reducing drag and improving lift.

- **FUEL ECONOMY:**

  Reduced drag means less fuel consumption, which is crucial for long-distance flights.

- **STABILITY AND CONTROL:**

  Proper aerodynamic design ensures stability and control of the aircraft in various flight conditions.



BASIC TERMS

- **AIRFOIL:**

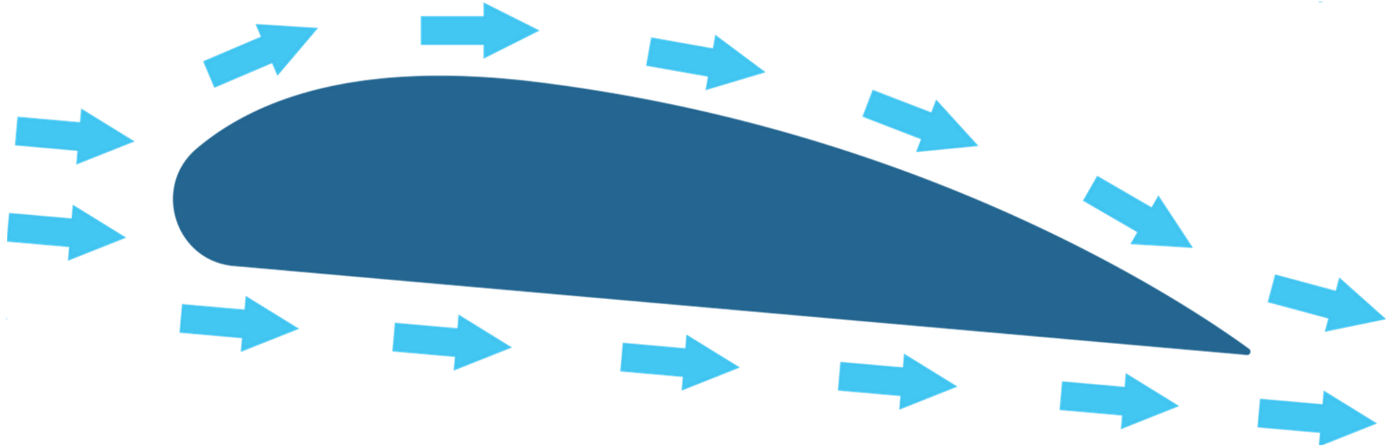
  The shape of a wing or blade that is designed to produce lift when air flows over it.

- **LIFT:**

  The force that acts perpendicular to the direction of airflow and enables an aircraft to rise and stay airborne.

- **DRAG:**

  The resistance to motion through the air that opposes the aircraft's forward motion.



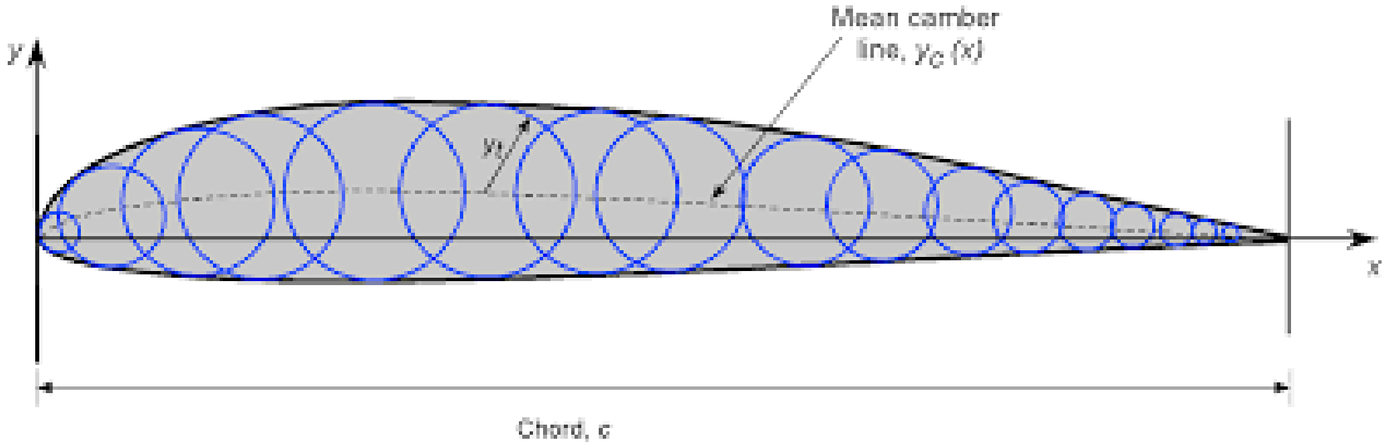
IMPORTANCE OF AIRFOIL DESIGN IN AERODYNAMICS

Applications:

- Airfoil design is crucial in various applications such as aircraft wings, helicopter rotor blades, wind turbine blades, and hydrofoils.

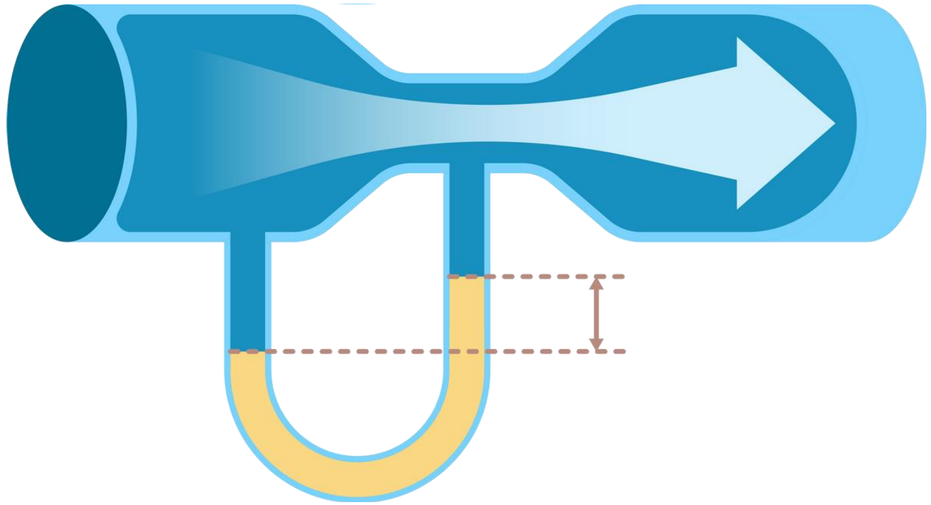
Safety:

- Proper airfoil design ensures safe and stable flight by controlling airflow over the aircraft surfaces.



BERNOULLI'S PRINCIPLE

- **DEFINITION:**
  - Bernoulli's principle states that an increase in the speed of a fluid (air, in this case) occurs simultaneously with a decrease in pressure.
- **APPLICATION TO FLIGHT:**
  - Faster-moving air over the top of a wing creates lower pressure, while slower-moving air below the wing creates higher pressure, resulting in lift.



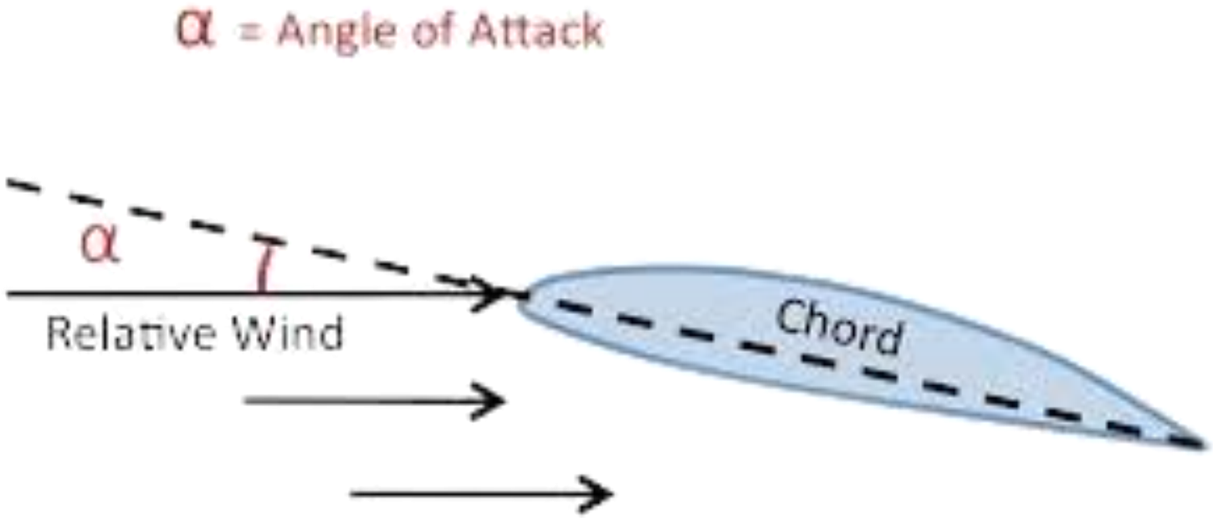
HOW WINGS GENERATE LIFT

- **SHAPE OF THE WING (AIRFOIL):**

The curved shape of the wing (airfoil) is designed to create a pressure difference between the upper and lower surfaces, resulting in lift.

- **ANGLE OF ATTACK:**

The angle between the wing chord line and the direction of the oncoming air. A greater angle of attack can increase lift up to a certain point before causing a stall.



TYPES OF DRAG

- **PARASITIC DRAG:**

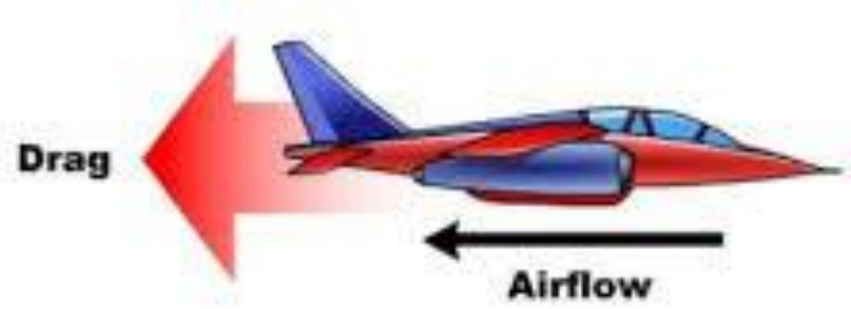
Form drag: Drag caused by the shape of the aircraft.

Skin friction: Drag caused by the friction between the air and the aircraft's surface.

Interference drag: Drag caused by the intersection of airflow streams around the aircraft.

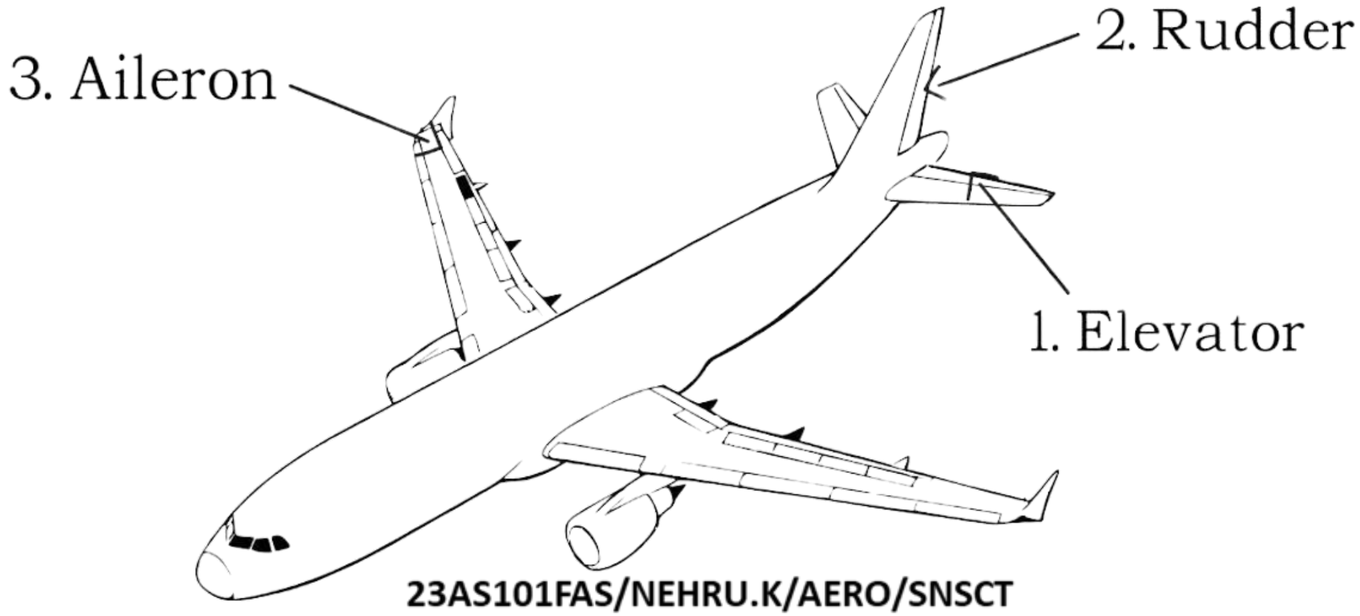
- **INDUCED DRAG:**

Drag that is created as a by-product of lift. It occurs as the wing generates lift by deflecting air downwards.



CONTROL SURFACES

- **AILERONS:**
  - Located on the trailing edge of the wings, ailerons control the roll of the aircraft by moving in opposite directions.
- **ELEVATORS:**
  - Located on the horizontal tail surface, elevators control the pitch of the aircraft by moving up and down.
- **RUDDER:**
  - Located on the vertical tail surface, the rudder controls the yaw of the aircraft by moving left and right.



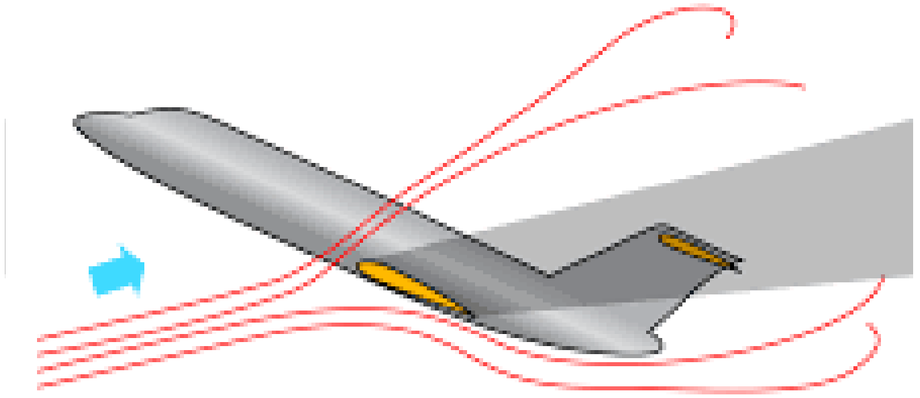
STALL

- **DEFINITION:**

A stall occurs when the wing's angle of attack is too high, causing the airflow to separate from the wing and the wing to lose lift.

- **EFFECTS**:

Loss of lift, which can lead to a loss of control and potentially result in a spin if not corrected.

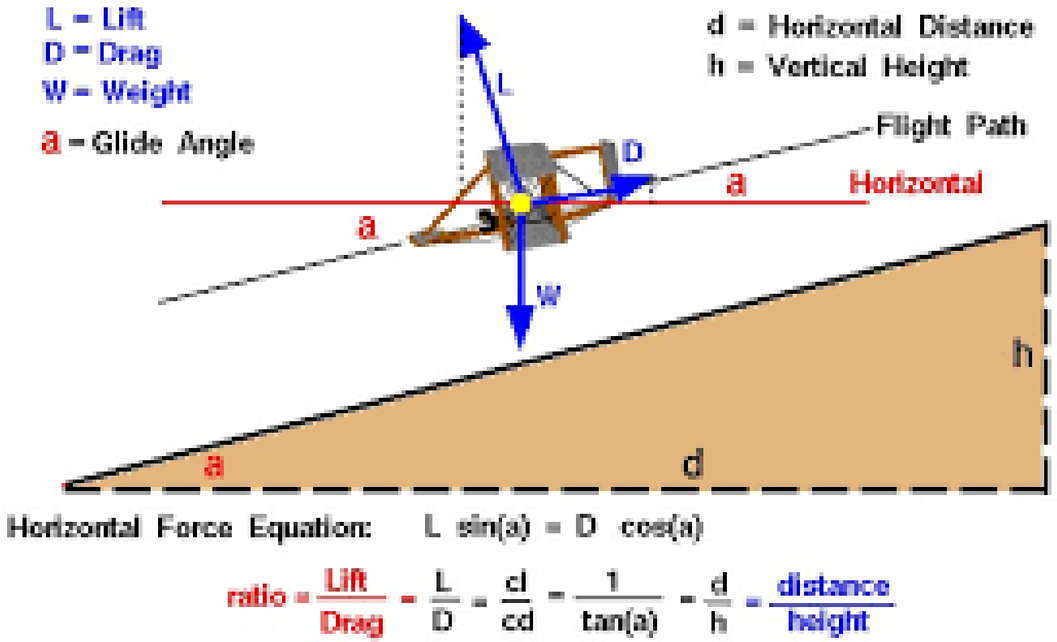


LIFT-TO-DRAG RATIO

- **DEFINITION:**
  - Lift-to-Drag ratio (L/D) is the amount of lift generated by a wing compared to the amount of drag it produces.

IMPORTANCE:

- A higher L/D ratio indicates a more efficient wing, resulting in better fuel economy and longer gliding distance.

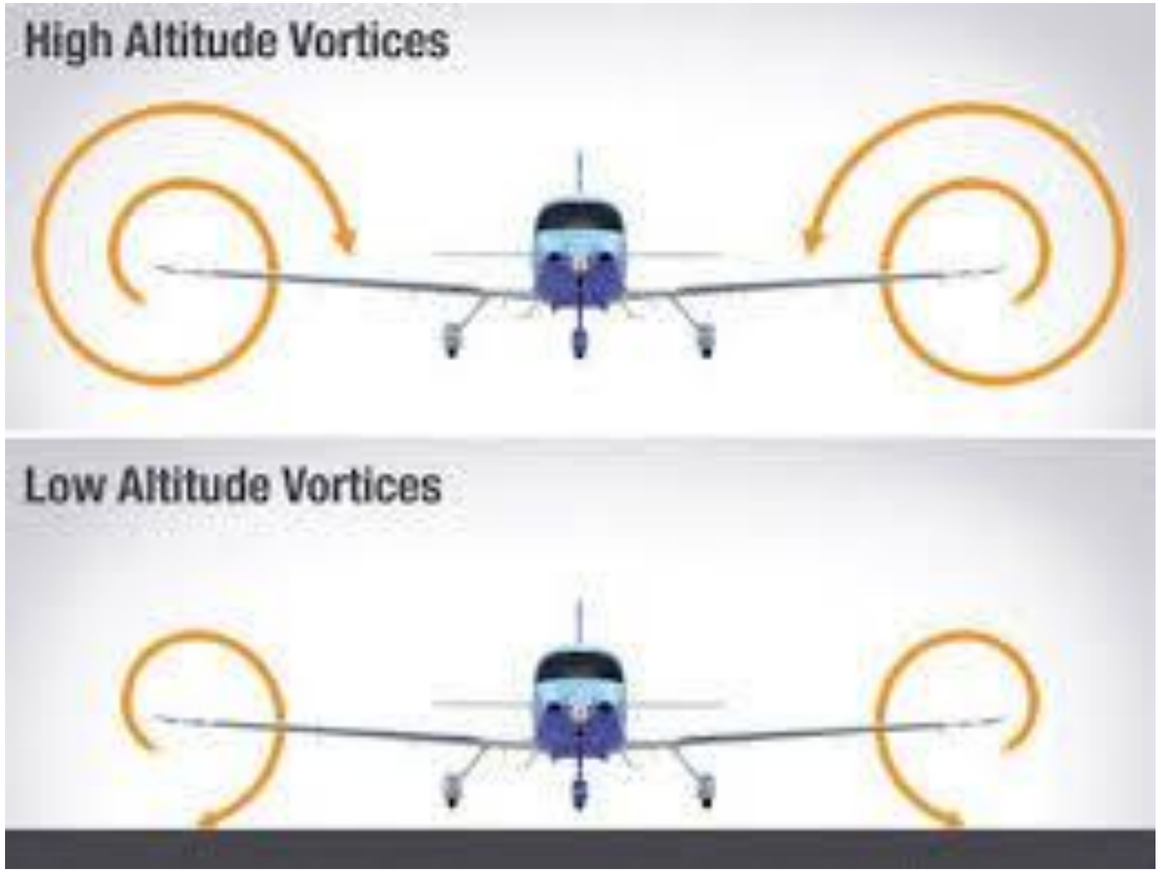


WINGTIP VORTICES

- **DEFINITION:**
  - Wingtip vortices are circular patterns of rotating air that form at the wingtips of an aircraft as it generates lift.

EFFECT:

- Wingtip vortices can cause induced drag and are a hazard to following aircraft, particularly during takeoff and landing.

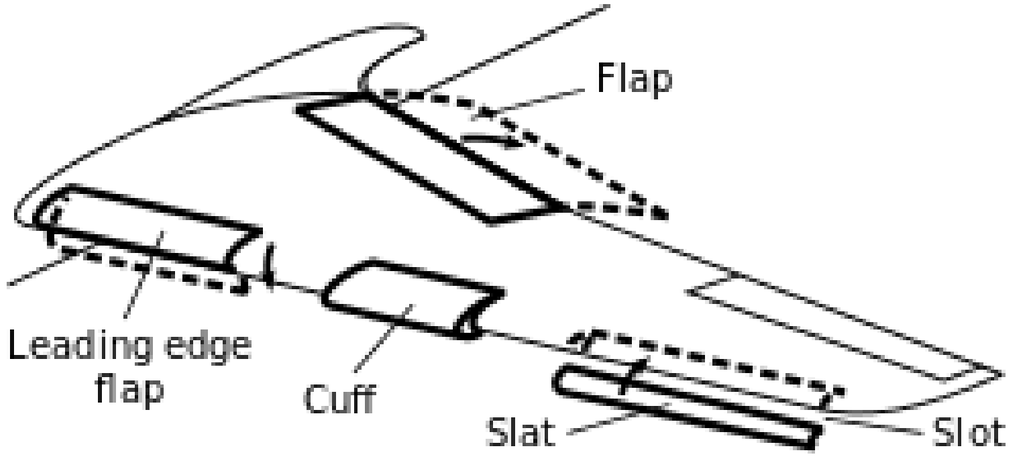


HIGH LIFT DEVICES

- **DEFINITION:**
  - High lift devices, such as flaps and slats, are used to increase the lift produced by the wings at low speeds during takeoff and landing.

TYPES:

- Flaps: Increase the wing area and curvature
- Slats: Extend the leading edge of the wing

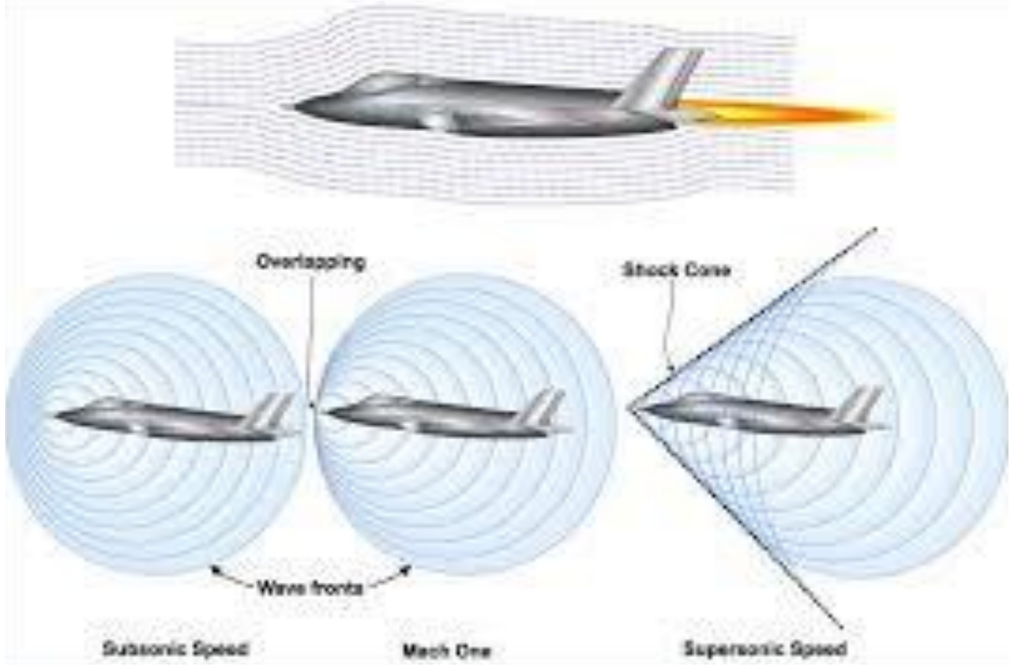


SUPERSONIC AERODYNAMICS

- **DEFINITION:**
  - Supersonic aerodynamics deals with the behavior of airflow around an object when the speed of the object is greater than the speed of sound.

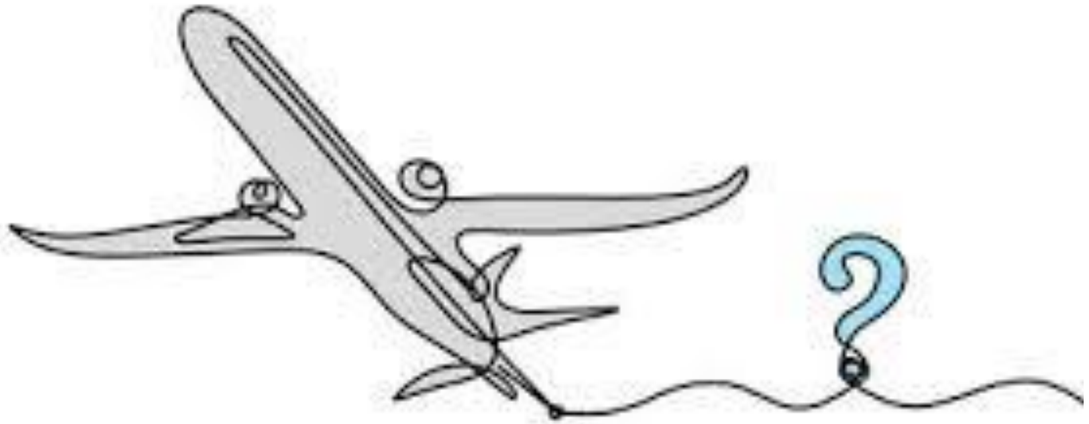
CHALLENGES:

- Shock waves, drag, and heating of the aircraft structure.



CONCLUSION

- KEY POINTS:
  - AERODYNAMICS IS CRUCIAL FOR FLIGHT EFFICIENCY AND SAFETY.
  - UNDerstanding basic aerodynamic principles is key for pilots and aircraft engineers.
  - Continued research and development in aerodynAMICS LEAD To advancements in aviation technology.



Thank you