Abstract for Laws of Motion

Due to the limited accommodation facilities, teams will be shortlisted for accommodation based on the following abstract provided by the team.

Guidelines for the submission of the abstract are as follows:

- **Rename** the .doc/.docx file as "TeamID.doc" or "TeamID.docx" (example: 25KTJ25IK2.doc/25KTJ25IK2.docx where 25KTJ25IK2 will represent the respective Team id and email the file to **lom@kt**j.in strictly before 31st **December, 2024**.(As last date of submission. The format for naming the file has to be strictly followed. Otherwise your abstract may not get accepted.
- **YOU NEED TO SUBMIT THE ABSTRACT IN PDF FORMAT (TeamID.pdf)**

Please fill in the information in the sections mentioned below.

- ❖ Kindly do not exceed the word limit mentioned in respective sections.
- ❖ Support your write up with google drive link of images and videos of your plane. Note that even photos of incomplete plane may be attached and if it is not at all possible to include the pictures then try and integrate 2D plans/CAD drawings in the abstract.
- ❖ The abstract of your plane will be helpful everywhere in future as an evidence of your hard-work, along with determining your position for the competition. So please pay adequate attention to it.

Please fill in the following details:-

Team ID:	25KTJLAWA968228
Team Leader's name:	Amogh Wadhonkar
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Frequency of Remote Control Panel:	2.4 GHz
No. of members in the team along with their KTJ ID:	1 .25KTJAMO215312 (Amogh Wadhonkar) 2. 25KTJKIN605890 (Kinjal Bunker) 3. 25KTJSOU652833(Sourajjal Mondal) 4. 25KTJGAU718676(GAURAV ANAND)

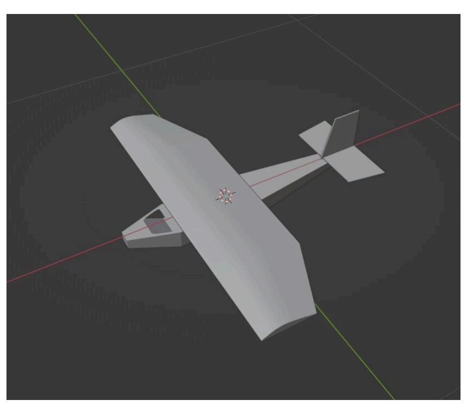
(In case of more than one frequency available, please write all the frequencies)

The details of the abstract will remain confidential with organizers of Kshitij

Fill in the information about your plane in the respective sections as mentioned below:

1. Describe the Plane design with a diagram, with pictures taken in the course of development of aircraft (of the plane you are building, attach a .jpeg image with the e-mail) or a picture of actual plane (if it is ready, attach a .jpeg image with the e-mail) or both. (Less than 250 words)

PART 1:- DESIGN 1.1 Soaring Eagles



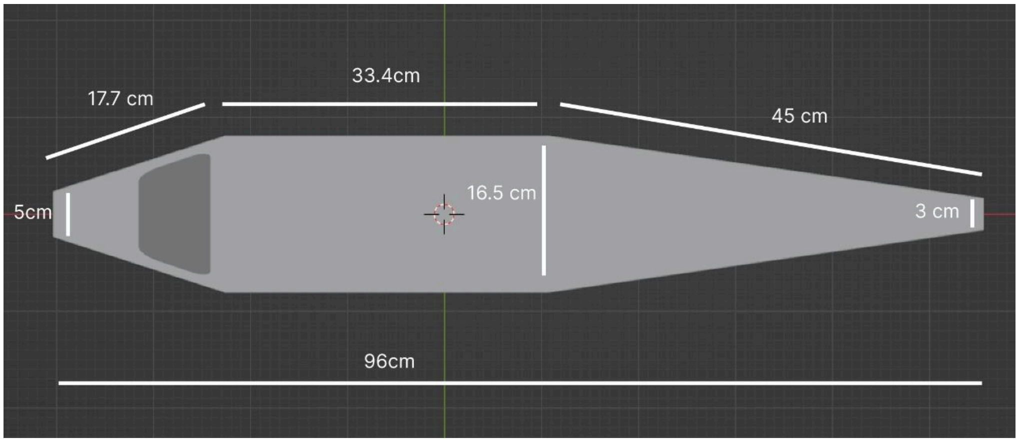
1.2 DIMENSIONS AND PERFORMANCE PARAMETERS

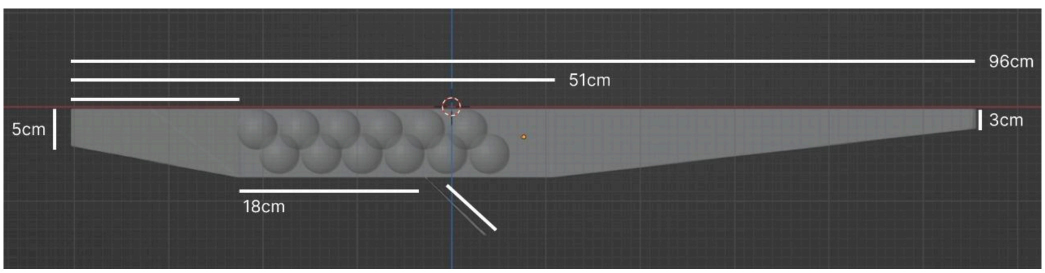
Conditions	
Air Speed	13 m/s
Air Density	1.225 kg/m^3

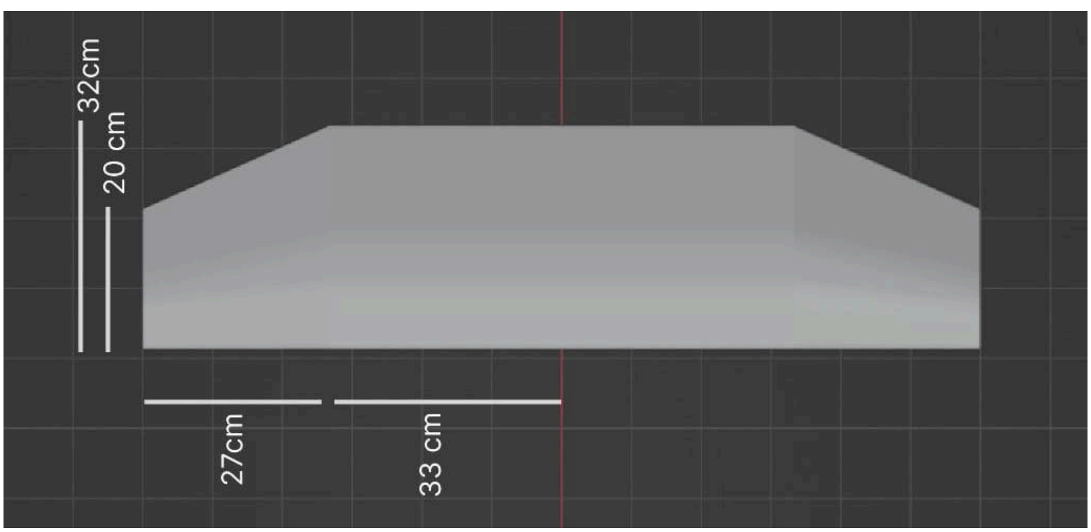
Weights	
Airplane including Batteries	0.8kg
Payload	1.8kg
Total	2.6kg

Main Wing	
Wing Loading	8.34 kg/m^2
Aspect Ratio	4.61
Wing Area	0.312 m^2
Semispan	0.6 m
Root Chord	0.32 m
Tip Chord	0.20 m
Average Chord	0.26 m
Taper Ratio	0.625 m

1.3 Machine Drawing Of The Aircraft

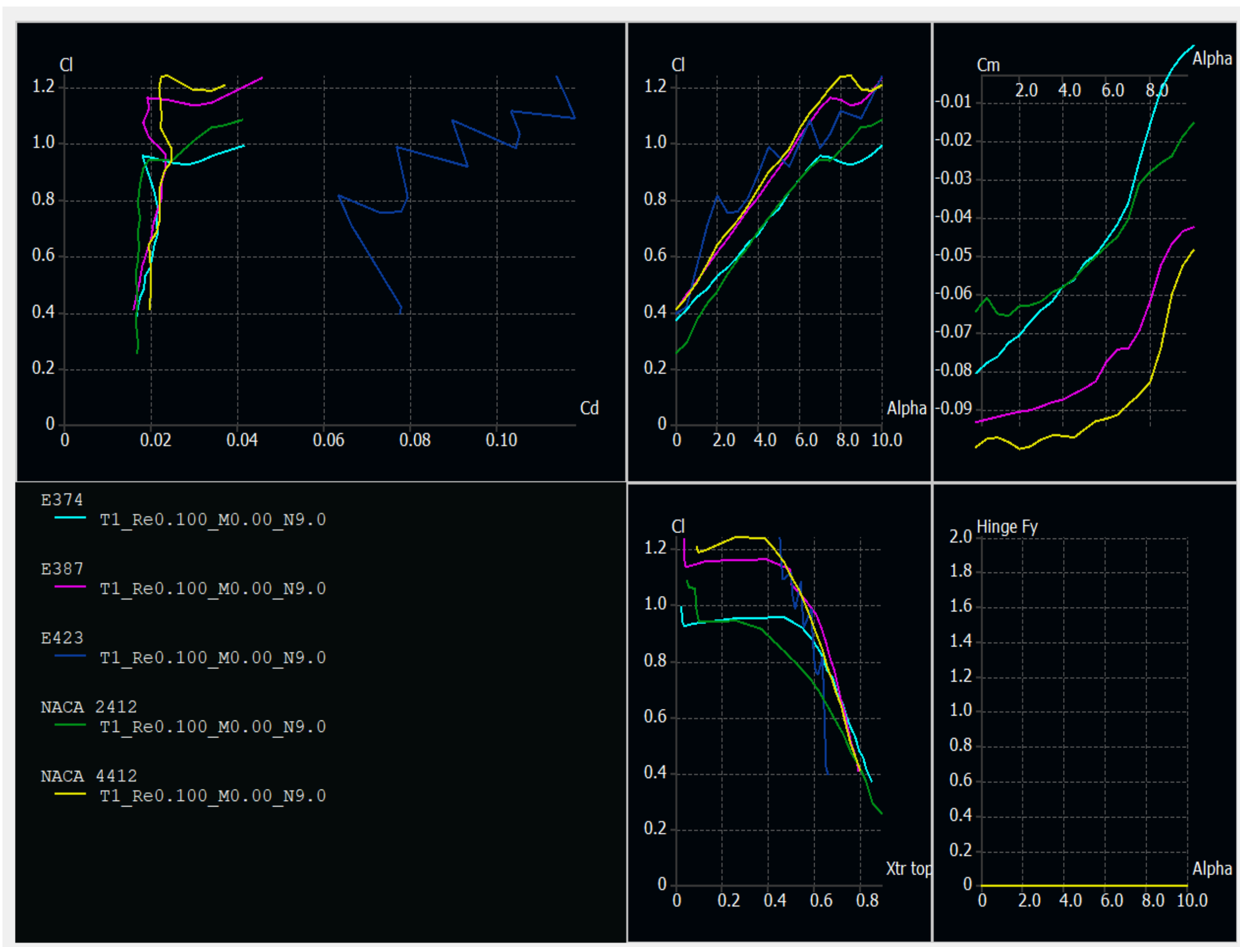






1.4 Wing Design And Specifications

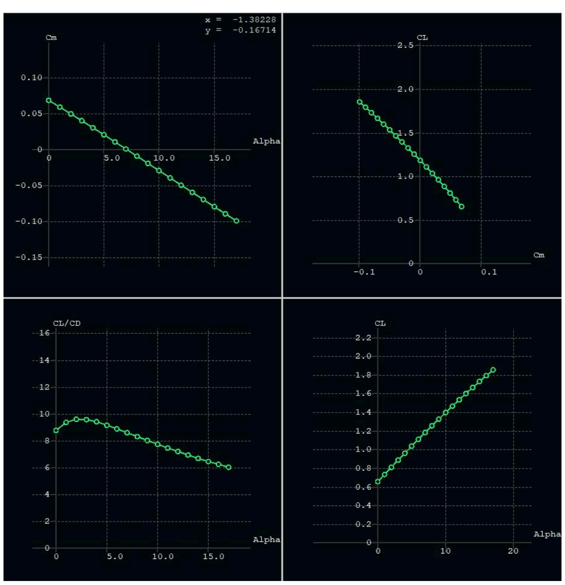
- To maximize payload, the wing design emphasizes lift generation. A high-wing configuration with a rectangular cross-section was selected, measuring 1.2 meters in span with a root chord of 0.32 meters and a tip chord of 0.2 meters. Airfoil profiles were evaluated, and while the e423 airfoil demonstrated slightly lower lift-to-drag ratios than some options, it excelled in lift generation. Prioritizing payload capacity over marginal efficiency gains, the e423 airfoil was chosen for its superior lift-producing characteristics.



1.4 TAIL OF THE WING

- **Tail Configuration:** Rectangular tail configurations were chosen for their simplicity and ease of manufacturing, despite potential minor aerodynamic advantages from more complex shapes.
- **Horizontal Tail Design:** An optimal aspect ratio between 3 and 5 was targeted for the horizontal tail to balance lift-to-drag ratio and angle of attack, resulting in a 0.39m span and 0.0534 m² area.
- **Vertical Tail Design:** The vertical tail was designed with an aspect ratio between 1 and 2 to prioritize stability, ultimately resulting in an aspect ratio of 1.86 through span and chord optimization.
- **Simplicity Prioritization:** Simpler tail configurations were prioritized to streamline manufacturing and reduce complexity.
- **Aspect Ratio Importance:** The selection of appropriate aspect ratios for both horizontal and vertical tails was crucial for optimizing aerodynamic performance, including lift-to-drag ratios, controllability, and stability.

1.5 STABILITY ANALYSIS



PROPULSION SYSTEM

Wattage = Plane Weight * Power Performance Level

Assuming a 3S battery configuration (common for 30-40 inch wingspans):

Voltage = Cells * 3.7 V

Current = Wattage / Voltage

Maximum Current = Current * 1.2

Plane Weight (kg)	2.6
Power Performance Level (watt/kg)	262.2
Voltage (volt)	11.1
Current (ampere)	47.24
Maximum Current (ampere)	56.9

Results

Our design prioritizes practicality with the e423 airfoil for optimal lift and lightweight stabilizers for ease of construction and stability. Rigorous calculations ensure compliance with regulations and safe operation, effectively meeting the competition's objectives.

References

TAIL CALCULATION- (References: aircraft_design-libre.pdf (d1wqtxts1xzle7.cloudfront.net)) (Department of Aerospace Engineering, IIT MADRAS)

PROPULSION SYSTEM– Selecting a Brushless Motor, ESC, LiPo Battery and Prop for a…

THRUST- ***(Reference : J.D Anderson "Introduction to Flight " 8th edition)***

DRAG- ***Reference : Lee_Nicholai's_White_Paper***
: https://youtu.be/QLGW3a_U6hY
: Nicolai, Leland M., "Fundamentals of Aircraft Design", METS Inc, 6520 Kingsland Ct, San Jose, Ca 95120, 1975

PERFORMANCE- (Reference: Nicolai, Leland M., "Fundamentals of Aircraft Design", METS Inc, 6520 Kingsland Ct, San Jose, Ca 95120, 1975)