AEROTHON 2024 – UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST

Rule Book

Revision 1
March 26, 2024

REVISION HISTORY

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FOREWORD

Welcome to SAEINDIA AEROTHON – UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST 2024. The system requirements are developed to align with real-world Uncrewed Aircraft System (UAS) requirements to provide industrial exposure to the teams. The theme for this edition of AeroTHON is "***Surveillance and Disaster Management.***"

The contest is planned in two phases:

- Phase – 1: Design Report & Oral Presentation
- Phase – 2: Flying Competition.

The teams must submit a design report of their UAS in Phase - 1, adhere to the contest design rules/ guidelines and make a presentation to the jury. The top 20 teams from the phase - 1 will qualify for the phase - 2 of the contest. The shortlisted are required to build an Uncrewed Aircraft System and successfully complete the missions as described in the rulebook during the flying competition. The top 3 teams will be declared as the winners of this contest.

Universities/ Institutions can nominate any number of teams as long as they meet the team formation requirements listed in this document.

Lastly, contesting teams are requested to pay special attention to the bold and italicized fonts throughout this document. These are important updates and clarifications on a variety of aspects pertaining to the design. Please read these rules carefully. Watch out for official announcements and updates concerning this contest and rule interpretations on the SAEINDIA website.

Best of luck to you all!!

SAEINDIA Aerospace Forum
SAEINDIA

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1. CONTEST DETAILS

1.1. OVERVIEW

The Indian government is on the mission to turn the country into an **U**ncrewed **A**ircraft **S**ystem (UAS)/ Drone hub by 2030 under the Atmanirbhar Bharat Abhiyan by accelerating the pace of development of India's Uncrewed Aircraft / Drone industry. India's UAS market could grow to INR 500 billion (US$ 6.8 billion) in the next five years. Uncrewed Aircraft Systems (UAS) are used across many industries like defense, construction, infrastructure, mining, telecom, geospatial mapping, agriculture/farming, media & entertainment, law enforcement, oil and gas. They are used for various applications such as surveillance, security, safety, disaster management, land survey, progress monitoring through aerial photography and thermal imaging. The widespread consumer market applications will soon become reality, with the progress in technological innovations and the reduced costs. Some of these include drone-facilitated last-mile delivery for the retail, healthcare and logistics sectors.

SAEINDIA Aerospace Forum is organizing SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST named as AeroTHON 2024 for students with a primary focus on developing skills to design and build an UAS to prepare them to be industry-ready in the emerging market. This contest provides a real-life engineering exercise to undergraduate and graduate engineering students. The contest has been designed to expose the students to the real-life work environment of engineers in the industry.

In this contest, students will perform trade studies and make decisions to arrive at a design solution that will meet the mission requirements and conform to the defined specification and build a flightworthy UAV. In a nutshell, AeroTHON 2024 provides an opportunity for the students to experience the complete design and build cycle of a UAS that meets the specified mission requirements and a flight demonstration in the flying event.

To help the students develop interpersonal skills, technical communication- both written and oral and solution mindset, the contest has been divided into two phases –

- Phase – 1: Design Report & Oral Presentation
- Phase – 2: Flying Competition.

The pre-requisite for the flying competition includes technical presentation and UAV inspection. This year AEROTHON organizing committee has included an new stage specially for developing entrepreneur mindset titled "**Tiger's Cave**" in phase 2.

1.2. OBJECTIVE

- To inculcate innovation mindset among the student community in emerging technologies like Uncrewed Aircraft System (UAS)
- Incubate and nurture skills and capabilities of aero design in young minds and prepare them towards Atmanirbhar Bharat in critical aerospace technologies.
- To provide a platform for Aero-passionate students to demonstrate UAS design expertise.
- To help develop the next generation of entrepreneurs.

1.3. RULES AND ORGANIZER AUTHORITY

General Authority

SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST committee reserves the right to revise the schedule of any contest and/or interpret or modify the contest rules at any time and in any manner that is, in their sole judgment, required for the efficient operation of the event.

Rules Authority

SAEINDIA Aerospace Forum owns the responsibility and authority of the rules of SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST and it has been issued under the authority of the SAEINDIA. Official announcements from the SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST Organizing Committee shall be considered part of and have the same validity as these rules.

Ambiguities or questions concerning the meaning or intent of these rules will be resolved by the officials, SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST Organizing Committee or SAEINDIA Staff.

Rules Validity

The SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST Rules posted on the SAEINDIA Website and dated for the calendar year of the contest are the rules in effect for the contest. Rule sets dated for other years are invalid.

Rules Compliance

By entering the SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST, the team members, faculty advisors and other personnel of the participating university/institute has agreed to comply with and be bound by the rules, interpretations or procedures issued or announced by SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST Committee. All team members, faculty advisors and other university representatives are requested to cooperate and follow all instructions from the contest organizers, officials and the jury.

Understanding the Rules

The participating student teams are responsible for reading and understanding the rules in their entirety, their effect on the contest in which they are participating. The section and paragraph headings of these rules are provided to facilitate the reading and will not affect the paragraph contents.

Consideration of "Participation" in the contest

Teams, team members as individuals, faculty advisors, and other representatives of a registered university who are listed as team members while registering their team are considered to be "participating" in the contest from the time they register for the event until the conclusion of the contest or earlier, in case of withdrawing.

Violations of Rule Intent

The violations of the intent of a rule will be considered a violation of the rule itself. Questions about the intent or meaning of a rule may be addressed to the SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST Committee or SAEINDIA Staff.

Conditions and Penalties

Organizers have the right to modify the points and/or penalties listed in the various event descriptions to better reflect the design of their events, or any special conditions unique to the contest.

Force Majeure

The AEROTHON organising committee and SAEINDIA shall not be held responsible for non-fulfillment of their obligations under this agreement due to the exigency of one or more of the force majeure events such as but not limited to the acts of God, war, flood, earthquake, strikes, lockouts, pandemics, epidemics, riots, civil commotion, scarcity, of water, electricity or such other

basic facilities, etc and shall inform the participating teams on the occurrence and cessation of the event within one week of such decision being made. If running the event is not feasible either due to unreasonable duration of force majeure conditions or any other reasons, the event may be cancelled for the year

(i) ("Force Majeure Events")

(a) Earthquake, flood, inundation and landslide, storm, tempest, hurricane, cyclone, lightning, thunder, pandemics, epidemics or other extreme atmospheric disturbances or any other act of God

(b) Strikes, labour disruptions or any other industrial disturbances not arising on account of the acts or omissions of the organisers, war, hostilities (whether declared or not), invasion, an act of a foreign enemy, terrorism, rebellion, riots, weapon conflict or military actions, civil war, ionising radiation, contamination by radioactivity from nuclear fuel, any nuclear waste, radioactive toxic explosion, volcanic eruptions or other such occurrences beyond the control of the organisers

(c) Acts of expropriation, compulsory acquisition or takeover by any government agency of the said venue where the event is to be held or any part thereof

(d) Any prohibitory order of any Court

1.4. ELIGIBILITY

1.4.1. TEAM MEMBER

Members of a Team must be undergraduate or postgraduate student and every member of the team must be a member of SAE India.

1.4.2. SOCIETY MEMBERSHIP

A university or institute can nominate as many teams as they wish by paying the requisite fee for each team. However, each team must work independently.

The registration fees indicated in Section 0 must be paid within 15 days of registration.

1.5. OFFICIAL LANGUAGES

The official language of the SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST is English. Document

submissions, presentations, and discussions in English are acceptable during all the phases of the contest.

1.6. CONTEST PHASES

1.6.1. Phase – 1: Design Report & Oral Presentation

- This phase invites innovative designs from the participant teams.
- The innovative designs will be evaluated by industry and academic experts.
- Design presentations from the teams to the jury.
- Top 20 teams shortlisted for phase 2 based on the design report and presentation

1.6.2. Phase - 2: Flying Competition

- Students build physical prototype of their design.
- Technical presentation, inspection and Flying competition.
- Prizes awarded to teams.

1.7. IMPORTANT DATES

Here are the key dates for the contest.

Table 1: Contest Timeline

Key Event	Dates
Registration opened for AeroTHON 2024	25th Feb 2024
Registration close	31st March 2024
Phase 1: Design Report submission by students	04th June 2024
Phase 1: Presentation submission	20th June 2024
Phase 1: Students present designs to Judges (industry and academic experts)	22nd June 2024
Judges (industry and academic experts) review reports & finalize scores	26th – 29th June 2024
Announce winners of Phase - 1	5th July 2024
Phase - 2: Physical prototype build	5th July – 13th Nov 2024
Phase - 2: Physical UAV inspection - 2pm to 5pm	14th Nov 2024
Phase - 2: Flying Round	15th Nov 2024
Phase - 2: Flying Round	16th Nov 2024
Awards Ceremony	16th Nov 2024

**** SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST Organizing Committee reserves right to alter any of the dates***

1.8. REGISTRATION AND FEES

A team can comprise a maximum of ten students and one faculty advisor. Please note all student participants must be SAEINDIA members to participate in the events or contests by SAEINDIA. Faculty advisors are advised to become members of SAEINDIA, though it is not mandatory.

The **registration fee** for AEROTHON is **Rs.15,000/- (Rupees Fifteen Thousand only) per team excluding 18% GST**. To register for AEROTHON visit: https://saeindia.org/aerothon2024

Steps to become a SAEINDIA Member

If you are not a SAEINDIA member, go to www.saeindia.com and select the "Membership" link. Students need to select the "Student Membership" link and provide the details as indicated. Alternate link to sign up for SAEINDIA membership https://www.saeindia.org/become-a-member

Faculty members who wish to become SAEINDIA members should choose the "Professional Membership" link.

1.9. CANCELLATION OF CONTEST REGISTRATION

Teams registering for SAEINDIA AEROTHON – UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST are required to submit a design report on the design of the UAS.

Failure to submit the design report on or within the specified date will constitute an automatic withdrawal of your team from the contest. Your team will be notified the next day of the due date about non-submission, your team's registration will be cancelled after two days of this notification and no refund will be given.

1.10. EXPECTATIONS

1.10.1. DESIGN WITH NO PROFESSIONAL'S INVOLVEMENT

The UAS must be designed by SAEINDIA student members without direct involvement from faculty members or professionals. The students may use any literature or knowledge related to UAS or aircraft design, construction and information from professionals/ industry mentors or professors, as long as the information is given as discussion of alternatives with their pros and cons and is acknowledged in the references in the design report. Professionals may not make design decisions, nor contribute to the drawings, the report, or the construction of the UAS. **The Faculty Advisor must sign the Statement of Compliance given in Appendix A**.

1.10.2. ORIGINAL DESIGN

Any UAS presented in the contest must be an original design whose configuration is conceived by the student team members. Photographic scaling of an existing model UAS design is not allowed.

1.10.3. UNIQUE DESIGNS

Universities or institutions may register more than one team in SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST, but each entry must be with a unique design, significantly different from each other. If the UAS designs were not significantly different based on the assessment by the organising committee, then the university/ institution will be considered to have a single entry and one of the team will be allowed to participate in the contest. For example, two designs with the same motor configurations and dimensions would not be considered significantly different.

1.10.4. FACULTY ADVISOR

Each team is expected to have a Faculty Advisor from the registered university or institution. Non-faculty members are not allowed to be advisors. The Faculty Advisor will be considered as the official university representative for that team by contest organisers. Faculty Advisors may advise their teams on general engineering and engineering project management theory but should not be directly involved in the design of any part of the vehicle nor directly participate in the development of any documentation or presentation. They may review the design reports and provide suggestions and guide the team prior to the report submission and flying competition.

2. UAS DESIGN AND FLIGHT REQUIREMENTS

The objective for this year's contest is to design, build and fly a multirotor UAV that can deliver cargo to a specified location along with survey, object identification and counting. The teams shall design a UAS that can carry a specified payload and deliver it to a target while performing survey and object identification of the competition area by manual as well as autonomous operations.

2.1. DESIGN REQUIREMENTS

The design requirements of the UAS are listed in Table 2 and the payload dimensions are 10 cm x 5 cm x 5 cm as shown in Figure 1.

Table 2: UAS Design Requirements

S.No.	Parameter	Requirement/Limitation
1.	UAS Type	Multirotor
2.	UAS Category	Micro UAS (i.e., Take-off weight < 2kg)
3.	Payload Capacity	200 Grams
4.	Propulsion Type	Electric
5.	Communication System Range	At least 1 km

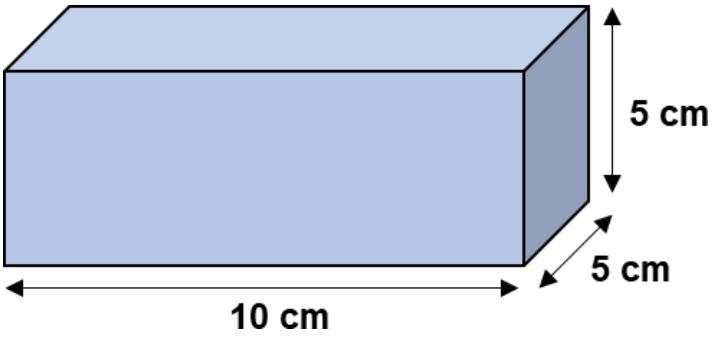

Figure 1: Payload Dimensions

Note: This year's contest is only for multirotor UAS. Fixed wings and VTOL Fixed wings are not allowed. Students are expected to bring innovation in the payload dropping method and mechanism to ensure a safe delivery of payload to the target point. Provide design and analysis details of various systems and sub-systems, selection of Commercially Off the Shelf (COTS) items like batteries, motors etc. Students should consider safety of the platform and the environment in the design and highlight the risks and how they have been mitigated in the design.

3. PHASE – 1: DESIGN REPORT & ORAL PRESENTATION

In phase – 1, the participant teams are required to submit a technical design report of their UAS as per the design requirements & constraint given in Section 2. The teams are also required to give a presentation to a jury comprising of industry and academic experts who will evaluate the designs.

3.1. DESIGN REPORT& PRESENTATION

Design Report is the primary means by which a team is to convey to the judges how they arrived at their design decisions, such that their uncrewed aircraft system is most suited to perform the intended mission. The design report should explain the team's thought processes and engineering philosophy that drove them to their conclusions. Further, it should detail the methods, procedures, and where applicable, the calculations used to arrive at the presented solution.

Teams are required to submit a design report and prepare a detailed presentation (Microsoft Power Point Format) and present it to the jury. The design report and presentation must have the following contents:

a) Conceptual Design
   I. High-level physical view: Physical elements and their arrangements

b) Detailed Design
   I. Estimation of Preliminary Weight.
   II. Estimation of Thrust required.
   III. Selection of Propulsion System.
   IV. UAV Sizing (Wheelbase, Rotor Arm, Hub, Propeller Clearance, Landing gear)
   V. UAS Performance (Power required estimation, Power System (battery) Selection, Endurance Estimation)
   VI. Material selection
   VII. Subsystem Selection (Communication System, Control & Navigation System & Other Avionics/ Sensors)
   VIII. C.G. Estimation & Stability Analysis
   IX. Preliminary CAD model (2D Drafting Front view, Top view and Side View, 3D Model)
   X. Computational Analysis
   XI. Optimized Final Design (Summary of Design Changes/Optimizations including the Final CAD model and 2D Drafting & C.G.)

XII. Detailed weight breakdown & C.G. of final UAS Design

XIII. UAS Performance Recalculation (Thrust/Weight, Power Required for the mission & Endurance calculation)

c) Final UAS Specifications and Bill of Materials.

d) System design for capturing the survey data- how or which format will the data be collected, how and where it will be recorded/ transmitted and what will be the mechanism to retrieve it.

e) Methodology for Autonomous Operations – how autonomous flight will be implemented, autonomous object/ target identification and how the UAV will be used to autonomously drop/ deliver the payload to the precise position.

f) Summary of innovations in the overall design

Refer to the Sections 5*,* 6*, &* 7 *the evaluation criteria, Design Report and presentation guidelines.*

4. PHASE – 2: FLYING COMPETITION

The phase - 2 of the SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST 2024 will have three stages,

1) **TECHNICAL PRESENTATION**
2) **TECHNICAL INSPECTION**
3) **FLYING COMPETITION**

The winners of the AeroTHON 2024 will be decided based on the total marks earned by the teams in the above stages. The evaluation criteria and the maximum scores is detailed in Section 5.

This year AEROTHON organizing committee has included a new stage specially for developing entrepreneur mindset in a separate business plan proposal titled "**Tiger's Cave**". This is a ***special category*** as it will not carry any marks towards deciding the winners of the competition. The best team in this stage selected by industry experts will receive this award.

4.1. TECHNICAL PRESENTATION

Prior to the flight inspections and the flying competition, the teams must give a 15-minute presentation (10mins presentation & 5mins Q&A) on the design performance of their UAS. This presentation shall include a brief overview of the design parameters (same as submitted during phase 1). If there are any changes to the UAS design with respect to the submitted design report, then the team shall appropriately highlight them in their presentation and provide a justification for the change.

Before the flying competition, the teams must have successfully flown their UAV at least a few times. The teams must include the summary of flight performance logs, test pictures and videos in this presentation. The teams must upload the videos and flight logs at least 10 days before the flying competition. In interest of time, the scoring of these mock missions (sub-section 1.3 in Table 4) will be pre-populated before the presentation. The medium to transmit this data will be communicated to the selected teams.

Scoring for this stage will be provided based on the UAS design conformance to the original design submitted in Phase -1, the flight performance achieved during these test flights compared to performance parameters submitted during the Phase – 1 design report and the successful testing of the autonomous operations. The Detailed evaluation criteria for the Phase – 2 of the contest is provided in Section 5.2.

4.2. TIGER'S CAVE- BUSINESS PLAN PROPOSAL

This year AEROTHON organising committee has included a new stage specially for developing entrepreneur mindset. Through this stage, we are looking for teams that have an appetite to not just solve challenges but also set new trends of growth and success in Drone industry.

During this event teams would pitch their product in front of notable jury from successful drone start-ups and related industries and gain insights from them.

This opportunity to pitch your product in front of industry trailblazers is a win in itself, the best team will be awarded a **special category prize**.

The team will be presenting to a panel of 3-4 ***tigers*** with a time limit of 15 minutes (10mins presentation & 5mins Q&A). The team is free to decide on the format of their presentation, props, display parts to make an impact.

The evaluation criteria are not defined as the winning team decided by the tigers, but the recommended topics to cover could be:

- Business plan proposal
- Capability of your UAS- key points
- Key Technical aspects and differentiators
- Practical market/ use case to which your system could be implemented.
- Market survey on the scope and growth of your use case
- USP of your design.
- Innovations used in your product which sets it apart from other teams.
- Financials, fund raising, sponsorships so far, plan to scale up.
- Team's structure for future success

These are just helping points to start with, but the teams are free to decide what points to cover and present it. Think of it as a shark tank experience.

This is an imagination exercise of what your product could be!!

Note: Scores of this stage will not be included in overall contest score.

4.3. TECHNICAL INSPECTION

All UASs will undergo a technical inspection by designated UAS inspector(s) prior to being allowed to make any flight demonstration. Technical and safety inspection of all UASs will be conducted as per the general safety guidelines followed in the industry and all decisions of the UAS inspector(s) are final.

Technical and safety inspection is the process of checking the UAS for:

1. Compliance with all specified UAS design requirements.
2. Overall safety and airworthiness.

All UAS must pass the Technical and Safety Inspection in order to compete. It is strongly recommended to have a self-inspection checklist before arriving at the contest.

During the Technical Inspection the following will be checked,

a) UAV Dimensions conformance to 2D Drawings submitted during Phase - 1

b) Use of the same components selected in Phase - 1

- Propulsion - Motor, Electronic Speed Controller & Propeller, Power System – Battery, Control & Communication System - Flight Controller, Radio Transmitter & Receiver)

c) Take-off weight same as submitted in the design report

d) Structural Integrity

- All the components are secured well, proper wiring (i.e., no wires hanging, use of appropriate gauge wires and connectors), secure fasteners - use of locknuts or thread locker for fasteners, no structural components are loose or shaking, propeller attachment, payload attachment.

e) Failsafe Checks:

- The UAV will be inspected if the Safety Features are enabled or not:
  - **Battery Failsafe:** The UAV should RTL in case of Low Battery.
  - **Geo-Fence:** The UAV Should not breach the geo-fence during the Manual mode. The UAV should Return to Launch when breached in Auto Mode. The Geo-fence co-ordinates will be provided at least a day before the flight.
  - **Radio-Failsafe**: The UAV Should RTL when datalink is Lost.

f) Other Checks

- Proper control response (motor rpm) to Radio controller inputs, Motor/ Propeller Rotating direction, Radio Range Check, Motor Arming and

Disarming check, FPV video transmission check

g) Deviation from the above if any, should be normalized through the prescribed change request process defined in section 4.3.2.

A detailed technical inspection will be performed for the first flight, and a visual inspection for the subsequent incident free flight. If the UAS is damaged during a mission or trial, a detailed inspection will be repeated. It is recommended to have strategically selected spare structures and components in case of any unexpected incident during the transit/ competition.

4.3.1. UAV Conformance to 2D Drawing

During Technical Inspection, the UAS will be inspected and measured for conformance to the 2D drawing presented in the Design Report.

a) At a minimum, UAV arm length, landing gear height and UAV height dimensions will be measured and compared to the 2D drawing.
b) All teams must have a hard copy of their design report with them during technical inspection.
c) UAV actual empty CG will be compared to the empty CG presented in the design report's 2D drawing.

4.3.2. Deviations from 2D Drawing

Any deviation in construction of the UAV from the submitted 2D drawing since submission of the Design Report must be reported in writing.

a) Each design change must be documented separately using the Modification Change Request (CR) in APPENDIX B.
b) Only one design change may be submitted per CR form.
c) Jury will assess penalty points for design changes.

4.3.3. Inspection of Spare UAS Components

- All spare UAS components (structural parts, motors, propeller, batteries etc.) must be presented for inspection at the same time of the UAS inspection.

4.3.4. Inspection Requirements throughout the Contest

- All UAS must meet all Technical and Safety Inspection requirements throughout the contest.
- Any official may request that an UAS be re-inspected if a general or safety requirement problem is seen on an UAS at any time during the event.
- This includes any unintended errors or omissions made by officials during inspection.

4.3.5. Technical and Safety Inspection Penalties

- Points are allotted for the Technical and Safety Inspection.
- Teams may lose points if errors and problems are encountered during the inspection process. Any penalties assessed during Technical Inspection will be applied to the overall contest score. Refer section 5.3 for the detailed evaluation criteria.

After the technical inspection, the UAV will be stored in designated area by SAEINDIA and the team can only take the battery for charging. After the first mission, the UAV must always be in the assigned anchor area for the team.

4.4. FLYING COMPETITION

The flying competition is ***tentatively*** scheduled from 14th to 16th November 2024. The agenda and timetable of the events will be circulated in due time. The teams are hereby requested to adhere to the schedule to successfully conclude the event on time.

4.4.1. General Mission Requirements

- The objective of AeroTHON2024 is to design, build and fly a multirotor UAS (UNCREWED AIRCRAFT SYTEM) to conduct survey, identify & classify objects, avoid obstacles, and deliver a payload to a specified target point.
- The aircraft must remain substantially the same as documented in the design report.
- **A total of four attempts will be provided.**
    - ❖ Flight Mission 1 – UAS Survey, Object Detection, Classification, and Counting – Manual Operation
    - ❖ Flight Mission 2– UAS Survey, Object Detection, Classification, and Counting – Autonomous Operation
    - ❖ Flight Mission 3 – UAS Obstacle Navigation and Payload Drop – Manual Operation
    - ❖ Flight Mission 4 – UAS Navigation and Payload Drop – Autonomous Operation
- Scoring will be awarded individually for all fours rounds (2 Manual & 2 Autonomous).
- If the UAS is damaged beyond repair or if it is deemed not airworthy by the UAS inspectors, then the team shall forfeit their next attempts.
- The cruise altitude for all the rounds in the competition is set to 15m. Any mention of cruise altitude in the Section 4.4.4 to Section 0 refers to this value unless specifically mentioned otherwise.
    - Cruise altitude → 15 meters
    - Payload drop altitude → 5 meters
- An overview of the missions to convey the scope of the missions is presented in this section. The details of the missions will be fine-tuned and communicated to the phase 2 contestants in a separate Webex session.

Note: Teams are required to maintain the original configuration of UAS during overhauling. Team shall be disqualified by Jury if any major deviations are observed from original design submitted in the contest.

4.4.2. Ground Rules

The following are the important rule which must be followed throughout the competition in view of safety and keep up the spirit of competition. If any team is found not following these rules, SAEINDIA reserves the right to disqualify the team.

- The team members as representatives of the university are required to maintain etiquette, decorum and uphold the dignity of their college. If the team has any concerns, only the team leader is to approach the jury politely without hampering the ongoing event.
- All queries/ concerns on the field must be directed to the grievance committee representative available onsite and teams should not disturb the jury to perform their functioning.
- Geo-fence coordinates will be given to the teams. Geo-fencing must be enabled and the team must cooperate with the marshals to verify it at any time.
- Expect for the missions, the teams must not fly in their system anywhere in the campus during the competition.
- The teams must cooperate with SAEINDIA representatives for inspection as per the requirements defined in section 4.3.4 and 4.4.1.
- Each team will be provided with a flight time of 10 minutes to complete the mission. The team must ensure that the UAS lands within this time.
- The teams are requested to adhere to the schedule of the program (Section 4.4.3). Teams will forfeit their chance to fly, if they do not report to ground within 5 minutes of being called for their respective mission flight.
- The scoring of the mission will be based on the survey data and telemetry data recorded by the team during the mission. Hence, the team is expected to transfer this data within 15 mins from end of each mission or else risk losing the points for that mission.
- If an UAS is damaged after an unsuccessful flight round, the teams shall carryout necessary repairs, if possible, without making any modifications that deviates from the submitted design before the flight call for their next attempt. However, the UAS must go through the inspection once again and be cleared as airworthy before their next attempt or else the team shall be forfeited by default.

4.4.3. Flying Competition Chronology

- Flying chronology will be shared with all the teams at least two days prior to the flying demonstration event scheduled as per the announced dates via email. Teams shall follow the chronology during the flight demonstration. The same order will be repeated for all the attempts/ rounds in AeroTHON 2024.
- Teams are expected to be in the field and ready to fly in the assigned order. In the interest of time, SAEINDIA reserves the right to skip the team if they are not able take off by the final call announcement. If a team misses/ forfeits their opportunity, their score will be 0 for that mission.
- If any team is unable to make it to the Flying competition due to conflict with examination schedule, medical emergency, etc. A delegate or substitute is allowed for only flying the UAS at the venue based on letter issued by Institute HoD / Principal / Faculty Advisor.
- The delegate or substitute should be from the same university but not necessarily from the same team.
- Teams are required to notify SAEINDIA in writing along with the letter at least 10 days in advance.
- Technical presentation must be still made by the team virtually over WebEx or any platform provided by SAEINDIA.
- SAEINDIA AeroTHON 2024 Organizing Committee reserves the right to honor the request for delegate / substitute. The decision of the organising committee will be final and binding to all teams.

4.4.4. Flight Mission 1 – UAS Survey, Object Detection, Classification, and Counting – Manual Operation

The mission's objective is to survey the field by crossing the hotspots, identify, classify, and count objects based on their shapes utilizing image processing and object detection algorithms. The detailed steps are described below followed by the schematic image of the mission.

- In the first leg of the mission, the UAV must take off from the designated area and navigate the survey field following a specified path marked on the ground at cruise altitude.
- As the UAV navigates the designated path at cruising altitude, the ground survey data must be recorded. Points will be awarded based on the number and the sequence of hotspots captured in the video/ images **in the correct order**. Captured survey data along with telemetry data must be provided to the jury panel within 15 minutes of flight completion. The scoring will be performed by the jury panel based on the data provided.
- After passing the last hotspot/ survey path, the first leg of the mission is completed the UAV proceed to the second leg which is the object identification maintaining the cruise altitude.
- In the object detection field, the pilot must skillfully identify and maneuver to the object area where the objects are placed.
- **The image processing, object classification and counting should be performed autonomously and not manually.** UAS should be equipped to count the number of different shaped objects within the field and log this information along with timestamp to be reviewed by the Jury Panel.
- Upon completion of counting objects, the pilot needs to bring the UAV back to take-off zone and land safely maintaining the cruise altitude thus completing the second leg as well as the mission.
- Pilots are responsible for manually maintaining mission altitudes as stated in the respective milestones, without the aid of autopilot programs, but the object identification and counting should not be done manually.
- Each team will be provided a flight time of 10 minutes to complete the mission. The time starts when the throttle input is increased for the take-off.
- Scoring will be provided for a successful flight mission. A flight is considered successful only if the UAV takes off, complete survey by crossing majority of the check points, reach objects area, identify objects, classify objects based on their shapes, count the number of objects, return to the take-off point, and land safely on the ground. Refer Section 5 for scoring information.
- Survey data and telemetry data must be shared with the jury members for enabling them to analyze and score timing and performance.
- While the Figure 2 depicts the mission profile, actual conditions on the field may vary.

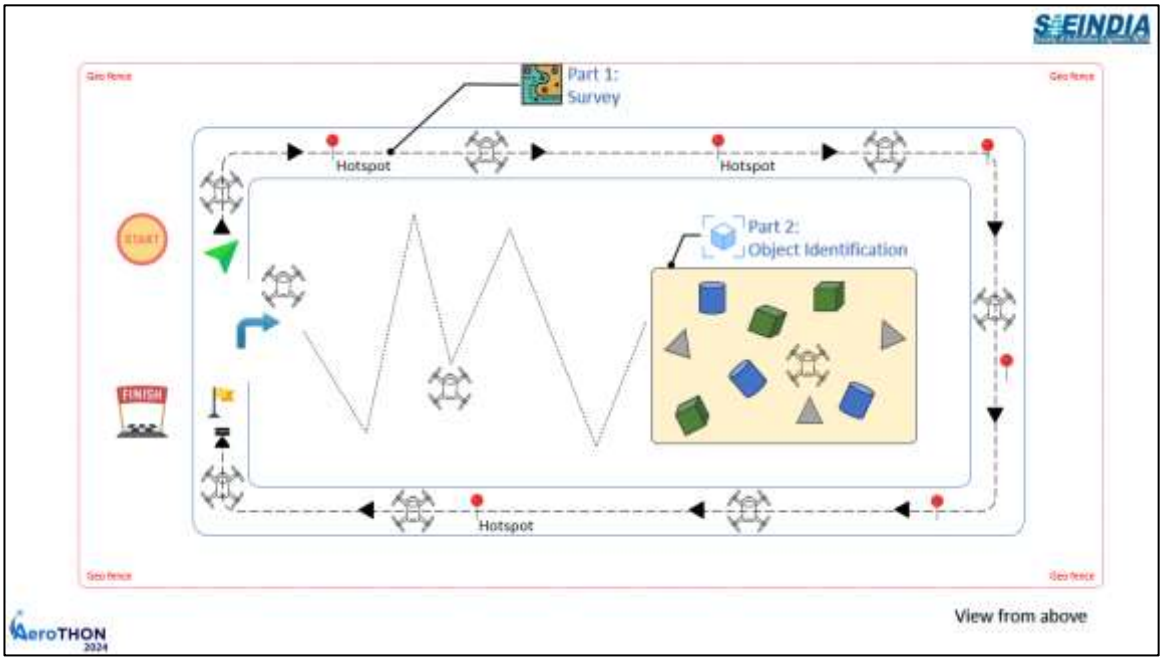

Figure 2: Flight Mission 1 – Manual - Mission Profile

4.4.5. Flight Mission 2– UAS Survey, Object Detection, Classification, and Counting – Autonomous Operation

This autonomous mission performs all the tasks defined below without any manual intervention.

- The UAV will navigate and survey the filed based on their chosen algorithm and capture the hotspots (6 counts) using the camera. The hotspot detection and counting will be done by means of computer vision, image processing and object detection algorithms to autonomously detect & count objects and accomplish the mission.

  Note: Coordinates for object identification area will not be provided, UAS needs to be programmed to survey and identify the object identification area on its own.

- The flight mission is as follows.
  - ❖ The complete mission will be in cruise altitude.
  - ❖ The mission's objective is to autonomously survey the field, capture the hotspots, identify, classify, and count objects based on their shapes utilizing image processing and object detection algorithms.
  - ❖ The UAV takes off, autonomously surveys the field, capture images/ video of the survey area and capture the hotspots.
  - ❖ If the hotspot is identified, the UAV can store an image along with the timestamp for jury review. Capture more mock targets for more points.
  - ❖ The UAV must autonomously identify the object area for object detection.
  - ❖ In the object detection field, UAV is programmed to identify, classify and count the objects placed on a white background surface autonomously.
  - ❖ UAV should be programmed and equipped to autonomously count the number of different shaped objects within the field and report this information to jury panel upon mission completion.
  - ❖ Upon successful completion of counting objects, the UAV must be programmed to return to the take-off zone and land safely.
  - ❖ Survey data and telemetry data must be shared with the jury members for enabling them to analyse and score timing and performance.
  - ❖ Scoring will be provided for a successful flight mission. A flight is considered successful only if the UAV takes off, complete survey, identify hotspots, classify objects based on their shapes, count the number of objects, return to the take-off point, and land safely on the ground. Refer Section 5 for scoring information. The flight course for autonomous operation is shown in Figure 3.
  - ❖ The order of the hotspot/ object identification is not relevant. For example, the UAS can identify 2 hotspots, and if it encounters the object area, it can perform object identification and then proceed with the survey of remaining hotspots.

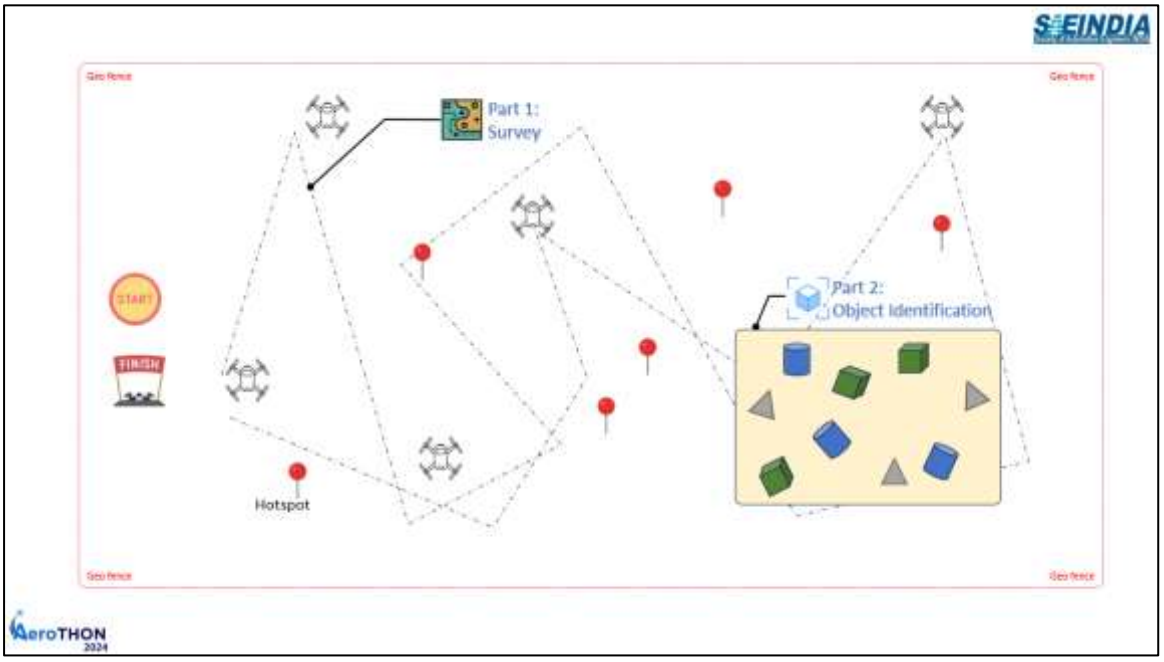

Figure 3: Flight Mission 2 – Autonomous - Mission Profile

4.4.6. Flight Mission 3 – UAS Obstacle Navigation and Payload Drop – Manual Operation

In this mission, the UAV is expected to take off from the designated area along with the payload and climb to the cruise altitude and fly towards the obstacle navigation hotspot. Clear the obstacle course, find the payload drop area and successfully deliver the payload.

- Take off, reach cruise altitude, fly towards the obstacle course. Upon reaching the obstacle navigation start point, the UAV must decent to near zero altitude for obstacle navigation course.
- Pilot should navigate the UAV through obstacles of varying difficulties placed on the ground.
- Pilot must skilfully manoeuvre the UAV to pass each obstacle without causing damage to the UAV or the obstacle.
- After successfully navigating the obstacle course, pilot may proceed to identify the target for payload drop.
- Once the target is identified, pilot needs descend to payload drop altitude and deliver the payload at the centre of the target.
- After dropping the payload, the pilot must bring the UAV back to the take off point at cruise altitude and land safely thus concluding the mission.
- Scoring will be provided for a successful flight mission. A flight is considered successful only if the UAS takes off, complete obstacle navigation course, drop the payload, return to the take-off point, and land safely on the ground. Refer Section 5 for scoring information.
- Scoring for the payload drop will be based on the distance at which the payload is dropped from the centre on the target area i.e., closer the payload is to the target centre, higher the score.
- Each team will be provided a flight time of 10 minutes to complete the mission. The time starts when the throttle input is increased for the take-off.
- Survey data and telemetry data must be shared with the jury members for enabling them to analyse and score timing and performance.
- While the Figure 4 depicts the mission profile, actual conditions on the field may vary slightly.

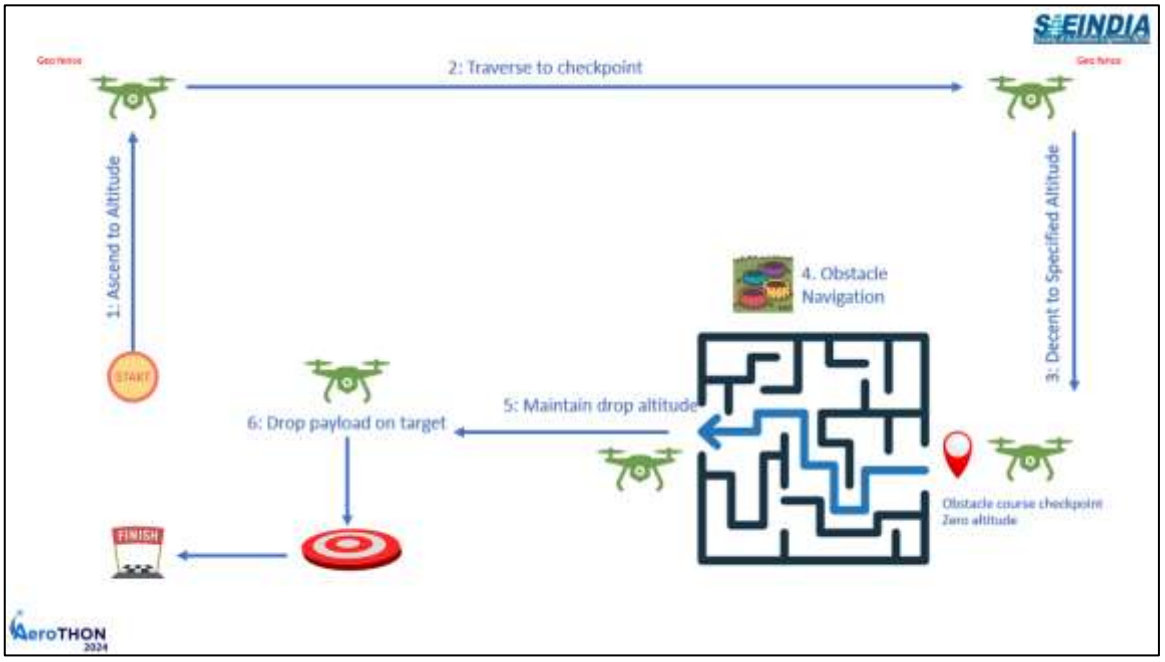

Figure 4: Flight Mission 3 – Manual - Mission Profile

4.4.7. Flight Mission 4 – UAS Payload Drop – Autonomous Operation

This autonomous mission performs all the tasks defined below without any manual intervention.

- In this mission, the UAS is expected to take off autonomously from the designated area, survey the field based on their chosen algorithm, capture the hotspots, find the target and deliver the payload and return to base.
- Identification of hotspots and payload drop will be done autonomously by means of computer vision, image processing and object detection algorithms.
- The complete mission will be in cruise altitude except for the payload drop.
- If the hotspot is identified, the UAV can store an image along with the timestamp for jury review. Capture more mock targets for more points.
- Upon identifying the target, UAV must lower to the payload drop altitude and deliver the payload.
- Once the payload is dropped, UAV needs to climb back to the cruising altitude and proceed toward the take-off zone and land safely. The whole mission needs to be accomplished autonomously without any manual intervention.
- Scoring for the payload drop will be based on the distance at which the payload is dropped from the centre on the target area i.e., closer the payload is to the target centre, higher the score.
- Survey data and telemetry data must be shared with the jury members for enabling them to analyze and score timing and performance.
- While the Figure 5 depicts the mission profile, actual conditions on the field may vary slightly.

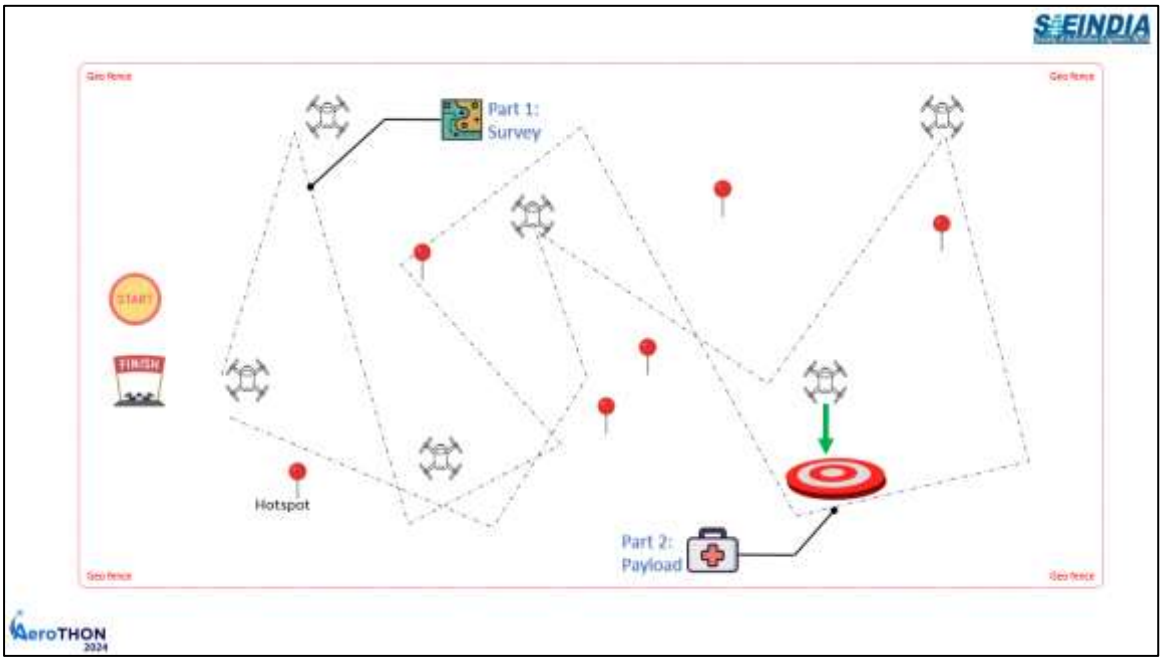

Figure 5: Flight Mission 4 – Autonomous - Mission Profile

5. EVALUATION CRITERIA

5.1. Design Report and Presentation (Phase 1)

Table 3: Evaluation Criteria for Design Report and Presentation

S.No.	Parameter	Max Score
1	**Technical Content**	**100**
1.1	Conceptual design	4
1.2	Preliminary Weight Estimation	3
1.3	Thrust Required Estimation (2) & Propulsion System Selection (2)	4
1.4	Aircraft Sizing (Rotor Arm (2), Hub, Wheelbase (2), Propeller Clearance (2), Landing gear (2))	10
1.5	Aircraft Performance (Power required estimation (3), Power System (battery) Selection (3), Endurance Estimation (4))	10
1.6	Material Selection	3
1.7	Subsystem Selection - Communication system (2), Control & Navigation System (3)	5
1.8	C.G. Calculation (2) & Stability Analysis (3)	5
1.9	Preliminary Computer Aided Design Model (2D Drafting Front view, Top view and Side View, 3D Model)	5
2	**Computational Analysis**	**5**
2.1	Optimized Final Design (Summary of Design Changes/Optimizations including the Final CAD model and 2D Drafting & C.G.)	5
2.2	Detailed Weight Breakdown (2), Aircraft Performance Recalculation (2) (T/W, Power Required for the mission & Endurance calculation), Final UAV Specifications (1) and Bill of Materials (3)	8
3	**Methodology for Autonomous Operation**	
3.1	Autonomous Flight	4
3.2	Autonomous Object Detection and Counting	5
3.3	Autonomous Payload Drop	4
4	**Innovation**	**10**
5	**Presentation**	**10**

5.2. Technical Presentation (Phase 2)

Table 4: Evaluation Criteria for Technical Presentation

S.No.	Parameter	Max Score
1	**Technical Presentation**	**25**
1.1	**Aircraft Design Overview - Prototype UAS must be the same design as design submitted in Phase – 1**	
	Design of Rotor Arm	0.5
	Motor Mount	0.5
	Hub	0.5
	Landing gear	0.5
	Overall Design	0.5
1.2	**Aircraft Performance Overview (Conformance to submitted design in Phase 1)**	
	T/W	0.5
	Power Consumption	0.5
	Endurance	0.5
1.3	**Mock Missions**	
	Mission 1: Video and Flight log	3
	Mission 2: Video and Flight log	3
	Mission 3: Video and Flight log	3
	Mission 4: Video and Flight log	3
1.4	**Surveillance System Design**	
	Strategy for data format (images/ videos)	0.5
	Data storage and transmission process	0.5
	Survey data retrieval approach	0.5
	Blue-print for such a system. Pitfalls and alternatives.	0.5
	Implementation and demo the system, training results, video.	2.5
1.4	**Computer vision and object identification**	
	Different approaches considered and selected for search area	0.5
	Algorithm selected for object identification and final selection reason	0.5
	Fall back strategy (in case of failure of object identification/ target search)	0.5
	Simulation results for search area and target identification	1
	Results of object identification training model file/ video.	2

5.3. Technical Inspection (Phase 2)

Table 5: Evaluation Criteria for Technical Inspection

S.No.	Parameter	Max Score
2	**Technical Inspection**	**25**
2.1	Aircraft Dimensions Conformance to 2D Drawings, Submitted during Phase – 1.	1
2.2	Use of the Same Components Selected in Phase - 1	
	Propulsion - Motor, ESC & Propeller	0.5
	Power System – Battery	0.5
	Control & Communication System - Flight Controller, Radio Transmitter & Receiver	0.5
2.3	Take-off Weight Same as submitted in the design report	
	Weight difference < 50g - 7 points	7
	Weight difference > 50g & < 100g - 5 points	
	Weight difference > 100g & < 200g - 2 points	
	Weight difference > 200g - No points	
2.4	Structural Integrity	
	All the components are secured well	0.5
	Proper wiring (i.e., no wires hanging, use of appropriate gauge wires and connectors)	0.5
	Secure fasteners - use of locknuts or thread locker for fasteners	0.5
	No structural components are loose or shaking	0.5
	Payload attachment	0.5
2.5	Other Checks	
	Proper control response (motor rpm) to Radio controller inputs	0.5
	Radio Range Check	0.5
	First Person View video transmission check	0.5
	Fail Safe Check	
	RTL for low battery	2.5
	RTL for datalink lost	2.5
	RTL for geo-fence breach	1.5
	Geo-Fence inputs	1.5
2.5	Miscellaneous	
	Aesthetics	2
	Inspector marks (this score is left to the purview of the inspector as he deems suitable based on his experience and interaction during the inspection)	1.5

5.4. Flight Mission – 1: Manual Operation

Table 6: Evaluation Criteria for Flight Mission – 1

S.No.	Parameter	Max Score
3	**Flight Mission 1**	**40**
3.1	Takeoff & Maintain Mission altitudes	4
3.2	Capture the Hotspots	12
3.3	Navigate to Object Identification Area	4
3.4	Object Detection and Classification	8
3.5	Count the objects	6
3.6	Return to Take-off point and Land	2
3.7	Within Time Completion	4

5.5. Flight Mission – 2: Autonomous Operation

Table 7: Evaluation Criteria for Flight Mission – 2

S.No.	Parameter	Max Score
4	**Flight Mission.2**	**50**
4.1	Takeoff & Maintain Mission altitudes	4
4.2	Capture the Hotspots (max 6)	15
4.3	Identify and navigate to Object Identification Area	5
4.4	Object Detection and Classification	10
4.5	Count the objects	8
4.6	Return to Take-off point and Land	4
4.7	Within Time completion	4

5.6. Flight Mission – 3: Manual Operation

Table 8: Evaluation Criteria for Flight Mission – 3

S.No.	Parameter	Max Score
5	**Flight Mission 3**	**50**
5.1	Takeoff, Maintain Mission altitudes and reach obstacle course start point	4
5.2	Capture the survey area (hotspots) on route to the obstacle start point	6
5.3	Obstacles Navigation	20
5.4	Identify the Target	4
5.5	Payload drop – Target point	10
5.6	Return to Take-off point and Land	2
5.7	Within Time Completion	4

5.7. Flight Mission – 4: Autonomous Operation

Table 9: Evaluation Criteria for Flight Mission – 4

S.No.	Parameter	Max Score
6	**Flight Mission 4**	**60**
6.1	Takeoff & Maintain Mission altitudes	4
6.2	Identify and Capture the hotspots	20
6.3	Identify payload drop target	4
6.4	Payload drop	4
6.5	Proximity to the target center	20
6.6	Return to Take-off point and Land	4
6.7	Within Time completion	4

Note: The evaluation criteria mentioned above highlight the area of focus the teams should concentrate. SAEINDIA reserves the right to fine-tune the evaluation criteria to be in line with the industry expectations and communicate the same to the teams.

6. DESIGN REPORT GUIDELINES FOR PHASE - 1

6.1. INTRODUCTION

Technical report writing is a skill that is different from informal writing – letters, notes, email – and, like all skills, needs practice to master them. The SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST 2024 provides an excellent opportunity for students to exercise this skill. This document provides guidelines to help design teams write clear, concise, and data-rich reports.

6.2. ORIGINAL WORK

The Technical Design Report shall be the team's original work for the current contest year. Resubmissions of previous and current year's design reports will not be accepted. Recitation of previous year's work is acceptable if and only if appropriately cited and credited to the original author(s). Plagiarism is forbidden in industry and academic practice. All references, quoted text and reused images from any source shall have an appropriate citation within the text and within the Technical Design Report's table of references, providing credit to the original author and editor.

Reports may be checked against previous and current years' submissions to determine if re-use, copying, or other elements of plagiarism are indicated.

For the SAEINDIA AEROTHON – UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST, plagiarism is defined as any of the following:

a) Use of information from textbooks, reports, or other published material without proper citation

b) Use of sections or work from previous SAE Aero Design contests without proper citation

If plagiarism is detected in the design report, the team will be disqualified, or points will be deducted as deemed by the rules committee/ jury depending on the amount of plagiarized content present in the design report.

The SAEINDIA AEROTHON – UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY CONTEST Rules Committee & SAEINDIA has the sole discretion to determine whether plagiarism is indicated, and the above rules are enacted. The above rules may be implemented at any time before, during, or for up to six (6) months after the contest.

6.3. ORGANIZATION OF CONTENTS

Reports are written for a person or group to read, and these readers have a purpose for reading the report. In the SAE contest, the readers are the jury, and their purpose in reading is to grade the paper. Therefore, the design team authors should write the design report using techniques that make it easy for the jury to grade them. Organizing the report for the reader's purpose is the first technique for effective technical writing.

Outline - The judge's grading criteria predominantly depend on the technical aspects. So, the teams are expected to,

- Explain the team's thought processes and engineering philosophy that drove them to their conclusions.
- Detail the methods, procedures, and where applicable, the calculations used to arrive at the presented solution.
- Cover these topics.
    - ❖ UAS configuration selection
    - ❖ UAS design including rotor arm, hub, landing gear, etc.
    - ❖ Subsystem Selection
    - ❖ UAS Performance
    - ❖ UAS C.G., stability, and control
    - ❖ Computational Analysis
    - ❖ Other as appropriate

It also covers the administrative aspects of the report – page limits, formats, and specific graphs and drawings. Although it may be harder to write the report to this outline, it will be easier for the jury to grade it. This outline also forces the team to address topics the jury **must** grade and develop necessary data.

6.4. WRITING PROCESS

Writing a multi-page design report can be made less daunting by using a multi-step process. The first step is described above, generating an outline that addresses the reader's purpose. The next steps, described below, help in generating a data-rich, well-edited design report.

Allocate Pages – Allocate 40 pages to the sections of the outline. The allocations should reflect the emphasis areas of the team's design. Do this before writing begins and adjust after reviewing the first draft. For each page of the design report, define the topic to be discussed and the message to be delivered. Make writing assignments for each page. Giving authors page-by-page assignments makes it easier to attack the writing – they are writing only one page at a time.

Create the Figures – Most juries will be engineers, and engineers are graphically inclined - they can understand a concept more easily when looking at a picture. Therefore, build each page around at least one figure. Create the figures first and review them before starting to write. Each figure needs a message which should be summarized in the figure title. Make the figures data-rich, but legible (9-point font is a minimum size - another advantage of using figures is that the rules do not constrain

type font or spacing on figures). Equations can be incorporated in figures to save space.

Draft the Text - Use text to highlight, explain, or further develop the major points of the figure. Writing guidelines for clarity and succinctness are presented in a subsequent section.

Edit the Text and Figures – Take the time to edit the document at least twice. A good approach is to perform one edit cycle based on a group review of the draft document (called a Red Team). Have the Red Team members read the document as juries, supplying them with a scoring sheet and a copy of the rules.

Create the Final Document – Although several persons may contribute to the writing process, one team member should make the final version. This person works to achieve a consistent style to the text and to make the messages consistent.

Schedule the Effort – Although this is the first step, it is described last so that the reader can see what the team needs to schedule! A good report takes more than a week to create. One month is a guideline for the duration of the writing effort. Create a schedule of the above tasks and status it regularly. An efficient method is to establish the outline, page allocations, and figures early in the project, so the team can generate the necessary data as the design progresses. This reduces both the last-minute cram and the amount of unused documentation.

6.5. DESIGN REPORT SPECIFICATIONS

6.5.1. Page Limit

The design report must not exceed forty (40) single-spaced, typewritten pages, cover page, table of contents and appendix. The maximum limit of the document is given below:

Document	Max. Number of Pages
Main content	30
Appendix- additional supporting material	10

Note: Statement of Compliance will not be counted toward the 40-page limit.

6.5.2. Electronic Report Format

All reports must be submitted in (.PDF) format only. The document should be submitted electronically, and no handwritten documents will be accepted.

6.5.3. Font

The minimum font size and type is Arial 12 point proportional.

6.5.4. Margin

The report margins shall be: 1” Left, 0.5” right, 0.5” top, and 0.5” bottom. Each page, except the cover page, Certificate of Compliance, 2D Drawing and technical data sheet shall include a page number.

6.5.5. Page size

All report pages shall be A4 portrait format.

6.5.6. Cover page

All Design Reports must feature a cover page that states the team's name, college or university, and team number. The cover page will count against the 30-page limit.

6.5.7. Submission of Reports

Teams are required to upload technical report in PDF file by the deadline date at the web link.

6.6. ELECTRONIC DOCUMENT SPECIFICATIONS

6.6.1. Format Size

Plan sheet must be in A3 page (PDF) format (11 x 17 inches). Plans must only consist of one (1) page and must have the US-standard third-order projection.

6.6.2. Required Views

The plans shall consist of a standard aeronautical three-view, using a US-standard third order projection; i.e., right side view in the lower left with the nose pointing right, top view above the right-side view also with the nose pointing right, and front view in the lower right.

6.6.3. Dimensions

At a minimum, the UAS must have the length, width, height, and CG location marked clearly and dimensioned in the submitted engineering drawings. All dimensions must be in Metric units to an appropriate level of precision. (Hint: four decimal places are too many!)

6.6.4. Summary Data

The plans must also contain a table with a summary of pertinent UAS data such as dimensions, empty weight, motor/engine make and model.

6.6.5. Weight and Balance Data

The plans must also contain a weight and balance table with a summary of pertinent UAS equipment (motor, battery, payload, etc.), location from datum in metric units, moment arms and resultant moment of CG.

- All UAS must have a designated UAS datum indicated on the 2D drawings.
- All UAS drawings must indicate the following static CG margins: forward CG limit, aft CG limit and empty weight CG. Hint: Weight and Balance worksheet should correspond with static margins on 2D drawings.

6.6.6. Other Required Markings

The plans must be marked with the team's name and university or institute name.

6.7. SUBMISSION DEADLINES

The Design Report and 2D drawing plans must be electronically submitted to SAEINDIA no later than the date indicated on the Action. Neither the Organizer nor the SAEINDIA is responsible for any lost or misdirected reports, plans, or Server routing delays. SAEINDIA will not receive any paper copies of the reports through regular mail or email.

7. PRESENTATION GUIDELINES FOR PHASE - 1

7.1. INTRODUCTION

Creating slides for presentation is a skill that is different from design report. PowerPoint Presentations skill is one of the effective visual communication tools that create the best first impression among the targeted audience. The SAEINDIA AEROTHON - UNCREWED AIRCRAFT SYSTEM (UAS) DESIGN, BUILD AND FLY
CONTEST 2024 provides an excellent opportunity for students to master their presentation skills and showcase their project to Jury.

7.2. GENERAL

Presentation slides should effectively capture the work of the team. Follow a logical sound structure to organize the presentation. Here are some tips for making an effective presentation.

- Plan and prepare your presentation professionally to deliver an effective message.
- Use visual points effectively, do not overwhelm your audience. A good PowerPoint presentation visual shouldn't complicate your message.
- Practice to perfection; rehearse your timing and delivery so that your points land as practiced with the Jury.
- Present with a relaxed calm and confident outward projection. Give your audience warmth, excitement, and energy.
- Avoid typos, cheesy clip art, and miscues like reading directly from your slides.

The team can identify preferably one or two team members to present their work in a compelling and influential manner to the Jury.

7.3. ORGANIZATION OF CONTENTS

Like the design report the presentation must all contain the following,

- Explain the team’s thought processes and engineering philosophy that drove them to their conclusions.
- Detail the methods, procedures, and where applicable, the calculations used to arrive at the presented solution.
- Cover these topics:
  - ❖ UAV configuration selection
  - ❖ UAV design including rotor arm, hub, landing gear, etc.
  - ❖ Subsystem Selection
  - ❖ UAV Performance

- UAV C.G., stability and control
- Computational Analysis
- Other as appropriate

Note: The teams/students shall have all the CAD and CAE files in the PC or Laptop they will be using during the presentation. During the presentation, the teams can open the CAD model files and Computational analysis files in the appropriate software and present them to the jury for validation. The teams are expected to have the following documents ready during their presentation – a) CAD files of the UAS b) FEA input file along with format details; & c) CFD input file along with format details.

7.4. TIME LIMIT

While there is no limit on the number of PowerPoint slides, Teams needs to complete their presentation within the allotted 15 minutes. In case teams are unable to complete their whole presentation, they would be stopped at whatever point they are at after end of 15 minutes. Post completion of the presentation, there would be 10 minutes Q&A with Jury.

8. REFERENCE BOOKS

- Introduction to UAV Systems - Paul Fahlstrom and Thomas Gleason
- Unmanned Aircraft Systems: UAS Design, Development and Deployment - Reg Austin
- Advanced Aircraft Design: Conceptual Design, Analysis and Optimization of Subsonic Civil Airplanes - Egbert Torenbeek
- Aircraft design: A conceptual approach - Daniel P. Raymer
- Introduction to Flight- John D. Anderson
- Fundamentals of Aerodynamics - John D. Anderson
- Airplane Performance and Design - John D. Anderson
- Flight stability and automatic control, Robert C. Nelson
- Airframe stress analysis and sizing – Michael Chun-Yung Niu
- Aircraft Structures, T.H.G. MEGSON (4th Edition)
- https://docs.px4.io/master/en/concept/ (Ty Audronis , Designing Purpose-Built Drones for Ardupilot Pixhawk 2.1: Build drones with Ardupilot)

APPENDIX A

STATEMENT OF COMPLIANCE

Certification of Qualification

Team Name: _____

University/Institute: _____

Faculty Advisor: _____

Faculty Advisor's Email: _____

Statement of Compliance

As Faculty Advisor, I certify that the registered team members are enrolled in collegiate courses. This team has designed the UAS for the SAE AEROTHON 2024 contest, without direct assistance from professional engineers, R/C model experts or pilots, or related professionals.

_____ _____

Signature of Faculty Advisor Date

Team Captain Information:

Team Captain's Name: _____

Team Captain's E-mail: _____

Team Captain's Phone: _____

Note:
A copy of this statement needs to be included in your Design Report as page 2

APPENDIX B

Engineering Change Request Form

Change Request	
Team Name:	Team ID:
Institute:	
Change Requester:	Date:
Change Requests information (Fill in appropriate information)	
Change Description:	
Details of Change:	
Alternates considered before selecting this change:	
Impact to previous Design:	
Why proposed change request should be approved? Explain	
What are the consequences if proposed change (s) is not implemented? Explain	

I have reviewed the information contained in this change request form and agree

Signature of Team Lead ***Signature of Faculty Advisor***

**Use additional sheets if the information cannot be accommodated in above form*