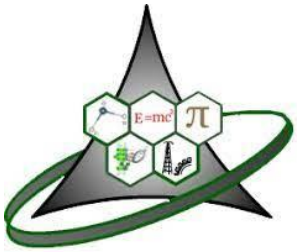

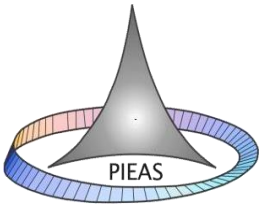

16th Design, Build & Fly Competition 2022

Design and Mission Constraints

Faculty of Mechanical Engineering, GIK Institute

Constraints and Rules

Design Constraints

- The aircraft can be designed in any configuration i.e., tractor, pusher, single motor, twin motor etc.
- The wingspan of the aircraft should not be more than 2.5 meters.
- The weight of the aircraft should be less than or equals 3 kg (for all missions, including payload(s)).
- Lithium Polymer (Li-Po) battery is allowed. The battery should not have a rated capacity of more than 5500 mAh and a rated voltage of more than 12 V.

Mission Constraints

- Aircraft will use ground rolling take-off and landing.
- Missions will simulate take-off from a small austere field.
- The aircraft must take off within 50 ft.
- Aircraft must complete a successful landing at the end of each mission to receive a score.

Mission 1: Without Payload

- Take-off within the prescribed area.
- Perform basic maneuvers:
    1) **Circuit pattern**
    2) **Aileron roll**
    3) **Inside loop**
- All maneuvers to be completed within 5 minutes and only one try is allowed.
- Time starts when the throttle is advanced for the (first) take-off (or attempt).
- Mission performance will be normalized over all teams successfully completing this mission.
- A successful landing is mandatory to get score for the mission.

Mission 2: With Internal Payload

- Payload should be exactly 300 grams in weight.
- The teams can choose the dimensions and material of the payload to suit their design.
- The payload should be a separate entity. It must not be a structural or functional part of the aircraft.
- Take-off within the prescribed area with payload. The payload should be secured in place to ensure that it does not move around during flight.
- Perform maneuvers as:
    1) Two (2) complete **circuit patterns**. (One circuit pattern is one complete round over the main field which is approx. 100 meters).
    2) During the second circuit, the aircraft must perform **inverted fly-pass** through the field once and a **vertical loop** before establishing a final approach for landing.
- All maneuvers to be completed within 5 minutes.
- A successful landing is mandatory to get score for this mission.

Mission 3: Payload Drop Challenge

- The goal of this mission is to drop at least one payload into the specified location on the airfield (see Figure: 03).
- There is no constraint on the total number of payloads. A team can include multiple payloads keeping in view the maximum weight constraint.
- The payload should be placed inside the aircraft. It must be rigid and a separate entity.
- Payload can be dropped via parachute, dropping any of the payload via parachute will get extra credit (marks) which would be judged by the jury depending upon the parachute design, dynamics and effectiveness. While a team can drop any of payload via parachute and simply drop the other payloads directly.
- To maintain a balance in dropping of the payload, the minimum height to drop the payload is 20 feet. The aircraft must be above this height before dropping the payload.
- **Only one payload should be dropped at a time and the plane should maneuver back for the next payload drop and so on.**
- Total time allowed for this mission is 7 minutes.
- **The shape and material of payload can be selected by the team that suit their design while the dimensions should not be less the 2x2x2 inches (the payload doesn't need to be in cubic structure, it can be of any other shape but it should have dimensions greater than 2x2x2 inches in diameter or lengths) .Refer to figure: 01 for Minimum payload dimensions requirement.**
- The maximum weight of a single payload should be 150 grams.

- The aircraft must complete a successful landing to get the score.

Note: Mission 3 can be performed using manual dropping mechanisms from transmitter or either with automation, which should include the use of different micro controllers e.g., Raspberry pi 2, or Arduino and Pixhawk.

Important Notes:

- It is not compulsory to drop any payload via parachute but the team who drops the payload via parachute will get extra marks which will be decided by the Jury.
- The dropping area for Payload is shown in figure: 03 where the payload dropped in the inner most circle get high marks, keep in mind that the payload should hit the inner circle to get the marks for inner circle, hitting the boundary of inner circle would get marks of middle circle.
- The first hit of the payload on the ground would be considered for marks .For example: if the payload hit the 1st circle but bounce to 2nd circle, it would be considered for 1st circle marks as the payload first hits the 1st inner circle.
- The payload in Mission 3 should be released at a minimum height of 20 ft, we will do a setup on ground to judge the height of plane at the time of payload drop.

Payload Minimum dimensions Requirement

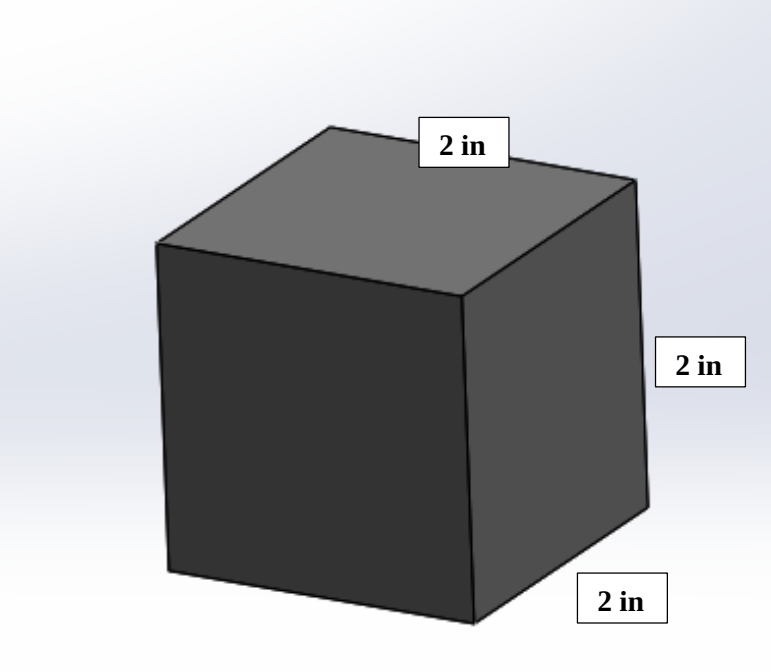

Figure 01

Takeoff and landing Runway

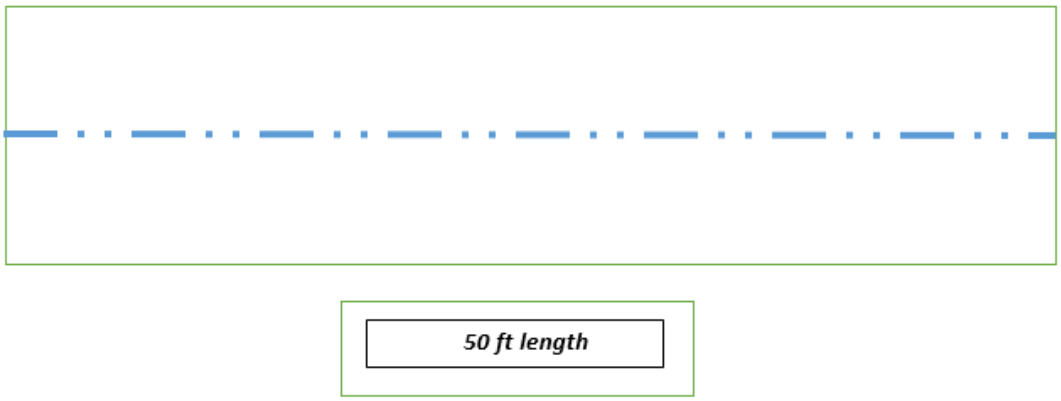

Figure: 02

Dimensions of the Target Payload Dropping Area circles

1st inner circle = 6 foot Dia

2nd middle circle = 9 foot Dia

3rd outer circle = 12 foot Dia

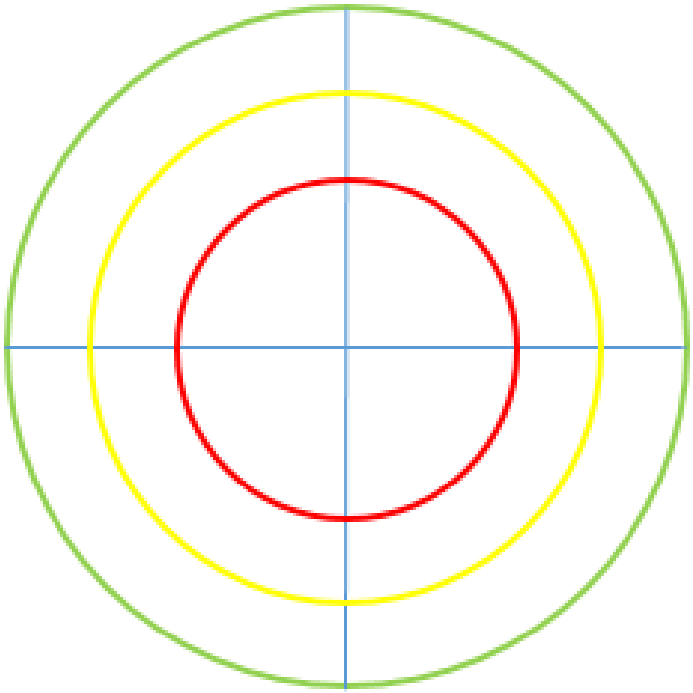

Figure: 03

Technical Report (Format)

Executive Summary

- Summary description of selected design and why it best meets the mission requirements
- Main points from subsequent sections
- Document the performance/capabilities of your system solution

Management Summary

- Describe the organization of the design team
- Chart of design personnel and work distributions
- Milestone chart showing planned and actual timing of major elements

Conceptual Design

- Describes mission requirements (problem statement)
- Translate mission requirements into sub system design requirements
- Review solution concepts/configurations considered
- Describe concept weighting and selection process and results

Preliminary Design

- Describe design/analysis methodology
- Document design/sizing trades
- Describe/document methodology for prediction of aircraft performance (include capabilities and uncertainties)
- Provide estimates of the aircraft lift, drag and stability characteristics and method of prediction
- Provide estimates of the aircraft mission performance

Detailed Design

- Document dimensional parameters of final design
- Document structural characteristics/capabilities of final design
- Document systems and sub-systems selection/integration/architecture
- Document Weight and Balance for final design
- Must include Weight & Balance table empty and with each possible payload/configuration
- Document flight performance parameters for final design
- Document mission performance for final design
- Drawing package:

1) 3-View drawing with dimensions of all parts
2) Assembly drawing of aircraft
3) Exploded view
4) Payload and dropping mechanism assembly drawings with all dimensions

Manufacturing Plan

- Document the process selected for major component manufacture
- Manufacturing processes investigated and selection process and results
- Manufacturing milestones chart: plan and actual

Testing Plan

- Describe all major ground and flight tests performed.
- Objectives and schedule for each.
- Data to be collected and how applied.
- Test and flight check lists

Performance Results

- Describe the demonstrated performance of key subsystems following execution of testing plan
- Compare to predictions and explain any differences and improvements made
- Describe the demonstrated performance of your complete aircraft solution
- Compare to predictions and explain any differences and improvements made

Bibliography

- List of all published works referenced in the text must be present in this section.
- Any material taken from a published source in all previous sections must have a numerical subscript corresponding to the appropriate citation in this section.
- References should appear in numerical order.
- Format must be APA style.

Contact Details:
Questions regarding the competition, schedules, or rules interpretation may be sent to the competition coordinator by e-mail mentioning team name and personal name. Written reports (only) should be sent at the following postal address:

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