LECTURE 3:

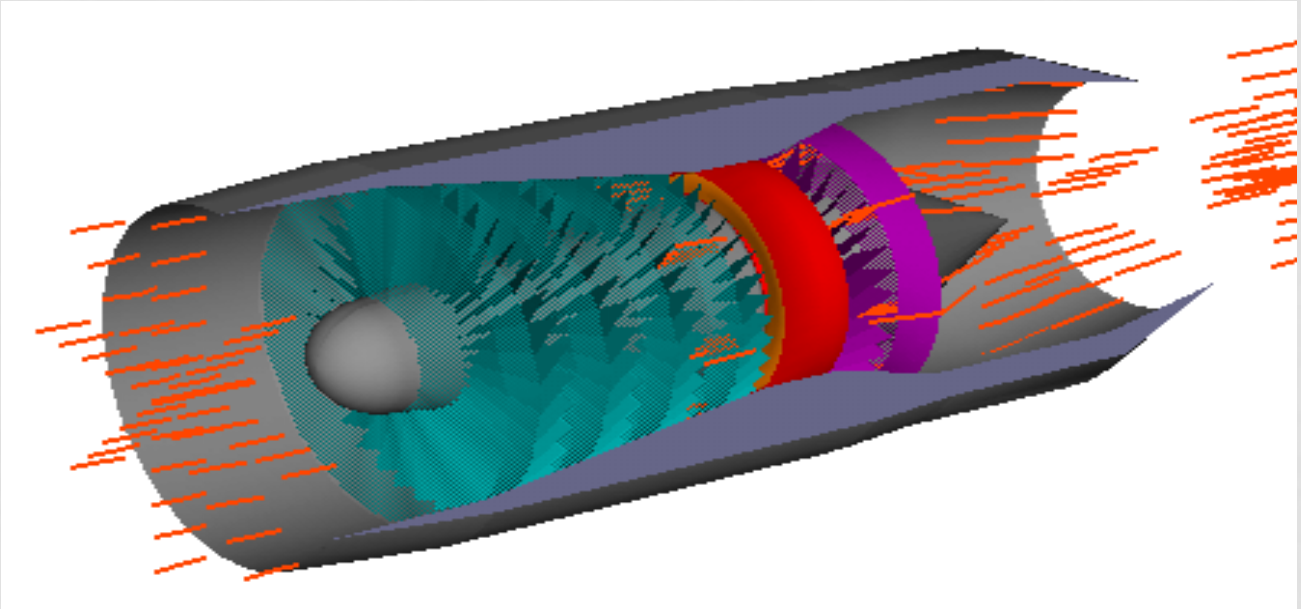
PROPULSION

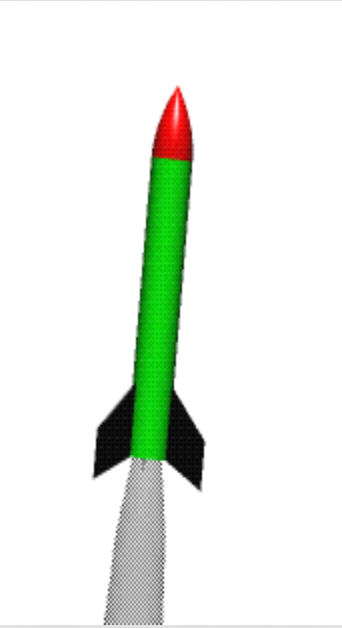
CONTROL SURFACES

STRUCTURES

SERVOS

PROPULSION

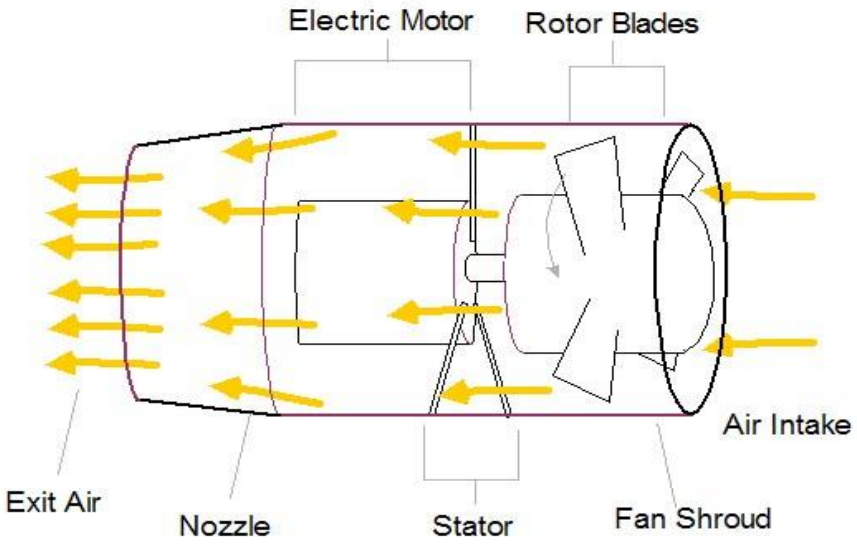


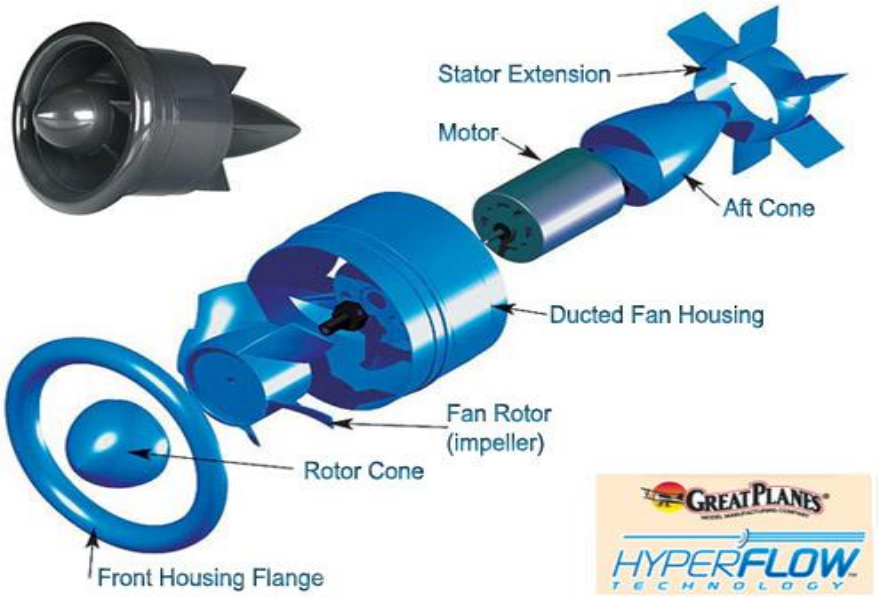


Electric Duct Fan (EDF) engine
Liquid Propellant propulsion
General propellers (already discussed previously)

pro meaning before or forwards and ***pellere*** meaning to drive.
Propulsion means to push forward or drive an object forward

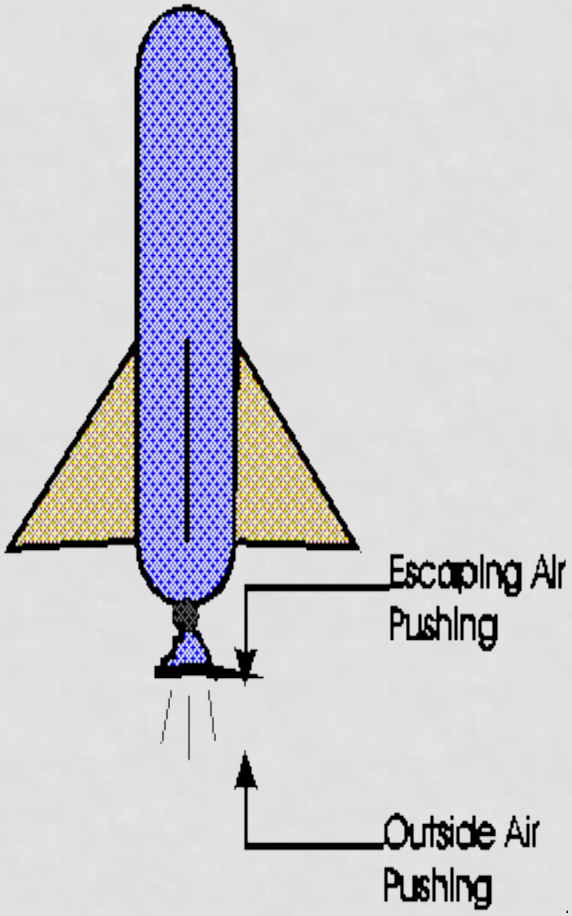
EDF





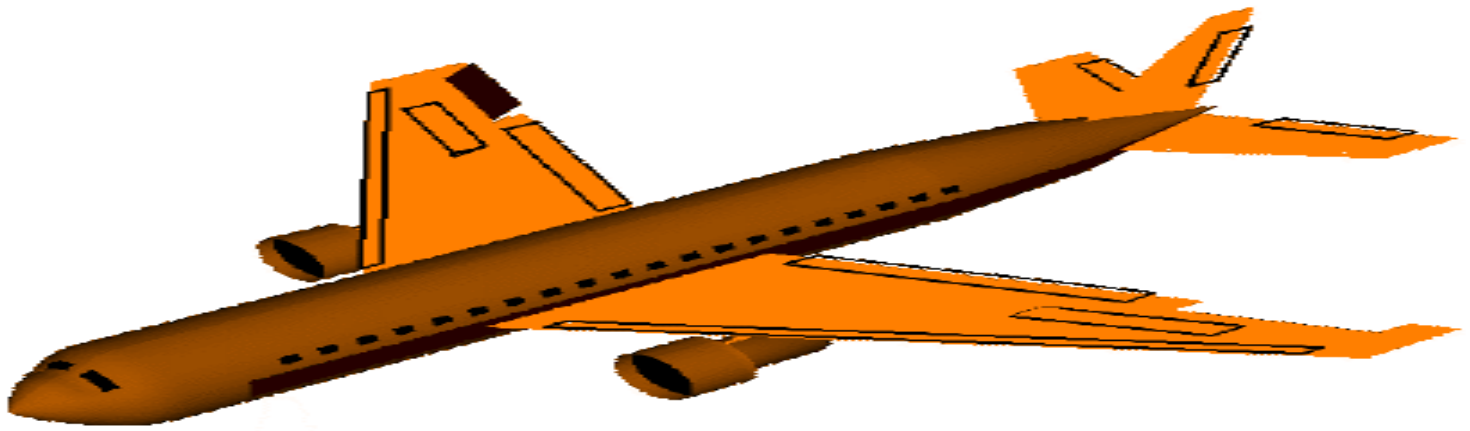
- A **ducted fan** is a propulsion arrangement with a fan, which is a type of propeller, mounted within a cylindrical duct.
- A gas is accelerated by the engine, and the reaction to this acceleration produces a force on the engine.

LIQUID PROPULSION



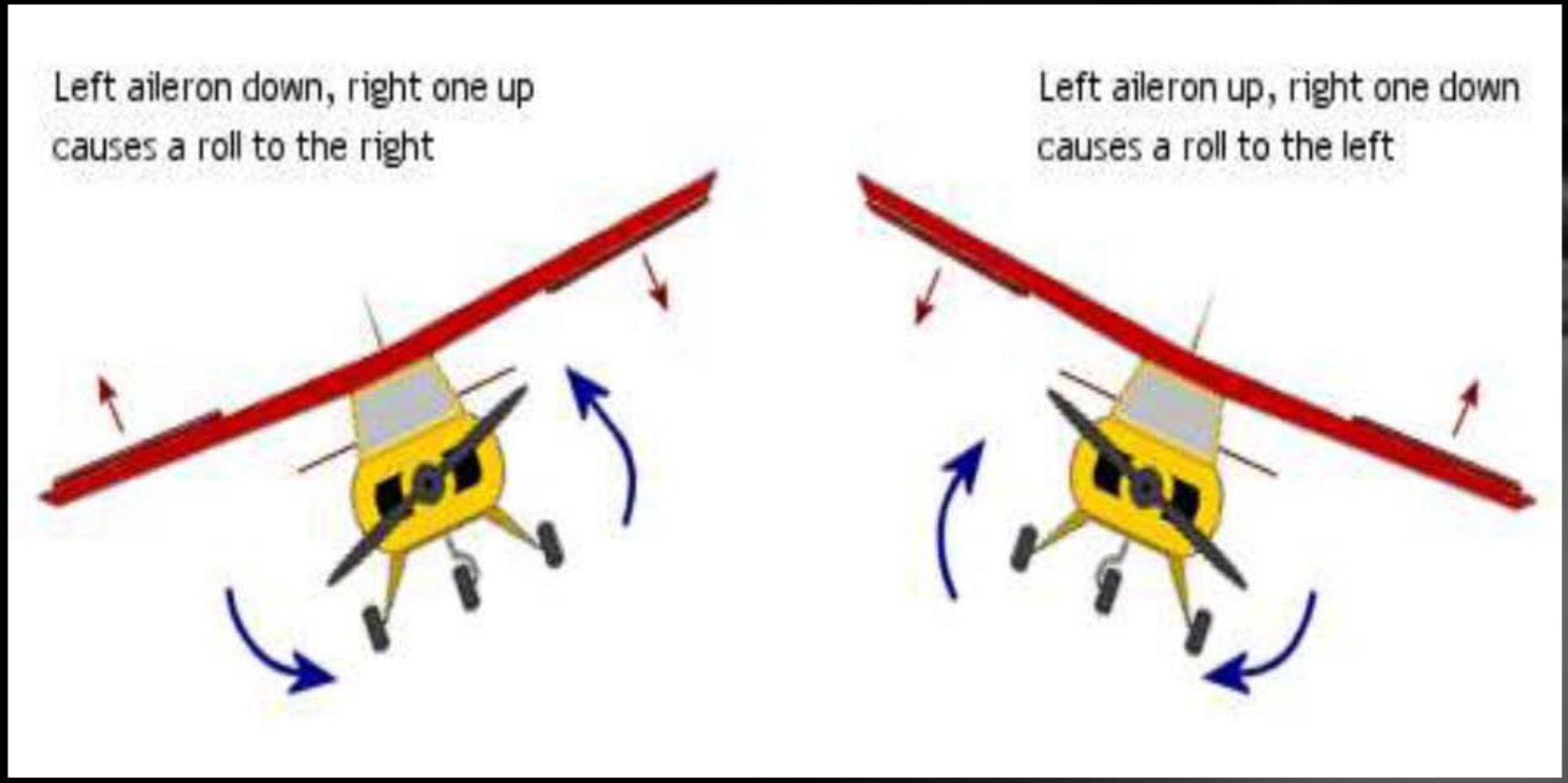
- By Newton's 3rd Law, a gust of escaping air pushes the body in the opposite direction, i.e. upwards.
- Fins must be symmetrical in the top view.
- Software like WaterRocketFun help in analyzing the approximate dynamics of flight.

ROLE OF AILERONS

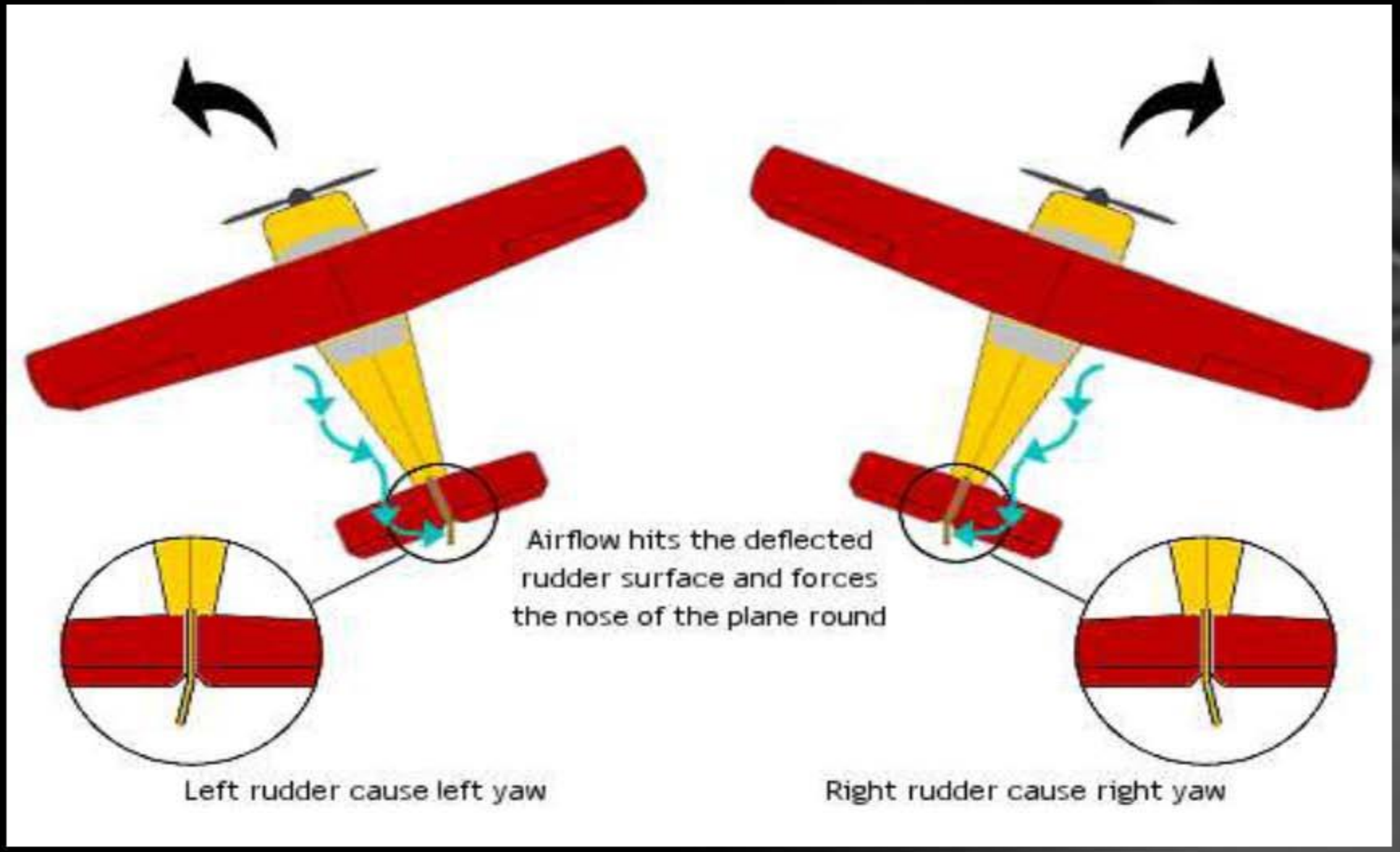


- To provide rolling motion i.e. rotation about the fuselage axis.

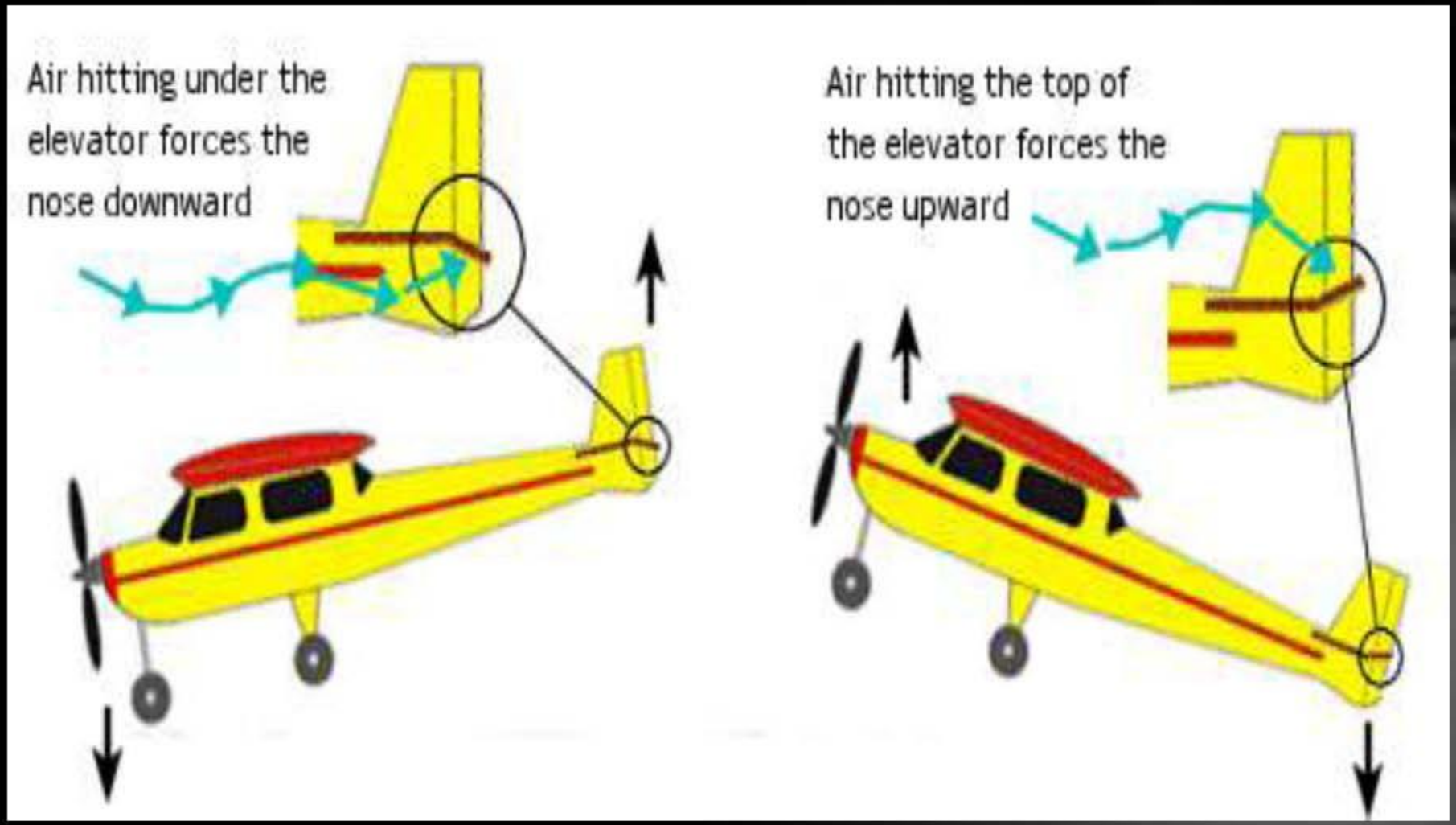
ROLE OF AILERONS



ROLE OF RUDDER



ROLE OF ELEVATOR

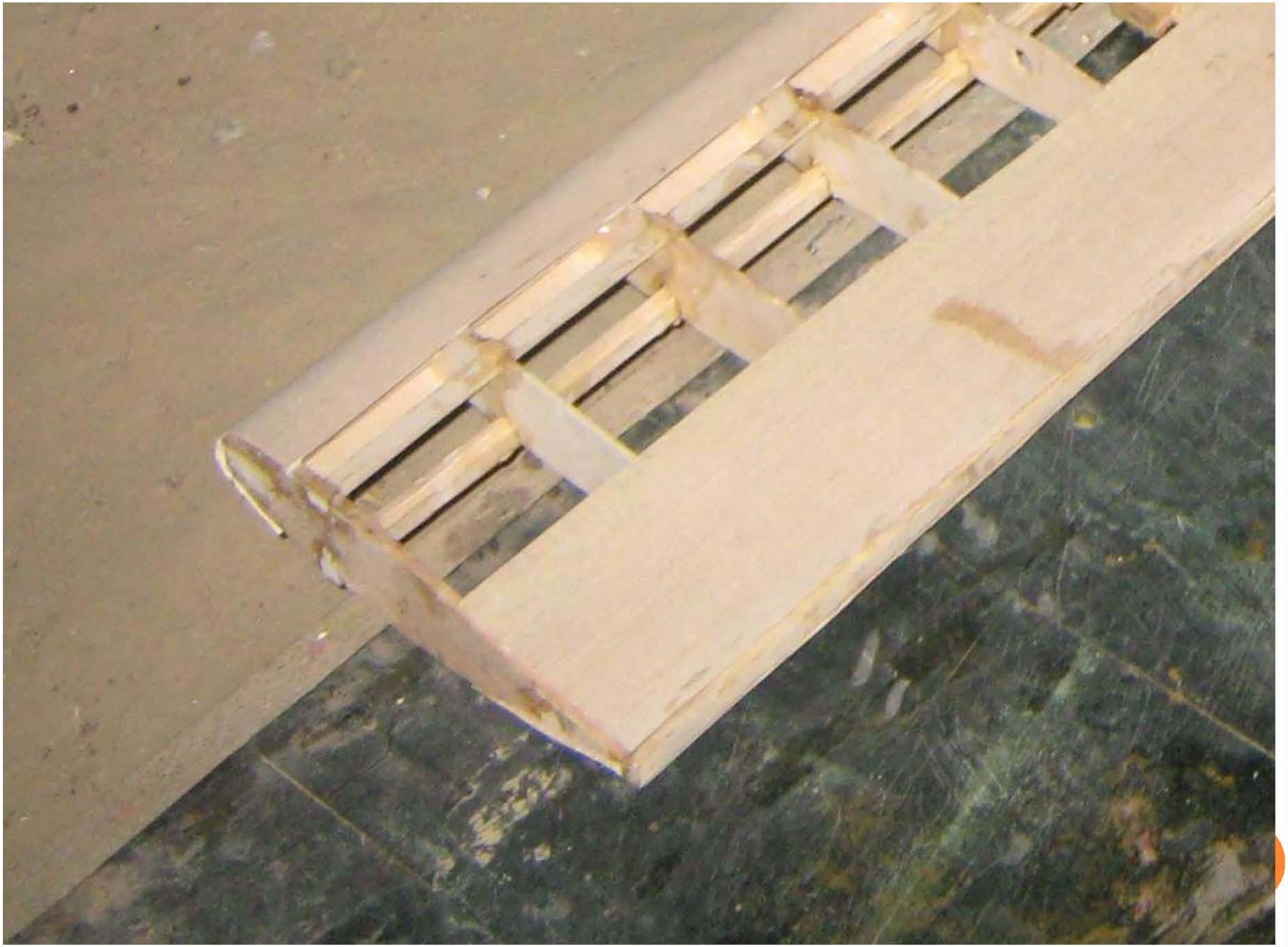


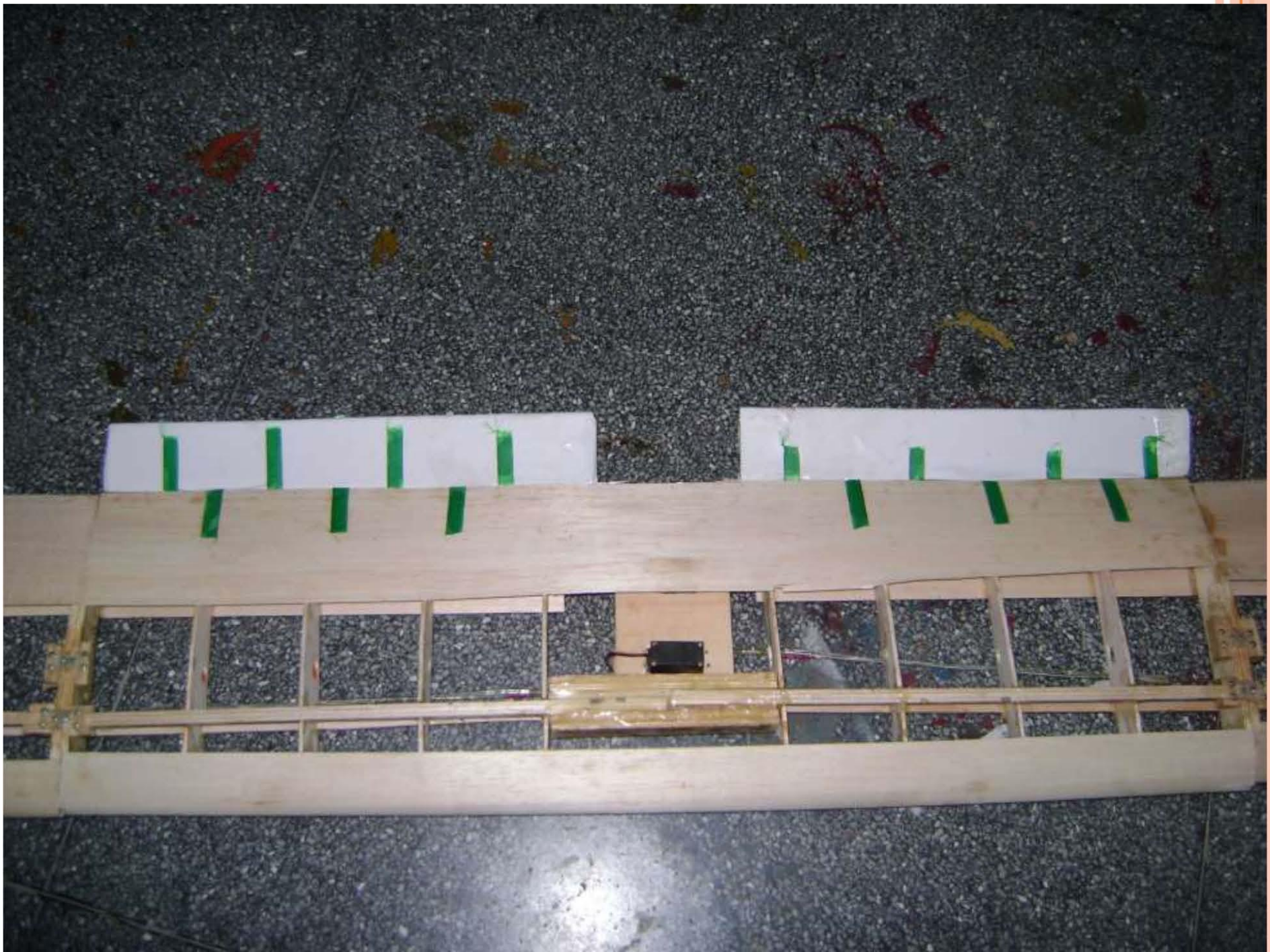
STRUCTURAL INTEGRITY

WING CONSTRUCTION:

- Several airfoils are cut from balsa wood
- These airfoils are connected using aluminium rod and balsa support rods
- The structure is partially covered with 1mm sheet balsa throughout the wing span
- Finally ailerons are attached to the wing

Following slides have some pictures of wings under construction:





AILERON & TAIL CONSIDERATIONS

- The edges of the aileron are generally rounded to minimize drag effect.

- One point to be kept in mind while making the elevator and rudder is that their area too is to be included in the area of the tail and vertical stabilizer respectively.

FUSELAGE/MAIN BODY STRUCTURE

- To maintain the proper aerodynamic shape of the fuselage, several scanners are set in the hind section of the fuselage.
- Between the scanners trusses are made.
- Similarly on the base we make trusses.
- At some places 6 mm balsa wood is also used to give strength.
- Also, the part where Landing Gear have to be mounted must be very strong, so that it can take up the vibrations at the time of landing.
- These parts are made using double layers of 6 mm ply.

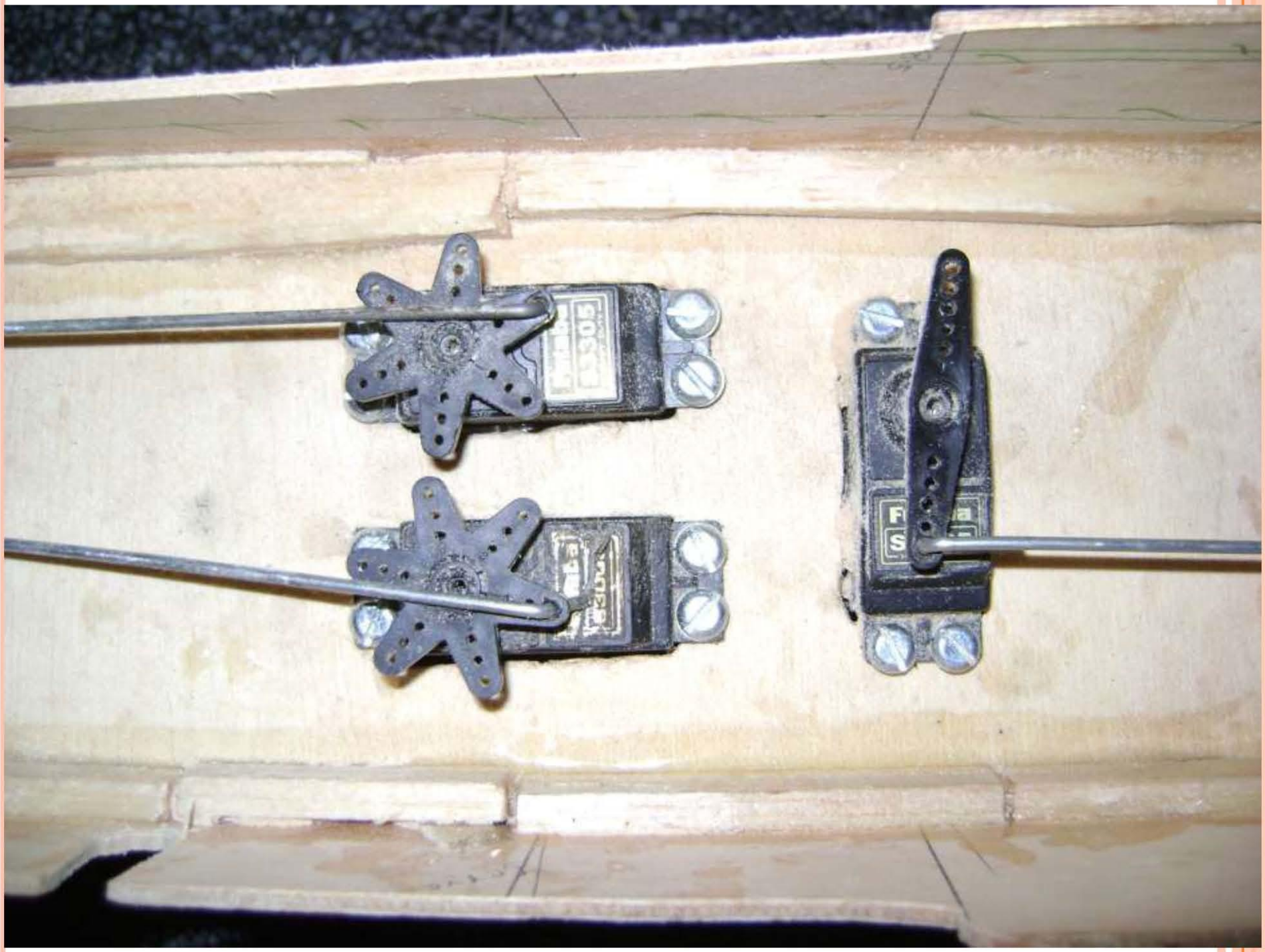
FINDING THE POSITION OF WING

- One of the most important thing is to find a suitable position for the wing.
- For if the centre of gravity of the entire system is not in between the aerodynamic centre and the tail then the plane will not be stable.
- We try to keep the position of centre of gravity at a distance of 0.1c to 0.2c from the aerodynamic centre.
- The aerodynamic centre is located at a distance of 0.25c (approximately) from the leading edge of the wing for subsonic speeds.

SERVO

- These are responsible for controls of aero models.
- The control parts – ailerons, elevators, engine throttle and rudders are connected to the servos using push rods .
- All servos are connected to receiver.
- Rotation of servos(torque) on receiving signal from transmitter causes the movements of control parts.
- They can also be used for thrust vectoring, which this time, is being pursued as a summer project.


HITEC



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Thank you!