SNS COLLEGE OF TECHNOLOGY

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Coimbatore – 35

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DEPARTMENT OF AEROSPACE ENGINEERING

19ASO301 BASICS OF AERONAUTICAL ENGINEERING

UNIT 2 – AERODYNAMICS

UNIT 2 – AERODYNAMICS

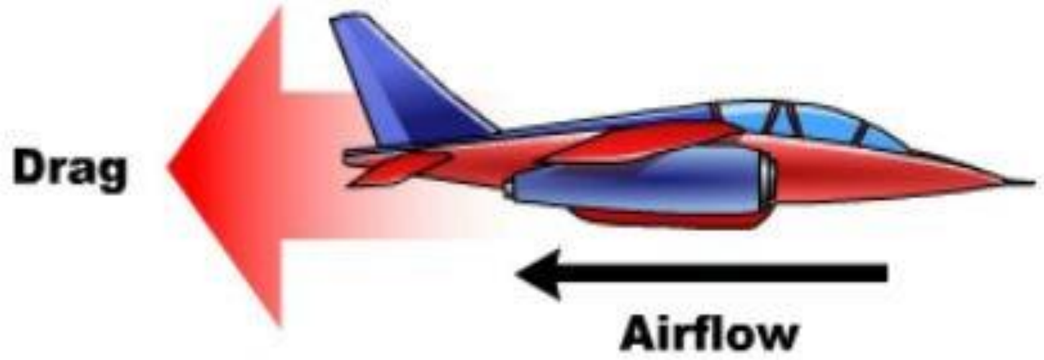
- *Aerodynamic forces on Aircraft*
- *Drag*
- *Mach Number*
- *NACA & NASA*
- *Airfoil*
- *Components of Airplane*

TEXT BOOK

- *Anderson. J D, "Introduction to Flight", McGraw-Hill, 1995*

- *Richard S. Shevel, "Fundamentals of Flight", Prentice Hall, 2010*

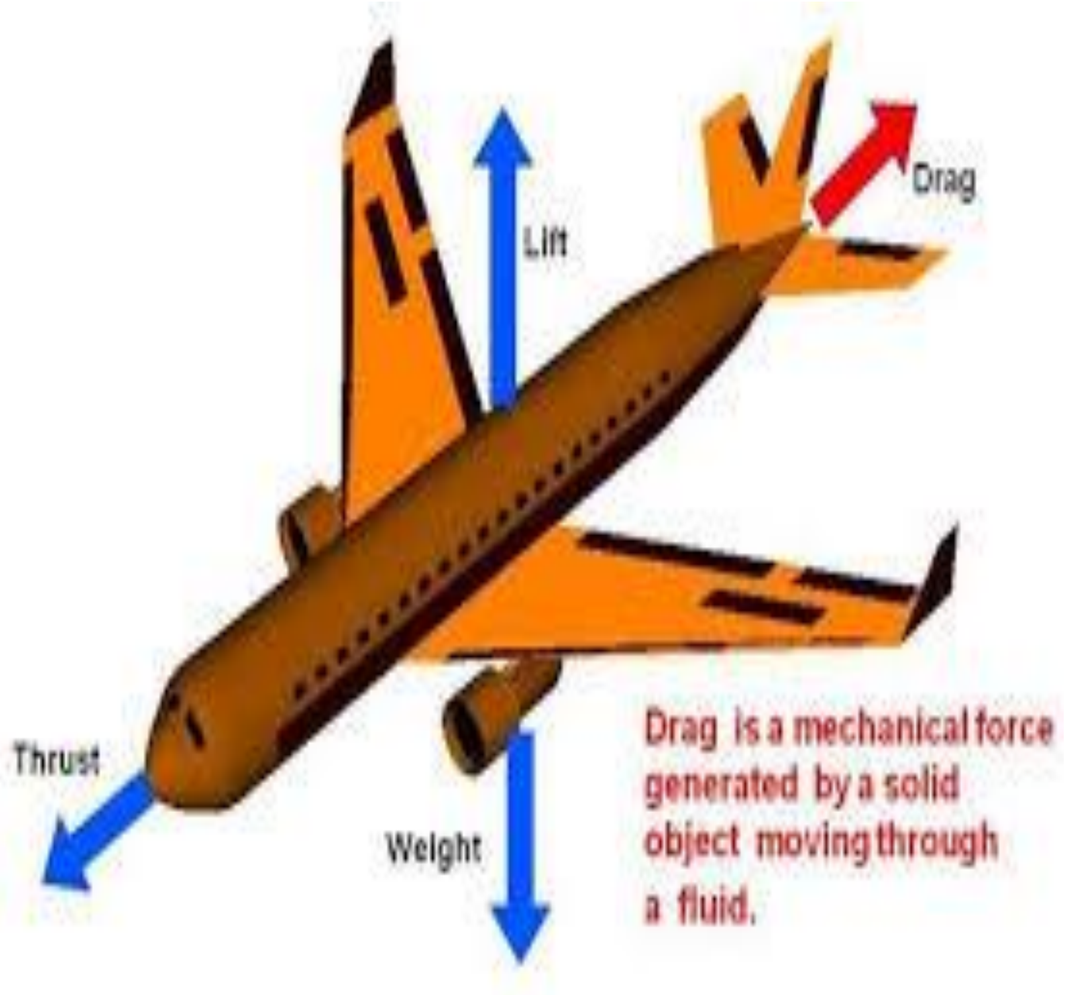
DRAG



DRAG

What is Drag in Aviation?

Drag is considered as the resistance to the forward movement of an aircraft. It is opposite thrust, so the more drag an aircraft has, the more power it will needed.



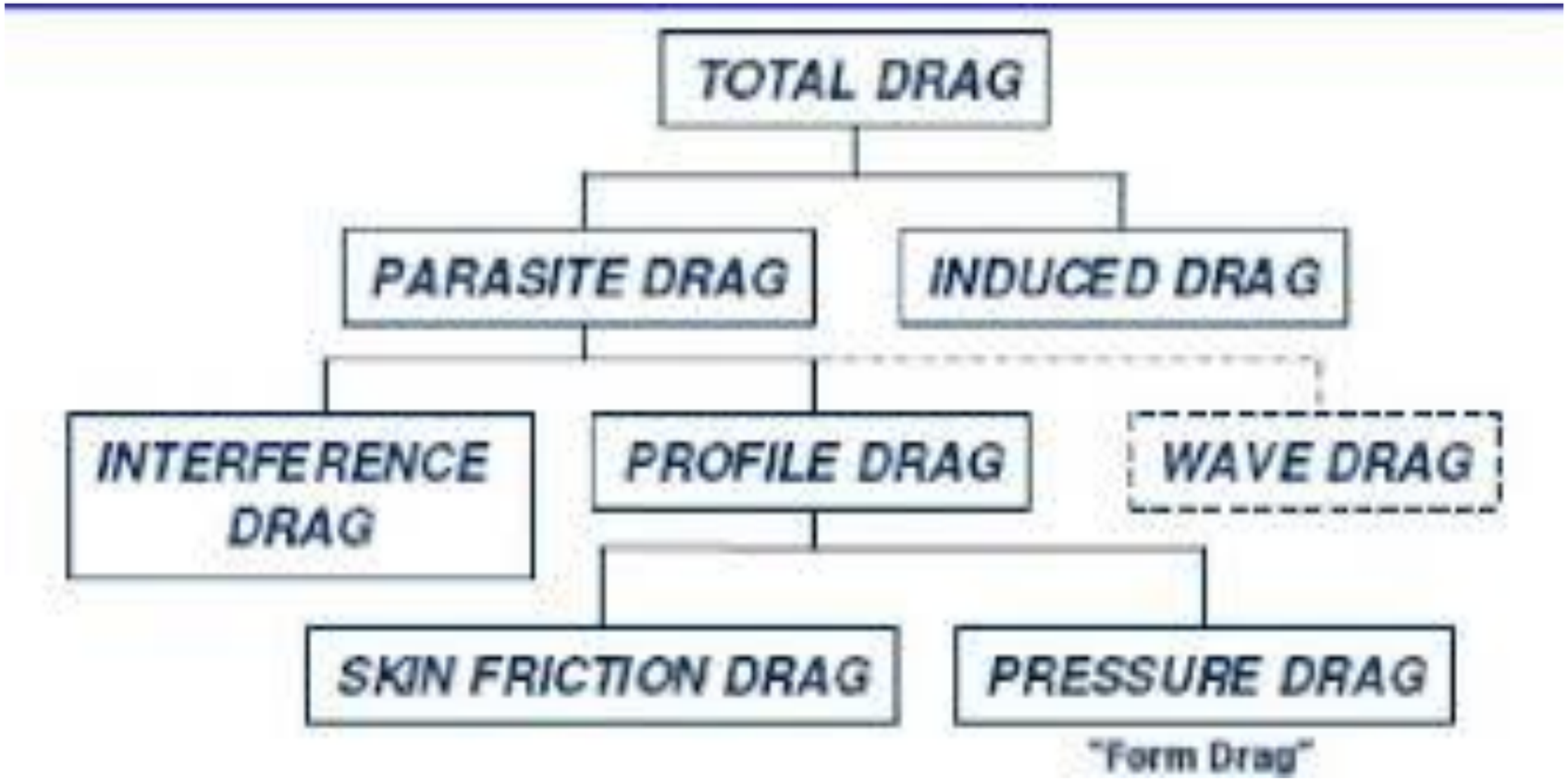
DRAG

- ***Drag*** *is the force that opposes the forward motion of an aircraft.*

- *The two main types of drag are* ***parasite drag*** *and* ***Induced drag****.*

- *Parasite drag is further broken into two types****, form drag*** *and* ***skin friction****.*

DRAG


TOTAL DRAG
PARASITE DRAG
INDUCED DRAG
INTERFERENCE DRAG
PROFILE DRAG
WAVE DRAG
SKIN FRICTION DRAG
PRESSURE DRAG
"Form Drag"

DRAG

Drag is created by air passing over the airplane. But the two main types of drag, induced and parasite are created differently.

Drag

- *Drag is one of the four aerodynamic forces that act on a plane.*

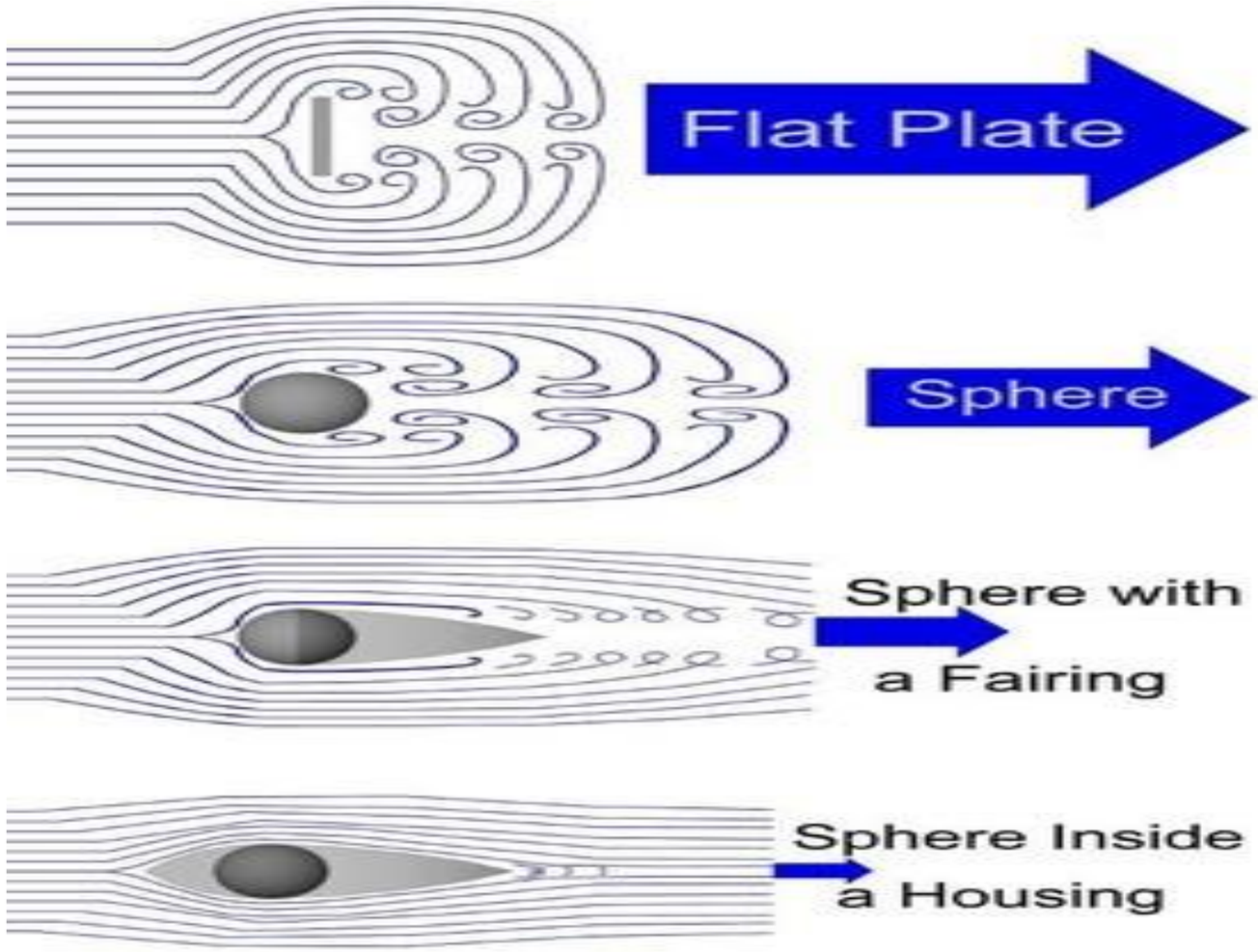
- *The force that resists the movement of an aircraft through the air and is produced when lift is developed is called 'Drag'.*

- *Drag always acts parallel to the relative wind.*

Drag

- *Parasite drag is created by anything that is moved through the air.*
- *The shape of the object-whether it's a box or a streamlined shape means that some objects create more drag than others.*
- *But everything makes drag as the air resists its movement.*

Drag


Flat Plate
Sphere
Sphere with
a Fairing
Sphere Inside
a Housing

Drag

Parasite Drag:

- *Parasite drag is a drag produced due to the motion of an object through a fluid.*
- *Parasite drag occurs due to air molecules.*
- *Parasite drag is classified as form drag or pressure drag, Skin friction drag and interference drag.*

Form Drag or Pressure Drag:

- *Form drag is produced due to the shape of the object moving through the fluid. It depends on the cross section of the object.*
- *An object with a larger cross section and blunt shape will have a larger form drag whereas an object with a smaller cross section area and will have a lesser from drag.*

Drag

Skin Friction Drag:

Skin friction drag is a drag produced due to friction between an object (aircraft) & fluid (atmospheric air). The rough surface will have high skin friction drag and conversely a smooth surface will have less skin friction drag.

Interference Drag:

Interference drag is produced due to the interference of two or more airflows having different speeds. And this drag is produced by the interference of different aircrafts parts, that is, due to a mixture of airflow around wing and the airflow around the fuselage.

Profile Drag:

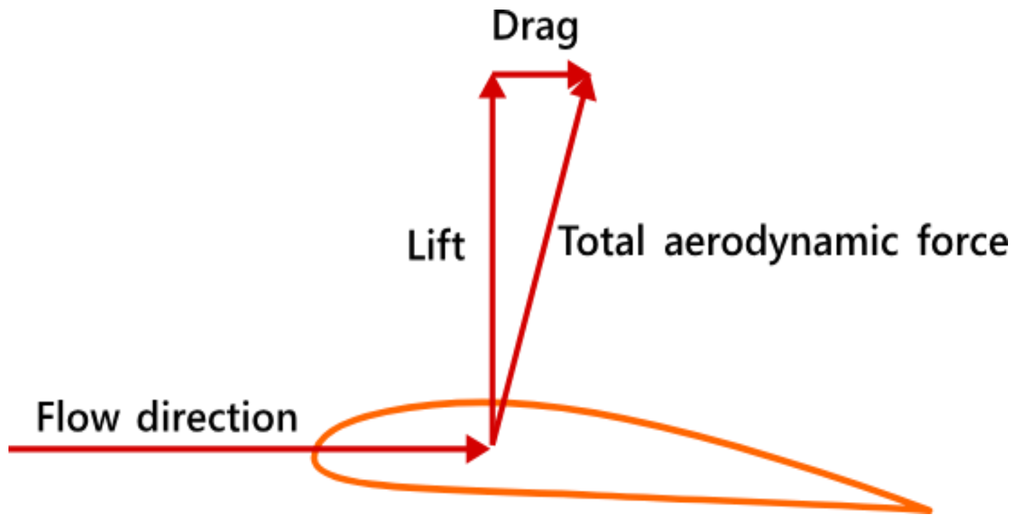
Profile drag is a sum of the form drag & Skin friction drag.

Drag

Induced drag is a byproduct of lift – anytime an airfoil (an airplane's wing, helicopter's rotor, or engine propeller) makes lift, it will also make drag.

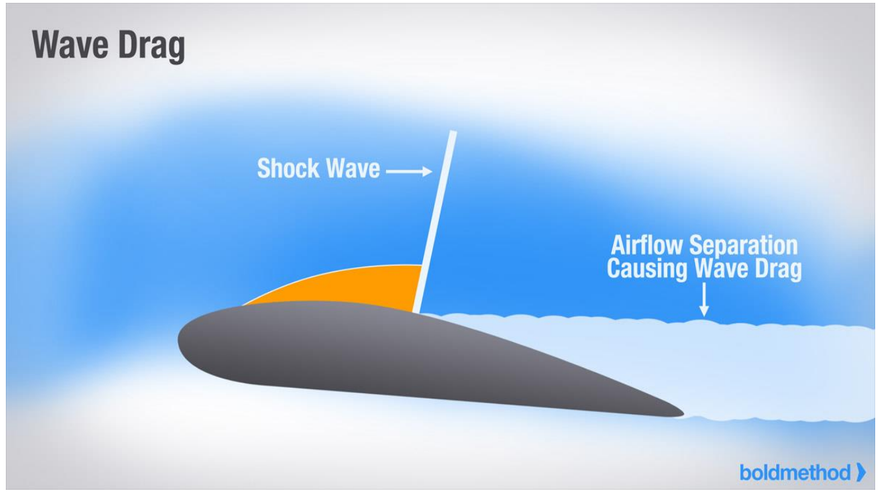
Drag

- *The direction of lift is perpendicular to the oncoming airflow towards the aircraft.*
- *Lift induced drag, as the name suggests, is a drag produced due to lift.*

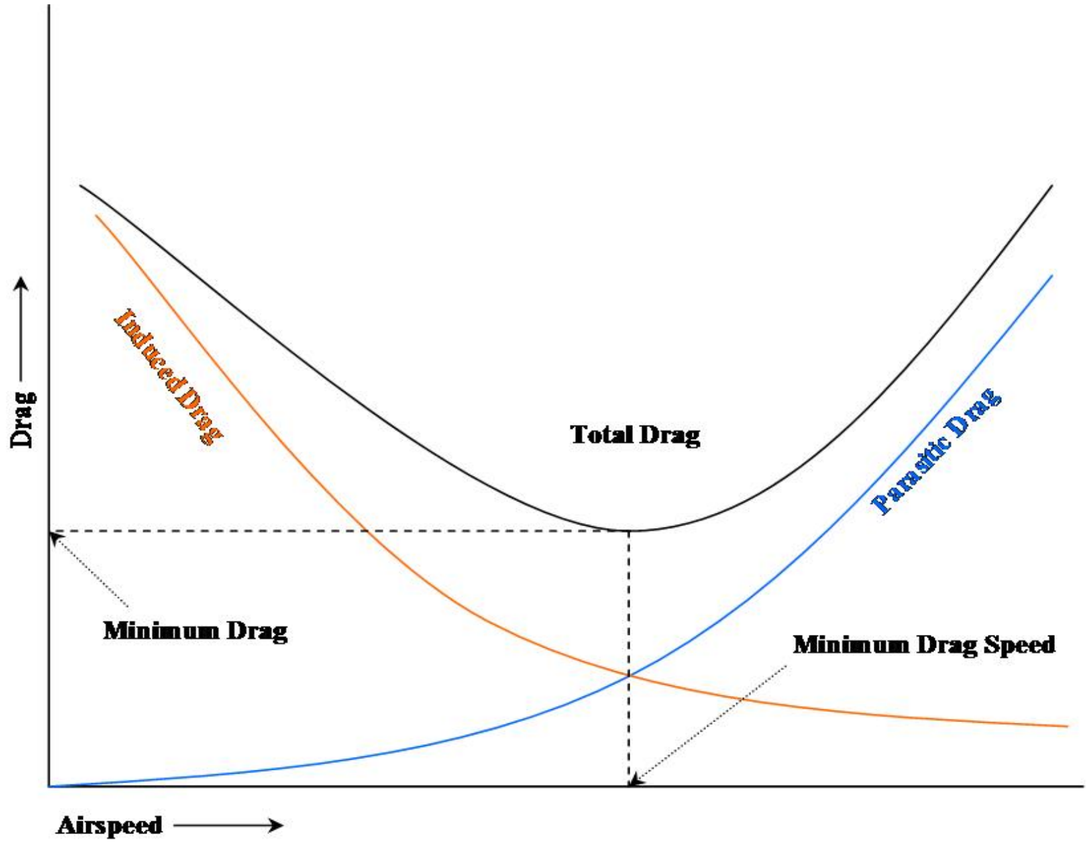


Drag

- *Wave drag is generally produced at transonic speed (speed almost equals to speed of sound) & supersonic speed (speed greater than speed of sound).*
- *Due to high speed of airflow, shock waves are produced. shockwaves are nothing but the disturbance in the air.*
- *This disturbance increases drag of the aircraft known as wave drag.*



DRAG


Drag
Induced Drag
Total Drag
Parasitic Drag
Minimum Drag
Minimum Drag Speed
Airspeed

Mach Number

- *Term 'Mach Number' widely used in Aeronautics.*
- *It is the ratio of velocity of an object in the air to that of the sound*
- *1 Mach no. is equal to 343 m/s.*

NASA & NACA

- *NASA – National Aeronautics & Space Administration. Established in 1958 and located in Washington D.C, District of Columbia*

- *NACA – National Advisory Committee for Aeronautics*

- *Both, NASA & NACA have been fundamental to the technology of flight*