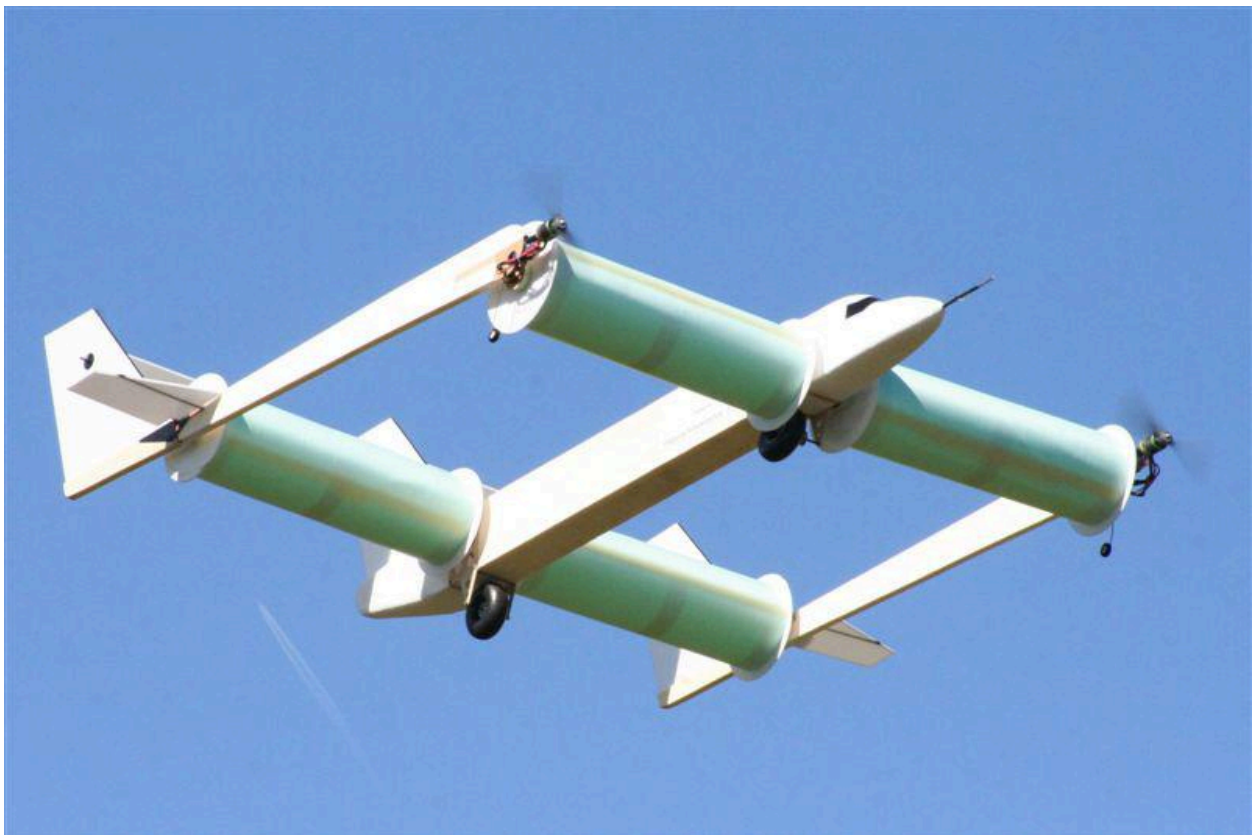


Flettner Aircraft(T-Magnus Plane)

Project in association with Kalam Labs, Lucknow

What is a Flettner Aircraft:

A **Flettner airplane** is a type of rotor airplane which uses a Flettner rotor to provide lift. The rotor comprises a spinning cylinder with circular end plates and, in an aircraft, spins about a spanwise horizontal axis. When the aircraft moves forward, the Magnus effect creates lift.



What is Magnus effect:

The **Magnus effect** is a phenomenon that occurs when a spinning object is moving through a fluid. A lift force acts on the spinning object and its path may be

deflected in a manner not present when it is not spinning. The strength and direction of the Magnus force is dependent on the speed and direction of the rotation of the object



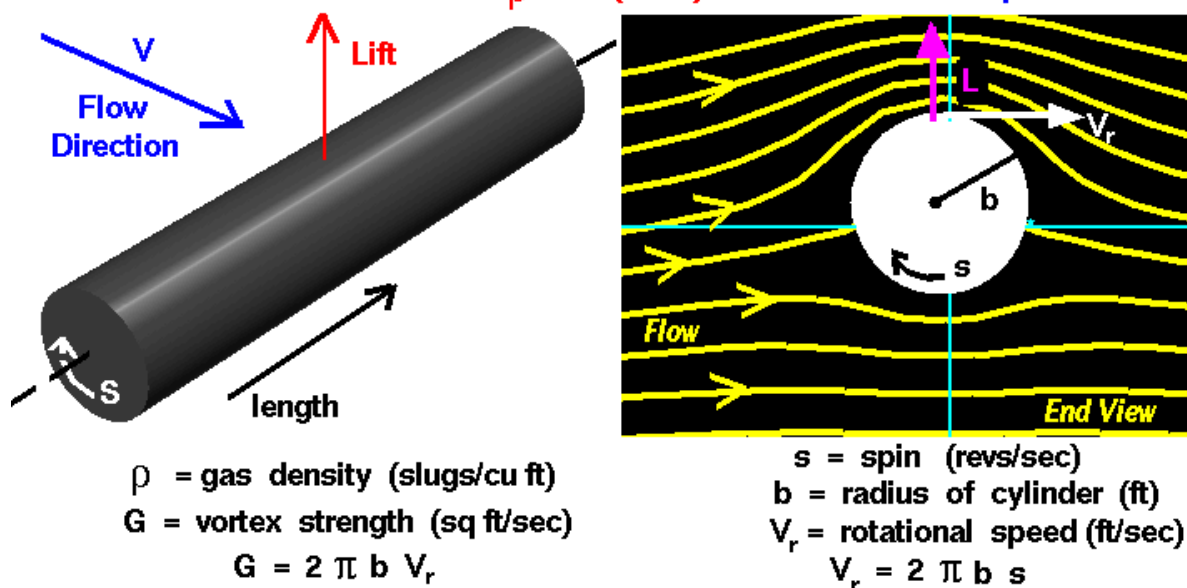
Lift of Rotating Cylinder

Glenn
Research
Center

Kutta-Joukowski Lift Theorem for a Cylinder:
Lift per unit length of a cylinder acts perpendicular to the velocity (V in ft/sec) and is given by:

$$L = \rho G V \text{ (lbs/ft)}$$

Imperial Units



Ideation of Project:

September, 2024

In Last week of September Kalam Labs contacted us for Ideas that gonna attract kids and compatible with their in house developed KL Microcontroller.

Then we came up with this idea and discussed it with Kalam Labs Co-Founders and confirm this idea for their showcasing.

Iterations of this project:

1st Iteration:

- Firstly made a aircraft with our resources.

Propeller motor- Sunsky 2200 kv motor

Rotor motor- Emax 935 kv motor

firstly we used gears for rotor but they didn't worked out so we used pulley belt system.

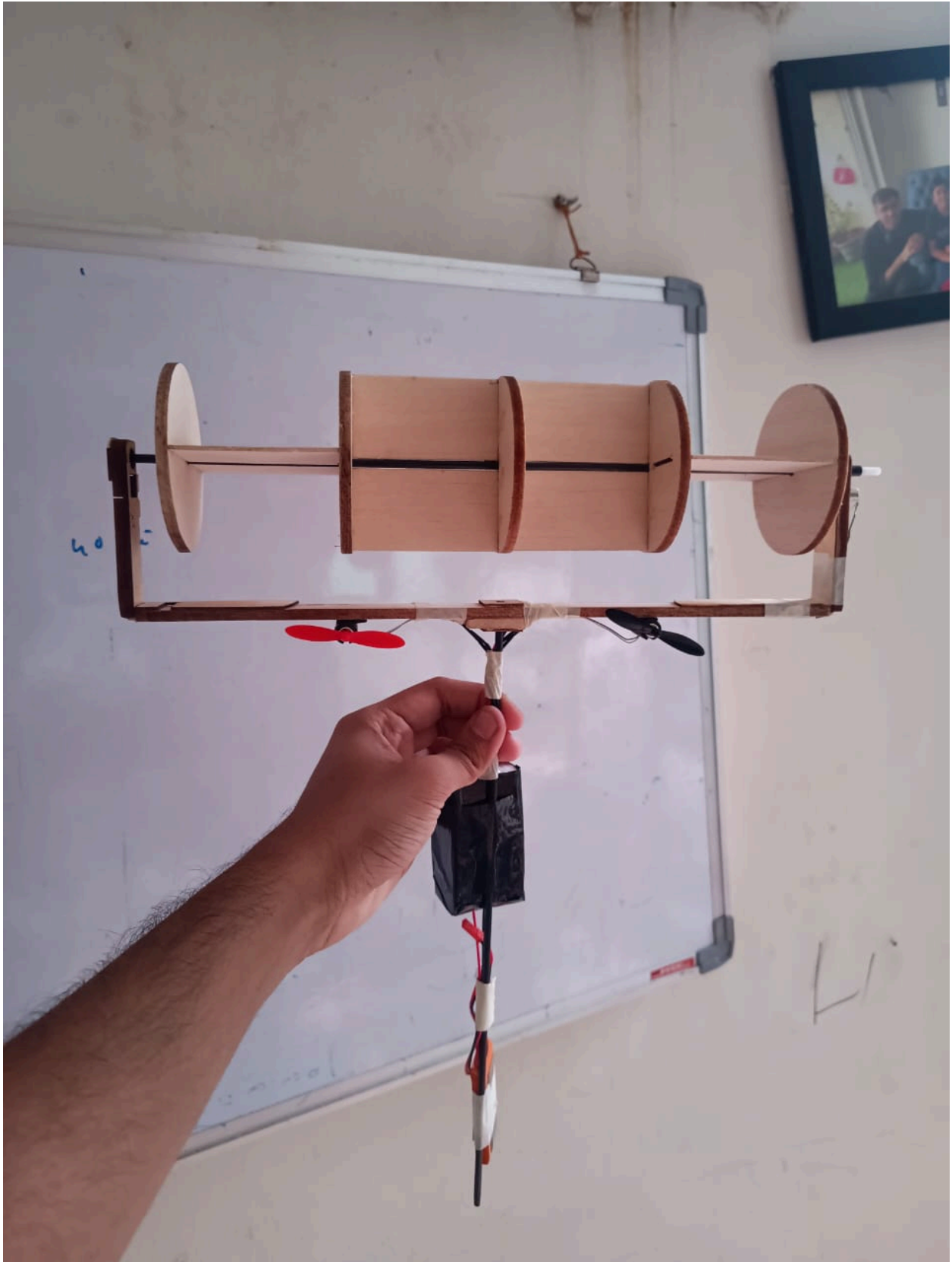
- Rotor axis and propeller motor was on the same line.
- This version is unable to create lift because due to propeller, rotor shaft was unable to get air around it.

2nd iteration:

- We moved propeller slightly lower than its previous position.
- From this improvement we get another problem of torque, During takeoff, an excessive torque reaction caused the aircraft to rotate uncontrollably about the rotor axis, ultimately leading to a crash.
- To counteract the torque-induced rotation, we extended the vertical rod and repositioned the battery at its lowest point. This adjustment lowered the aircraft's center of gravity, enhancing stability and reducing unwanted rotational motion during takeoff.
- We tested this version at Kalam Labs and this didn't takeoff due to low lift generation in comparison of weight.

3rd iteration:

- We integrated our idea with KL microcontroller and developed our aircraft according to the limitations of their flight controller.
- We reduced its size and significantly decreased its weight from 400g to 85g, improving efficiency and overall performance.
- This version is still unable to achieve flight due to insufficient lift.



Flettner Aircraft(T-Magnus Plane)

Showcasing:

On October 25, 2024, we will pitch our project to the judges at the showcase event, where multiple teams invited for the Techmaker program will present their projects.

[Aero x Kalam Labs.pdf](#)

