LECTURE 1:

IT KANPUR

BASIC TERMINOLOGIES AERODYNAMIC FORCES MECHANICS OF FLIGHT

TERMINOLOGY

National Aeronautics and Space Administration

Airplane Parts and Function



AERODYNAMIC FORCES



Popular & Incorrect theory for lift generation



"Longer Path" or "Equal Transit" Theory

Top of airfoil is shaped to provide longer path than bottom. Air molecules have farther to go over the top.

- Air molecules must move faster over the top to meet molecules at the trailing edge that have gone underneath.
- From Bernoulli's equation, higher velocity produces lower pressure on the top.
- Difference in pressure produces lift.

SIMULATED FLOW



Factors Affecting Lift



The Motion: Velocity and Inclination to Flow

The Air: Mass, Viscosity, Compressibility

ANGLE OF ATTACK



VARIATION OF LIFT COEFFICIENT WITH ANGLE OF ATTACK



Newton's 3rd Law for Aerodynamics





DESIGNING YOUR AEROMODELS

- Decide the loading on your lifting surface, which generally is the wing.
- Conventionally, the loading is taken as 35-45kg per sq m for a typical RC plane.
- Formula for lift:

$Lift, L = 1/2 \times \rho \times U^2 \times C_L \times S$

THE LIFT EQUATION

In the previous equation, symbols used are:

- p = Avg. Density of air at Certain Height (in Kg/m3)
- U = Relative vel. of air (in m/s)
- CL = Cofficient of Lift

 S = planform area of wing/Projection of wing area on horizontal plane (in m2)

• The lift coefficient is determined from this equation

WING DIMENSIONS

- For Level flight, Weight = Lift (W=L)
- •Using wing loading value, we obtain the planform area.
- •To get the value of Chord Length, we assume Aspect Ratio (AR) around 6 to 8.
- In rectangular wing AR = span/Chord

DesignFoil is used to get the required airfoil, which will be demonstrated to you shortly...

OTHER PARTS

Fuselage –
70-75 % of wing span.
Horizontal Stabilizer –
25% of the wing area
Vertical stabilizer –
50% of Horizontal Stabiliser



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