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:	25KTJLAWH276410
Team Leader’s name:	Harshit Goel
Email Address:	harshitgoel2601@gmail.com

Contact Number:	9877355569
Frequency of Remote Control Panel:	2.4 GHz
No. of members in the team along with their KTJ ID:	1. 25KTJHAR310502(Harshit Goel) 2. 25KTJSUM581130(Sumit Singatia) 3. 25KTJANU264128(Anuraj Gogoi) 4. 25KTJPRA156804 (Amit Kumar)

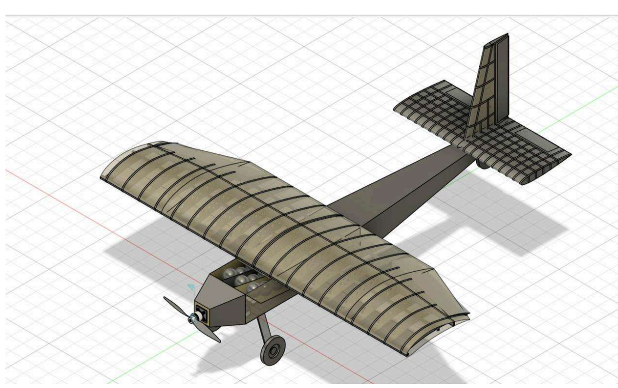
(In case of more than one frequency available, please write all the frequencies)

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 After Burners



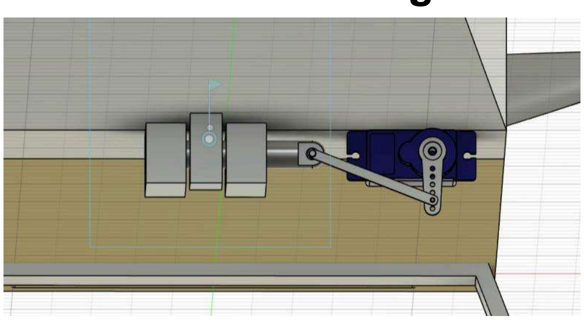
1.2 DIMENSIONS AND PERFORMANCE PARAMETERS

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

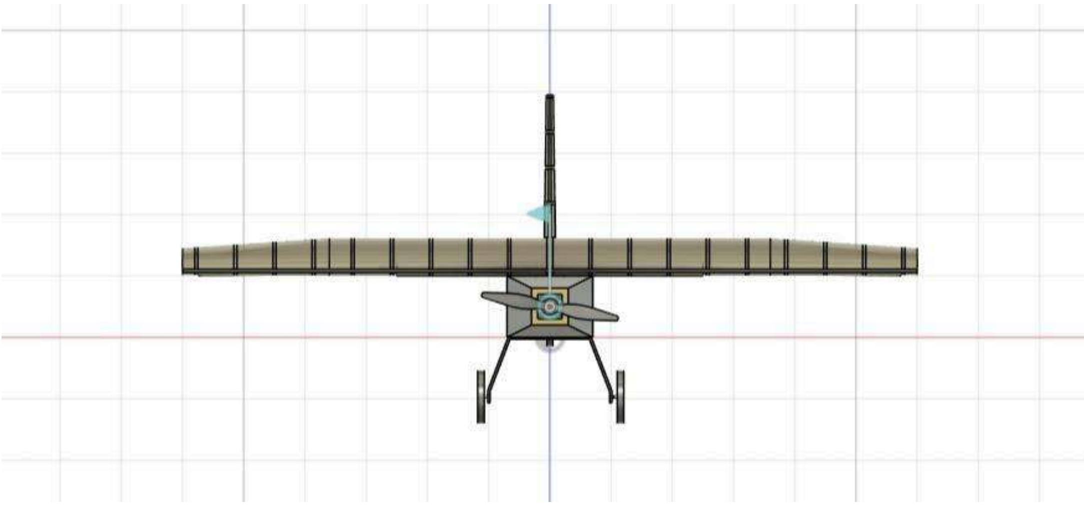
Weights	
Airplane including Batteries	1.2kg
Payload	1kg
Total	2.2kg

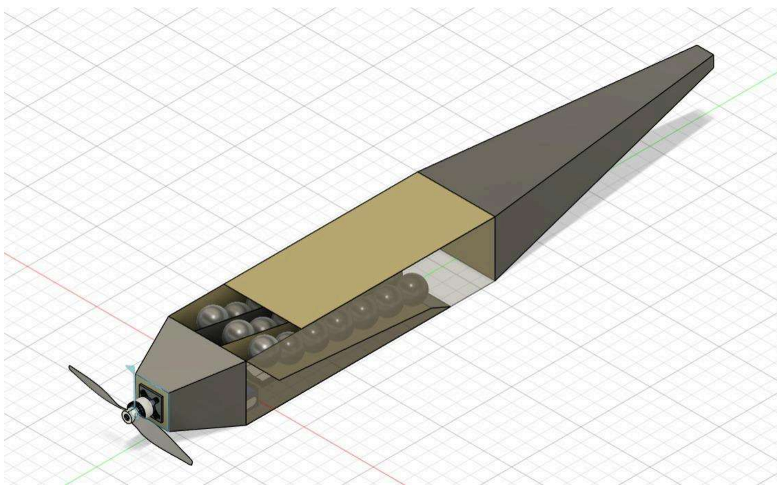
Main Wing	
Wing Loading	6.12 kg/m^2
Aspect Ratio	4
Wing Area	0.36 m^2
Semispan	0.6 m
Root Chord	0.35 m
Tip Chord	0.25 m
Average Chord	0.3 m
Taper Ratio	0.71 m

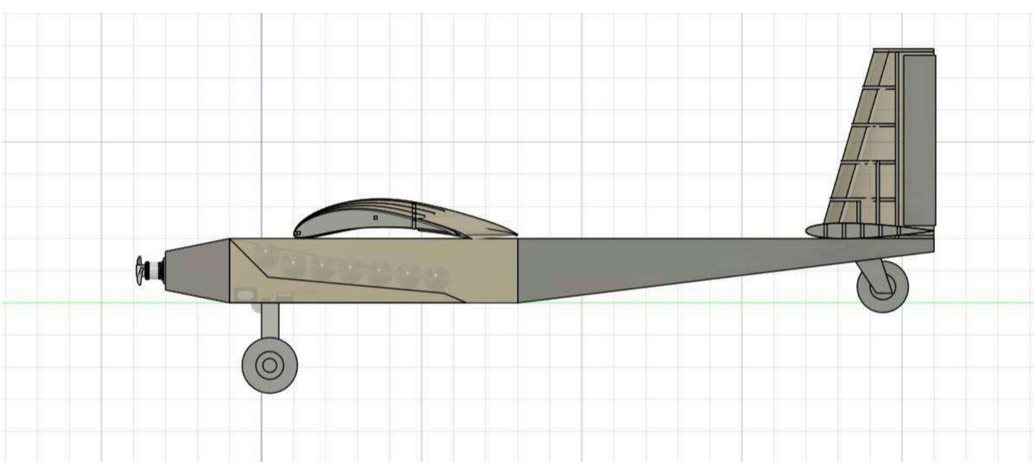
1.3 Machine Drawing Of The Aircraft



Dropping Mechanism

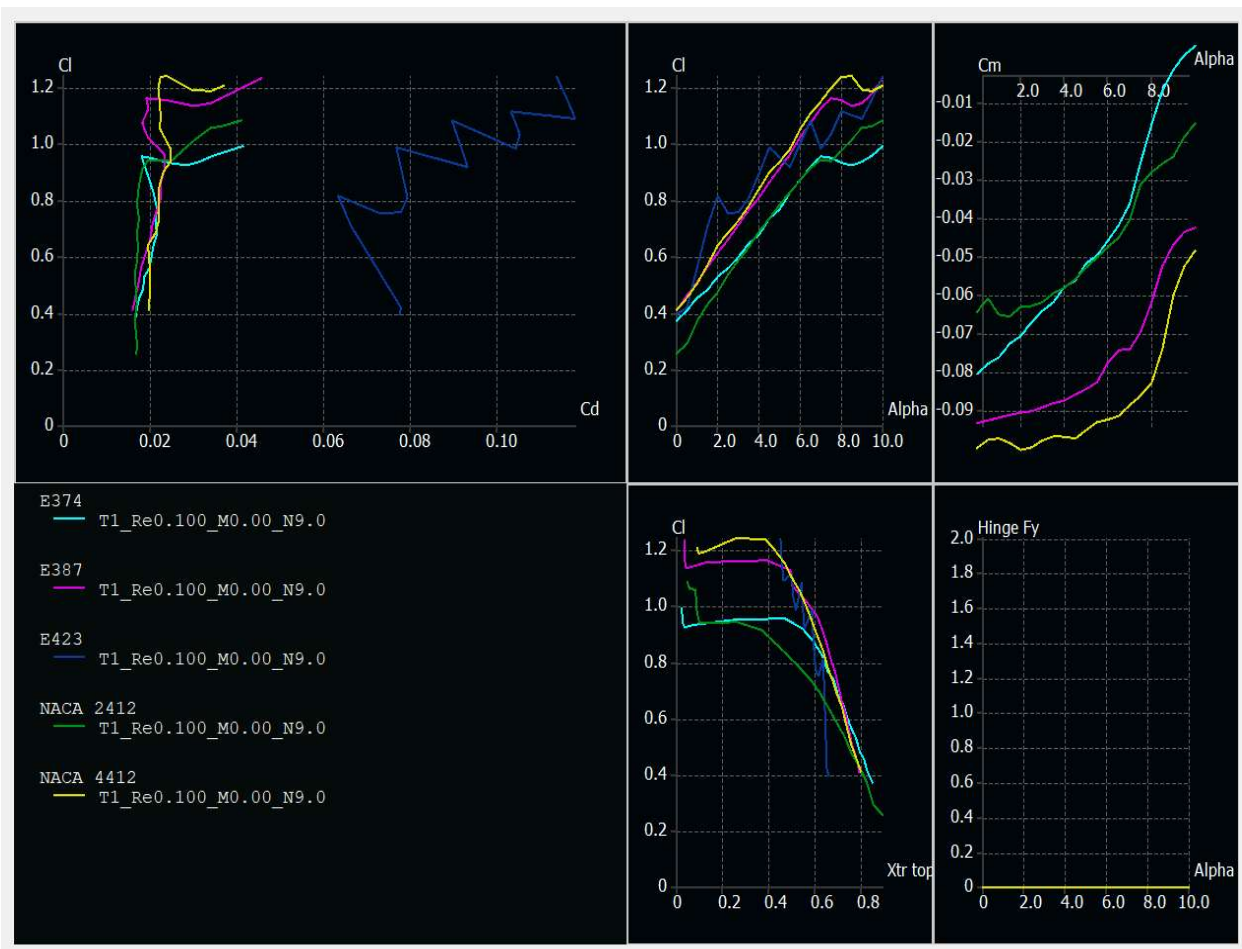






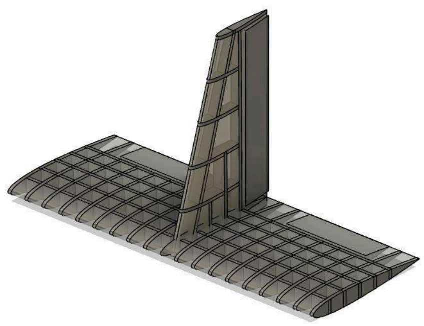
1.4 Wing Design And Specifications

- The wing design prioritizes maximizing payload, necessitating a focus on lift generation. A high-wing configuration with a rectangular cross-section was chosen, featuring a 1.2-meter wingspan and a root chord of 0.35m and a tip chord of 0.25m . To achieve this, a comparative analysis of airfoil profiles was conducted. While the e423 airfoil exhibited slightly lower lift-to-drag ratios compared to some alternatives, it demonstrated superior lift generation capabilities. Recognizing that a slight compromise in efficiency was acceptable to achieve the desired payload capacity, the e423 airfoil was selected for its ability to provide the highest lift.

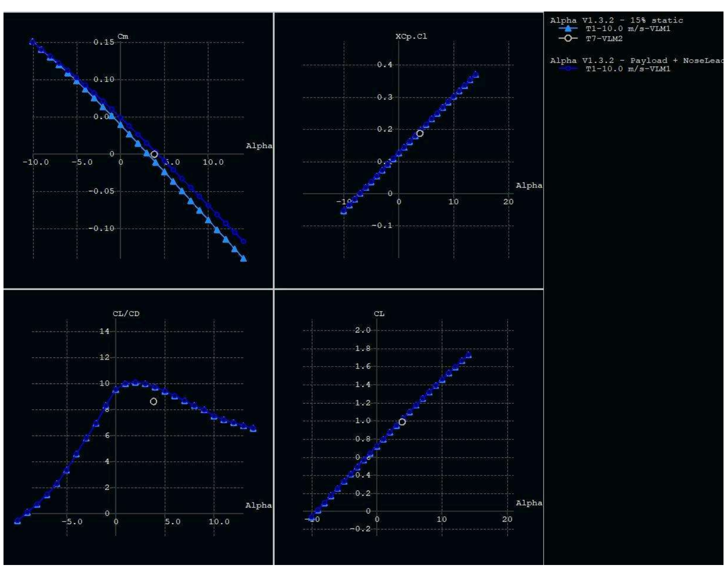


1.4 TAIL OF THE WING

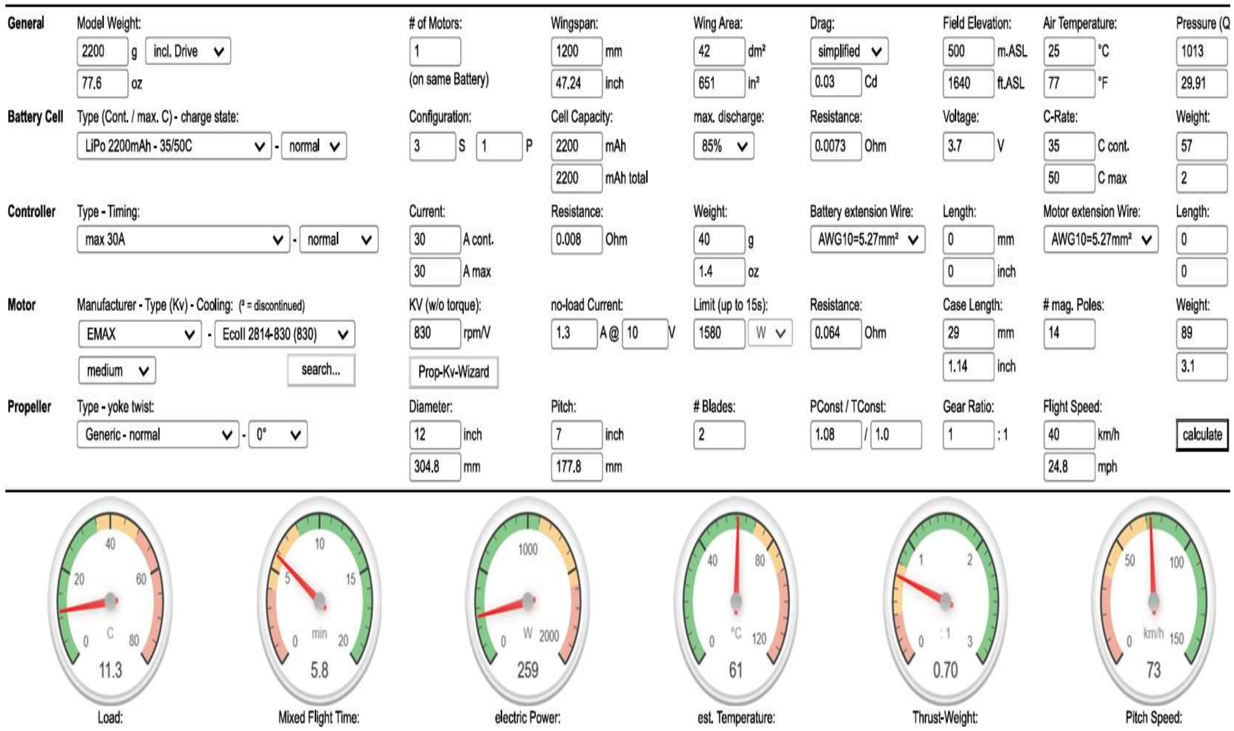
- We evaluated different tail configurations including symmetrical airfoils, cambered airfoils, and flat plates. Each configuration has its own set of advantages and disadvantages. While more complex shapes might offer slight aerodynamic advantages in specific situations, the benefits of simplicity and ease of manufacturing often make the rectangular configuration a compelling choice for many aircraft designs.
- The horizontal tail design targeted an ideal aspect ratio between 3 and 5. To optimize lift-to-drag ratio (CL/CD) and angle of attack (α) for zero pitching moment (0 CM), the team selected a span length of 50 cm and a tail area of 825 cm².
- The vertical tail design prioritized stability by targeting a smaller aspect ratio between 1 and 2. The team optimized the span area and chord length, resulting in a final aspect ratio of 1.86.



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)	2.2
Power Performance Level (watt/kg)	222.2
Voltage (V)	11.1
Current (A)	44.04
Maximum Current (A)	52.85

Results

Our heavy lifter design incorporates the e423 airfoil for optimal lift generation and features lightweight stabilizers for stability and ease of construction.Calculations, including adherence to relevant regulations, have been conducted to ensure the aircraft's safe and efficient operation while meeting the competition's specific 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)