ITSP Abstract - 2016

Flettner Airplane

Team Name – <u>The Magnusites</u>

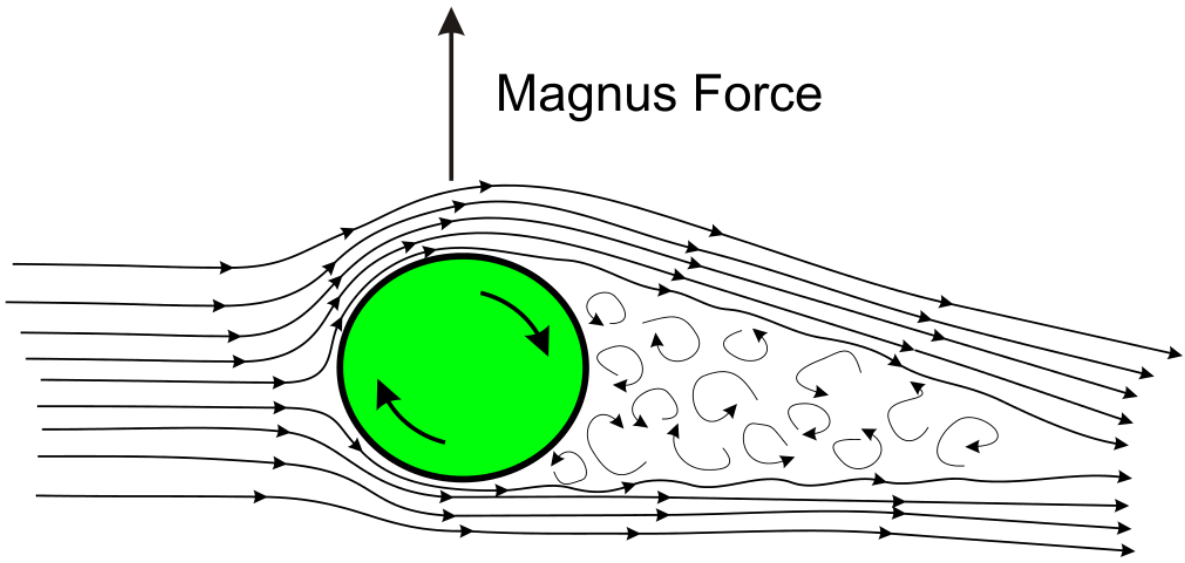
Team Members:

1) **Anmol Gupta (150110060)**
2) **Apurv Tiwari (150010003)**
3) **Atharva Sathe (150010008)**
4) **Nimit Kapadia (150110061)**

Topic – Making a RC Plane which produces lift due to magnus effect. Such a plane is called the Fletner airplane.

Basic Idea

Our basic idea is the construction of a RC plane which uses Magnus effect to produce lift. For this, we will use a pair of rotating cylinders instead of the usual aerodynamic wings. The Magnus effect is the commonly observed effect in which a spinning ball (or cylinder) curves away from its principal flight path.



The streamline of air on the upper surface of cylinder, i.e., the one which is attached to the surface speeds up as the direction of tangential velocity of the cylinder is along the streamline. This results in acceleration of the streamlines above the dividing streamline. On the other hand, the streamline attached to the lower surface of cylinder slows down as the direction of tangential velocity is opposite to that of the streamline. Thus the streamlines below the dividing streamline get decelerated. This difference in the speeds and hence the pressures on the upper and lower side of the cylinder results in an upward force. This force is the lift.

There is a considerable region of pressure drag in the wake of this cylinder as the flow separates at some point on the surface of the cylinder. Intuitively, this drag is more than what would have been caused due to an aerofoil. But reducing the diameter of the cylinder will help in reducing the drag as then the height difference between the upper and lower separated streamlines is less and hence they will take lesser space to recombine and hence the region of pressure drag reduces. But this means that the lift will be reduced as the tangential velocity is proportional to the radius of the cylinder. Thus, there has to be a trade off between these properties for the best use for our purpose.

Aim

This is aimed to be a low speed air vehicle. We can use such aircrafts for surveillance as they are stable and have typically low speeds due to high pressure drag. It can also be used to make an aerial map of different places just like Google has a satellite map. We can also use it in dire situations like if

a leopard is on the prowl. Land vehicles might be broken by the leopard and the cameras destroyed, but this air vehicle will remain safe.

Hardware Required

- ➢ 4 servo motors – for control surfaces
- ➢ 3 motors – 2 for cylinders and 1 for propeller
- ➢ Landing gear
- ➢ Propeller
- ➢ Miscellaneous – connecting wires, Styrofoam, etc.

Timeline

- → 1st week: Collecting components, structures and control design of the plane.
- → 2nd - 3rd week: Assembling the plane
- → 4th week – test trials and removing experimental bugs

Expected Cost

Around 5000 – 7000 rupees.

References

1. www.google.com
2. www.wikipedia.com
3. www.youtube.com