CAIC TROPHY

TECH GC 2025

DESIGNER'S CHALLENGE

SYSTEM DESIGN

AeroClub

CAIC TECH GC 2025

Introduction & Motivation

Welcome to “Designer’s Challenge”, the aeromodelling design challenge of the year. This is your opportunity to display your knowledge and engineering vision along with gaining points for your hostel in the race of the coveted CAIC trophy. This is a competition of skill and grit, designed to provoke practical thinking. May the best design win!

Problem Statement

Participants are required to design a modular CAD model of an RC plane that meets the following criteria:

1. **Modular Design**: RC Planes can find themselves in a ton of high impact crashes/ difficult situations. We expect teams to make a modular RC plane design such that if a single part is damaged, it can be manufactured and reattached.
2. **Flight:** The plane must be able to justify good flight characteristics. More than payload capacity, the model is expected to perform better manoeuvrability and easy control as the model is expected to perform certain stunts through hoops or following a certain path.
3. **Payload Capacity:** The design must be capable of carrying a payload of at least 500 grams.

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Guidelines

General Rules :

1. Participants can work individually or in teams of up to five members.
2. Designs must be created using one of the following CAD software only:

- Fusion360, Autodesk Inventor, SolidWorks, Free CAD

3. Only specified materials (listed below) are permitted for the design.
4. All designs should adhere to the principles of aerodynamics and structural integrity as analysis will be performed on the submitted model and results can be used for tie breaks.
5. Plagiarism will result in immediate disqualification.

Box dimension :

1. Maximum internal box dimensions: 120 cm x 50 cm x 40 cm [L x B x H]
2. All disassembled parts of the plane must fit into the box without exceeding the dimensions.

Payload Requirement :

1. The RC plane must be designed to carry a minimum payload of 500 g.
2. The payload compartment must be explicitly detailed in the CAD model.

Electronics:

Design must account for weight of electronics component used

1) ESC- 25 grams
2) Receiver-20 grams
3) Servo motor- 12 grams
4) Propeller: 13 grams
5) BLDC motor with mount- 60 grams
6) Battery: 175 grams

Box Dimensions and Features

1. Maximum internal box dimensions: 120 cm x 50 cm x 40 cm [L x B x H]
2. All disassembled parts of the plane must fit into the box without exceeding the dimensions.

Plane Dimensions and Features

1) Plane weight <= 4kg
2) 100 cm<=Wingspan<=150 cm

Undercarriage

There are two options, whether to use an undercarriage or conduct a hand launch by throwing the plane.

- If an undercarriage is included, it should be made sure that it is strong enough for a landing/crash and should sustain minor to major damages.
- If undercarriage is not provided, the plane must have some kind of protection under the plane belly so that main fuselage remains undamaged.

Online Library

1. Participants may use some parts of their model from online libraries like Grab Cad, but these parts should be explicitly mentioned.
2. There will be a negative penalty and/or less points associated with parts through online library in order to ensure that the option to use the online libraries is not misused.

Permitted Materials

Participants may only use the following materials for their design:

	Material	Density (g/cm³)
1.	Balsa Wood	0.16
2.	Carbon Fibre	1.75
3.	Alluminium Alloy	2.70
4.	ABS Plastic	1.04
5.	PLA Plastic	1.25

Solution Deliverables

Zip the CAD files and report and name it as your Team name.

- CAD Files
  - Individual part files.
  - Assembly file showing the assembled RC plane.
  - Assembly file showing all components disassembled and arranged to fit within the box.
- Report
  - Details Discussed Below

Evaluation Parameters

A detailed report must be submitted, which will be evaluated based on the following criteria:

CATEGORY	POINTS
Design Specifications:	10
Sketches And CAD Model :	10
Design Analysis:	30
Fabrication Methods:	20
Electronics Design:	15
Bill of Materials:	10
SURVEY:	05

Team Size

A team of maximum 5 members will be allowed to register

Detailed Pointing System

Survey(05 POINTS)

- What are the challenges and pain points in designing a RC Plane for industry ?
- Include factors which you consider to be important for RC Plane design.
- Explain how the problem should be approached.
- Show your findings through bar graphs, pie charts etc.
- Give the references of your research.

Design Specifications(10 points):

- A detailed analysis of the weight, payload capacity and overall dimensions must be specified.
- Higher payloads and less weight receive more points; must demonstrate structural integrity under load.
- Points deductions if disassembled model does not fit in the box dimension.

Design Analysis (30 points):

- Justify your choice of aerofoil shape and explain how it improves flight performance (e.g., lift, drag, stability).
- Provide a detailed material selection analysis, including weight and density calculations.
- Conduct a stress, CFD, FEA analysis to show how your design handles loads and impacts.

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Detailed Pointing System

Sketches and CAD Model (10 points):

- This category evaluates the quality and clarity of your design sketches and CAD model.
- Provide detailed sketches of your RC plane, showing all key components and dimensions.
- Submit a well-organised CAD model with individual part files and an assembly file.

Fabrication Methods (20 points):

- Explain the manufacturing process for each part of your RC plane.
- Highlight how your design ensures ease of assembly and disassembly.
- Discuss the tools and techniques you will use to fabricate the plane.
- Steps to assemble and disassemble the model.

Electronic Design(15 points):

- Provide a detailed layout of all electronic components use and their functionality in your design.
- Ensure your design accounts for the weight and placement of electronics.
- Give a clear Block Diagram of the electronics.

Bill of Materials (10 points):

- Provide an estimate of total cost required for manufacturing of the plane.
- Give a detailed justification and analysis of it.

* Include references and cited sources.

Resources

For Aerofoil shape: https://joyplanes.com/en/selection-of-airfoil-model-airplanes/

For Design:
https://www.printables.com/model/422806-hawk-modular-rc-wing-airplane
https://grabcad.com/library/rc-trainer-airplane-1

Motion Axes and Control Surfaces
https://www.studyaircrafts.com/aircraft-control-surfaces

Electronics
https://www.instructables.com/Beginners-Guide-to-Connecting-Your-RC-Plane-Electr/

Drag and Lift
https://youtu.be/E3i_XHlVCeU?si=ieQstgnuHJhPRlFv