



AeroTHON 2026



Track 2

Track 2: Next-Gen Air Mobility Challenge

Hybrid VTOL UAS – Conceptual & System Design Challenge

Theme: Aerial Surveillance and Rapid Delivery

Rule Book

**Revision 1
April 2026**

REVISION HISTORY

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FOREWORD

Welcome to SAEINDIA AEROTHON 2026 – Next Gen Air Mobility Challenge (Hybrid VTOL UAS) – Design Evaluation Contest.

This track has been introduced to align with the rapidly evolving landscape of Uncrewed Aircraft Systems (UAS) and Advanced Air Mobility (AAM), with a strong emphasis on design-driven engineering excellence. The system requirements are developed to reflect real-world aerospace challenges, providing students with valuable exposure to industry-oriented design practices and methodologies. Unlike the Rotorcraft Systems Challenge (Track 1), this track is focused exclusively on design evaluation, encouraging participants to develop a comprehensive, feasible, and mission-driven Hybrid VTOL UAS concept.

The contest is planned in a single phase:

Phase 1: Design Report & Technical Presentation

Participating teams are required to:

- Submit a detailed Technical Design Report (TDR) of their proposed Hybrid VTOL UAS,
- Ensure compliance with all design requirements and guidelines specified in this rulebook,
- Present their design to a panel of jury members comprising industry experts and academia.

The evaluation will be based on the depth of engineering analysis, design justification, system integration, and feasibility of the proposed solution. This challenge is intended to simulate a real-world aerospace design environment, where teams are expected to perform trade studies, make informed engineering decisions, and justify their design choices with clarity and technical rigor.

Universities/Institutions may nominate multiple teams, provided they meet the team formation requirements outlined in this document. Each team must present a unique and independent design.

Teams are strongly advised to **pay attention** to the bold and *italicized text* throughout this rulebook, as these indicate important updates, clarifications, and critical requirements. Participants are encouraged to regularly check the official SAEINDIA AeroTHON webpage for announcements, updates, and rule interpretations. We wish all participants the very best in this challenging and rewarding engineering journey.

SAEINDIA Aerospace Forum
SAEINDIA
AEROTHON 2026 Organising Committee

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1.0. INDUSTRY CONTEXT & COMPETITION OVERVIEW

1.1 OVERVIEW

AeroTHON 2026 continues to be a crucial initiative for engineering students in India as the country accelerates its push to become a global leader in Uncrewed Aircraft Systems (UAS), Advanced Air Mobility (AAM), and next-generation drone technologies. This vision aligns with the Government of India's **Atmanirbhar Bharat Abhiyan**, which emphasizes indigenous development and self-reliance in critical technologies, including drones and autonomous aerial systems.

Globally, the UAS industry is experiencing rapid expansion, driven by advancements in artificial intelligence, sensing technologies, autonomy, and connectivity. Uncrewed systems are increasingly being deployed across a wide range of sectors such as agriculture, infrastructure inspection, logistics, disaster response, environmental monitoring, and defense operations. In particular, Hybrid VTOL systems are emerging as a key enabler for future aerial mobility solutions due to their ability to combine vertical take-off capability with efficient forward flight.

India's drone ecosystem is also expanding rapidly, supported by progressive regulatory reforms, government initiatives, and increasing adoption across commercial, industrial, and public sectors. The country's drone market is expected to witness significant growth in the coming years, driven by technological innovation, expanding applications, and supportive policies that encourage indigenous development and manufacturing.

In parallel, the Government of India has introduced several initiatives to promote domestic drone innovation and manufacturing, including the Production-Linked Incentive (PLI) scheme, Drone Shakti initiatives, and expanded research and development programs. These initiatives aim to strengthen the domestic drone ecosystem, encourage local technology development, and position India as a global hub for drone innovation.

In this context, the SAEINDIA Aerospace Forum is organizing the **SAEINDIA AeroTHON 2026 – Next Gen Air Mobility Challenge**, a **design-focused competition** centered on **Hybrid VTOL UAS systems**. The primary objective of this challenge is to develop students' capabilities in **conceptualizing, analyzing, and designing advanced aerial mobility platforms**, preparing them to contribute effectively to the rapidly evolving drone and air mobility industry.

This competition provides undergraduate and graduate engineering students with a **real-world engineering design experience**, exposing them to the practical challenges faced in aerospace system development. Participating teams will conduct trade studies, perform engineering analyses, and make design decisions to develop a **Hybrid VTOL UAS** that satisfies the defined mission requirements and system constraints.

Unlike traditional design-build-fly competitions, this track focuses exclusively on the **design and evaluation phase**, where emphasis is placed on:

- System-level engineering thinking
- Design feasibility and justification
- Integration of multidisciplinary subsystems
- Alignment with real-world mission scenarios

As part of the competition, teams will design a **complete and feasible UAS architecture** capable of performing **aerial surveillance and rapid payload delivery missions**, particularly in applications such as **medical supply delivery in urban and remote regions**.

This process requires students to apply multidisciplinary engineering principles, including:

- Aerodynamics
- Propulsion systems
- Structures and materials
- Avionics and control systems
- Systems engineering and integration

In essence, the **Next Gen Air Mobility Challenge** offers students a unique opportunity to experience the **engineering design lifecycle of a Hybrid VTOL UAS**, from conceptual design and configuration trade studies to subsystem integration, performance evaluation, and final design validation.

Through initiatives such as AeroTHON, SAEINDIA aims to nurture the next generation of aerospace and drone engineers in India. As the nation progresses toward becoming a global hub for drone technology and advanced air mobility, there is a growing need for skilled professionals capable of designing, developing, and deploying advanced unmanned systems.

By providing students with a platform to innovate, analyze, and demonstrate engineering solutions aligned with real-world applications, AeroTHON plays a vital role in strengthening India's drone ecosystem and supporting the country's vision of technological leadership in autonomous aerial systems.

To support the development of these skills, this track is structured as:

Phase 1: Design Report & Presentation

In this phase, students will focus on designing a Hybrid VTOL UAS that adheres to the defined technical requirements and mission objectives. The design process must include:

- Configuration trade studies
- Engineering analysis and justification
- System integration approach
- Performance evaluation

Teams are required to submit a **comprehensive Technical Design Report (TDR)** and present their design to a panel of experts. This phase emphasizes the importance of **engineering rigor, clarity of documentation, and effective technical communication**, reflecting real-world industry expectations.

1.2 OBJECTIVES

To design a Fixed-Wing Hybrid VTOL Uncrewed Aircraft System (UAS) capable of executing a realistic aerial surveillance and rapid delivery mission, with emphasis on:

1. Engineering accuracy in analysis and design justification
2. Robust system integration across all subsystems
3. Optimized performance aligned with mission requirements
4. Feasibility for manufacturing and real-world implementation

1.3 RULES AND ORGANIZER AUTHORITY

1.3.1 General Authority

SAEINDIA AEROTHON – NEXT GEN AIR MOBILITY CHALLENGE (HYBRID VTOL UAS) – DESIGN EVALUATION CONTEST 2026 Committee reserves the right to revise the schedule of the contest and/or interpret or modify the contest rules at any time, in any manner deemed necessary for the efficient conduct of the event.

1.3.2 Rules Authority

The SAEINDIA Aerospace Forum holds the responsibility and authority over the rules of the **Next Gen Air Mobility Challenge (Hybrid VTOL UAS) – Design Evaluation Contest 2026**, issued under SAEINDIA.

Official announcements from the Organizing Committee shall be considered part of these rules and carry equal validity. Any ambiguities or questions regarding the interpretation or intent of the rules will be resolved by the Organizing Committee or SAEINDIA officials.

1.3.3 Rules Validity

The rules published on the SAEINDIA website for the AeroTHON 2026 Track 2 competition are the only valid rules for the current contest year. Rules from previous editions are not applicable.

1.3.4 Rules Compliance

By registering for the competition, all participating team members, faculty advisors, and associated representatives agree to comply with these rules, including any updates, interpretations, or procedures issued by the Organizing Committee.

All participants are expected to co-operate fully with event officials, jury members, and organizers at all times.

1.3.5 Understanding the Rules

Participating teams are responsible for reading and understanding the rules in their entirety. Section headings are provided for ease of reference and do not affect the interpretation of the rules.

1.3.6 Consideration of “Participation” in the contest

Teams, team members, faculty advisors, and associated representatives listed during registration are considered “participants” from the time of registration until the conclusion of the contest or formal withdrawal.

1.3.7 Violations of Rule Intent

Any action that violates the intent of a rule will be treated as a violation of the rule itself. Clarifications may be sought from the Organizing Committee.

1.3.8 Conditions and Penalties

The Organizing Committee reserves the right to modify evaluation criteria, scoring parameters, or penalties to ensure fairness and effective assessment of designs under specific conditions.

1.3.9 Mode of Communication

The official mode of communication for the event will be through the registered email address provided on the event website:

<https://saeindia.org/aerathon2026/>.

Teams are required to regularly monitor their registered email.

Communication via WhatsApp or other messaging platforms is strictly for convenience and alerts only and shall not be considered official.

Teams must not contact industry experts, jury members, or organizers through

social media or unofficial channels regarding the competition. Any such attempt may lead to disciplinary action.

1.3.10 Force Majeure

The AeroTHON 2026 Organizing Committee and SAEINDIA shall not be held responsible for any delay or failure in conducting the event due to Force Majeure conditions, including but not limited to:

- Natural disasters (earthquakes, floods, storms, pandemics, etc.)
- War, civil disturbances, or government actions
- Industrial disruptions or resource shortages
- Legal restrictions or court orders
- The Organizing Committee will notify teams regarding such events. If conditions prevent the conduct of the competition, the event may be postponed, modified, or cancelled

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 the Section 1.7 are required to be paid within 15 days of registration for offline registrations. For online registrations, the fee payment must be made at the time of registration.

1.5 OFFICIAL LANGUAGES

The official language of the competition is **English**. All reports, presentations, and communications must be in English.

1.6 CONTEST PHASES

1.6.1 Phase 1: Design Report & Presentation

The AEROTHON organizing committee reserves the right to select the top-performing teams from Phase1 to advance to Phase 2, with the number of teams varying based on performance in Teams will submit innovative Hybrid VTOL UAS designs

Designs will be evaluated by industry and academic experts

Evaluation will focus on:

- Engineering depth
- Design feasibility
- System integration
- Innovation
- Scalability & Future Growth Potential

This track is **design-only**, and no build or flight phase is included. The presentation and subsequent Jury evaluation would be conducted virtually using appropriate collaborative platform tools like Microsoft Teams / Webex etc. and notified in advance. **Awards will be presented to the top-performing teams** based on the overall in the competition.

IMPORTANT DATES

Kindly refer to the AeroTHON 2026 website for the latest updates on the dates and timelines (<https://saeindia.org/aerathon2026/>)

1.7 REGISTRATION AND FEES

A team can comprise a minimum of 5 students and a maximum of 10 students of multiple disciplines with 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.5,000/- (Rupees Twenty Thousand only) per team excluding 18% GST**. To register for AEROTHON and registration guidelines visit: <https://saeindia.org/aerathon2026/>

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.

1.8 CANCELLATION OF CONTEST REGISTRATION

Registration fees are not refundable and non-transferable to other team or to subsequent year's competition. Teams registering for **Next Gen Air Mobility Challenge (Hybrid VTOL UAS) – Design Evaluation Contest 2026** 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 two days after this notification and no refund will be given.

1.9 EXPECTATIONS

1.9.1 Design with no professional's involvement

The UAS must be designed solely by student team members.

- Faculty and mentors may provide guidance only and No direct design contribution is allowed
- Faculty Advisor must sign compliance declaration

1.9.2 Original design

- Any UAS presented in the contest must be an original design, with the configuration conceived and developed by the student team members. Replication or direct copying of existing UAS designs is not permitted.
- **Photographic scaling, reverse engineering, or direct reproduction of any existing model UAS design is strictly prohibited.** Teams must demonstrate that their design is the result of their own conceptual development and engineering analysis.

1.9.3 Unique designs

Universities or institutions may register more than one team for the **Next Gen Air Mobility Challenge (Hybrid VTOL UAS) – Design Evaluation Contest 2026**. However, each team entry must present a unique and independently developed UAS design that is significantly different from the others.

If multiple teams from the same university or institution submit designs that are **not significantly different**, as determined by the **Organizing Committee**, the university/institution will be considered to have **only one valid entry**. In such cases, only **one team will be permitted to participate in the contest**. For example, two designs having the **same configuration, motor layout, and overall dimensions** will not be considered significantly different.

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.

2.0. UAS DESIGN REQUIREMENTS

The objective of this year's contest is to design a Fixed-Wing Hybrid VTOL Uncrewed Aircraft System (UAS) capable of performing a realistic aerial surveillance and rapid payload delivery mission, demonstrating strong engineering fundamentals, system integration, and feasibility.

The proposed UAS shall be designed to operate in scenarios requiring **efficient long-range flight combined with vertical take-off and landing capability**, enabling operations in both **urban and remote environments**.

As part of the mission definition, the UAS should be capable of:

- Performing **vertical take-off and landing** in constrained areas
- Transitioning efficiently between hover and forward flight modes
- Conducting **aerial surveillance of the target area** using onboard sensing systems
- Identifying and assessing the delivery zone based on mission requirements
- Executing **accurate and controlled payload delivery**, suitable for applications such as medical supply transport
- Ensuring safe return to the base location after mission completion

Teams are required to design their UAS with a strong focus on:

- **Hybrid VTOL system integration** (lift + cruise configuration)
- **Aerodynamic and propulsion efficiency**
- **Stable flight performance across all flight regimes (hover, transition, cruise)**
- **Reliable payload integration and delivery mechanism**
- **Autonomy-ready architecture**, where applicable for mission execution

The design must demonstrate the capability to meet the mission requirements through **engineering analysis, system-level justification, and realistic performance estimation**, though physical flight demonstration is not part of this track.

2.1 DESIGN REQUIREMENTS

The design requirements of the UAS are listed in **Table 1**. Teams must ensure that their proposed design complies with all the specified constraints while meeting the mission objectives.

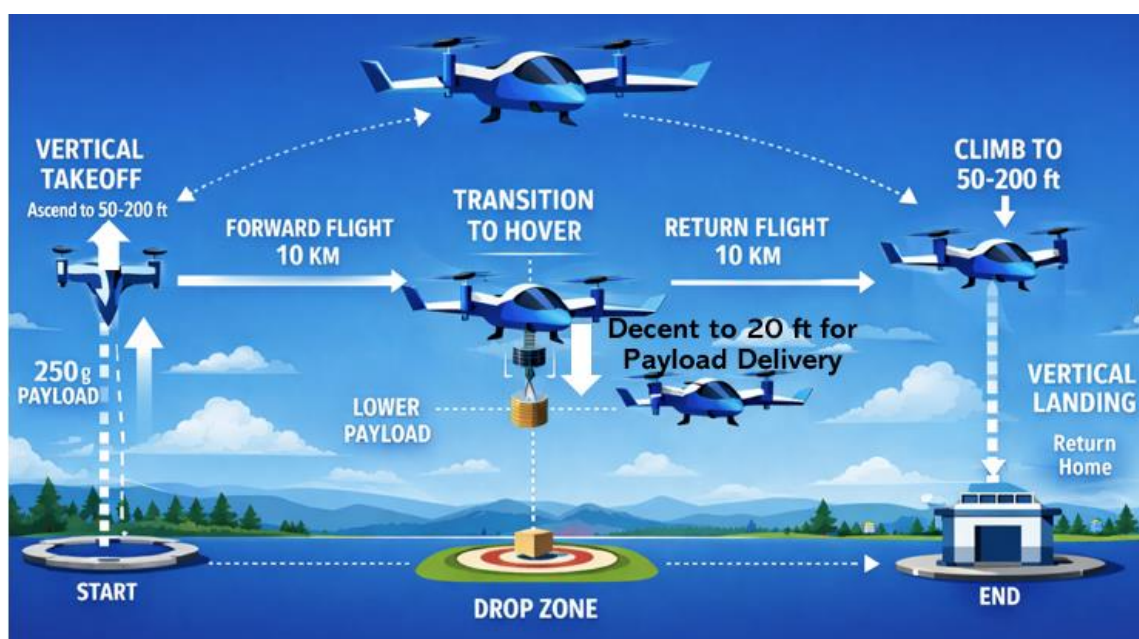
Table 1: UAS Design Requirements

Sl. No.	Parameter	Requirement/Limitation
1.	UAS Type	Fixed-Wing Hybrid VTOL (eVTOL)
2.	UAS Category	Small UAS
3.	UAS MTOW	MTOW 4 kg Max – Including Payload
4.	Payload Capacity	Minimum 250 grams (no upper limit within MTOW constraint)
5.	Propulsion Type	Electric
6.	Mission Range & Altitude	20 Km & 200 ft
7.	Communication System Range	Must be justified based on mission requirements

Note: Teams shall design a payload integration and delivery mechanism suitable for rapid delivery applications such as medical supply transport. The payload system must ensure:

- Secure integration within the UAS structure
- Controlled and precise delivery at the target location
- Minimal impact on flight stability and performance

Payload dimensions and configuration are not fixed, allowing teams flexibility to innovate based on their mission concept and design approach.



3.0. PHASE 1: TECHNICAL DESIGN REPORT & PRESENTATION

In Phase 1, participating teams are required to submit a comprehensive Technical Design Report (TDR) describing their proposed Fixed-Wing Hybrid VTOL Uncrewed Aircraft System (UAS). The report must strictly adhere to the design requirements, mission objectives, and constraints specified in this rulebook.

Teams shall clearly demonstrate:

- Technical feasibility of the proposed system
- Design methodology and engineering approach
- System integration strategy for Hybrid VTOL configuration
- Leverage Model Based System Engineering in the design
- Innovation and performance optimization
- Feasibility for manufacturing and real-world deployment

The design report must include detailed descriptions of:

- Airframe configuration (fixed-wing + VTOL integration)
- Propulsion architecture (lift and cruise systems)
- Avionics and control systems
- Payload integration and delivery mechanism
- Transition mechanism (hover to forward flight)
- Safety considerations and risk mitigation
- Mission-oriented system performance

Teams are strongly encouraged to support their design decisions using:

- Engineering calculations
- Trade studies
- Simulations to justify the design requirements are met
- Analytical justification

In addition to the written submission, teams will present their design to a panel of industry experts and academic professionals.

3.1 TECHNICAL DESIGN REPORT

The Technical Design Report is the primary medium through which teams communicate their engineering design to the judges. The report must clearly explain:

- Design philosophy and decision-making process
- System architecture and configuration selection
- Engineering analysis supporting the design
- Suitability of the UAS for the defined mission

Teams must submit the report as per the timeline and present their design using a structured presentation format.

Technical Design Report Contents

The Technical Design Report (TDR) submitted in Phase 1 must clearly document the conceptual development, engineering analysis, and final design of the proposed UAS. The report shall include, but not be limited to, the following sections.

a) Conceptual Design

➤ High-Level Configuration Overview

Provide a detailed description of the overall UAS configuration, including:

- Hybrid VTOL configuration type (without prescribing a specific architecture)
- Arrangement of lifting surfaces and propulsion units
- Payload placement and system layout
- Design rationale based on mission requirements

b) Detailed Design

➤ Preliminary Weight Estimation

Estimate the initial weight distribution, including:

- Structural components
- Propulsion system
- Avionics
- Payload

➤ Thrust Requirements Estimation

Define thrust and power requirements for:

- Vertical take-off and hover
- Transition phase
- Cruise flight

➤ Propulsion System Selection

Select and justify propulsion architecture, including:

- Lift propulsion system
- Cruise propulsion system
- Power source and energy system

➤ UAS Sizing

Provide sizing parameters relevant to Hybrid VTOL configuration:

- Wingspan and wing area
- Fuselage dimensions
- Rotor/propeller sizing
- Landing gear configuration
- Control surface dimensions

➤ UAS Performance Estimation

Estimate key performance parameters:

- Power consumption across flight regimes
- Endurance and range
- Cruise efficiency
- Payload impact on performance

➤ **Material Selection**

Justify materials used considering:

- Weight optimization
- Structural strength
- Manufacturability

➤ **Subsystem Selection**

Identify and justify key subsystems:

- Communication system
- Navigation and control system
- Avionics and sensors
- Power management system

➤ **Center of Gravity (C.G.) Estimation & Stability Analysis**

Calculate Provide:

- C.G. estimation across mission conditions
- Stability considerations for both hover and forward flight
- Transition stability considerations

➤ **Preliminary CAD Model**

Submit:

- 2D drawings (top, front, side views)
- 3D CAD model showing system integration

➤ **Computational Analysis**

Perform analysis such as:

- Aerodynamic evaluation
- Structural assessment
- Performance simulations

➤ **Optimized Final Design from Baseline Design**

Provide:

- Final configuration after design iteration
- Updated CAD models
- Revised C.G. and system layout

- **Detailed Weight Breakdown & C.G. Analysis**
Provide complete weight distribution and final C.G. analysis
- **UAS Performance Recalculation**
Re-evaluate:
 - Thrust-to-weight ratio
 - Power requirements
 - Endurance and mission capability
- **Final UAS Specifications and Bill of Materials (BoM)**
- Submit a detailed specification of the final UAS design, along with an exhaustive Bill of Materials (BoM), listing all components used in the construction of the UAS.

Summary of Innovations

- Provide a concise summary of the innovative aspects of the proposed **Hybrid VTOL aircraft design**. Teams should clearly highlight novel configurations (e.g., tilt-rotor, tilt-wing, lift + cruise, distributed propulsion), advanced technologies, or unique integration strategies that distinguish their design from conventional aerial mobility solutions.
- Emphasis should be placed on innovations in **vertical-to-forward flight transition**, propulsion architecture, flight control strategies, and aerodynamic efficiency across multiple flight regimes.
- Teams are encouraged to describe any advancements in **energy systems (hybrid/electric), autonomy, urban air mobility integration, noise reduction, safety, or redundancy features** that enhance operational feasibility.
- If applicable, explain how these innovations contribute to improved **performance, reliability, efficiency, scalability, and mission effectiveness**, particularly in the context of next-generation air mobility applications.

Refer to Sections 4.0, 5.0, and 6.0 for detailed information on the evaluation criteria, Technical Design Report submission requirements, and presentation guidelines.

3.2 DESIGN PRESENTATION

In addition to the Technical Design Report, teams are required to present their proposed Hybrid VTOL aircraft design to a panel of jury members comprising industry experts, subject matter specialists, and academic professionals.

The presentation should clearly communicate the key elements of the team's design process, demonstrating how the proposed **Hybrid VTOL system** meets the mission objectives and next-generation air mobility requirements. Teams are expected to explain their design methodology, engineering analyses, subsystem selections, and the rationale behind major design decisions.

Special emphasis should be given to **VTOL configuration selection, transition mechanism (vertical to forward flight and vice versa), propulsion system architecture (electric propulsion), flight control strategy, and aerodynamic performance across different flight regimes.**

The presentation should be structured in a manner that effectively engages an audience with diverse technical backgrounds, ensuring that the content is technically sound while remaining clear and comprehensible. The use of visual aids such as slides, diagrams, CAD models, simulations, system architecture diagrams, and **transition sequence illustrations** is strongly encouraged to support the explanation of the design and technical concepts.

Teams must also be prepared to respond to questions from the jury panel and justify their design decisions, demonstrating a thorough understanding of **Hybrid VTOL design challenges**, including stability, control, energy management, structural considerations, and system integration trade-offs.

4.0. EVALUATION CRITERIA

4.1 PHASE 1 - DESIGN REPORT SUBMISSION

PHASE 1 - DESIGN REPORT EVALUATION – 100 Marks		
Parameter		Score
1	Aircraft Design & Engineering Calculations	40
1.1	Configuration Selection & Design Rationale (Lift + Cruise justification, trade studies)	4
1.2	Mission Profile Definition & Design Requirements	3
1.3	Preliminary Weight Estimation (Detailed MTOW breakdown with iteration)	5
1.4	Thrust & Power Calculations (Hover, Cruise, Transition regimes)	6
1.5	Wing Sizing & Airframe Layout (Wing loading, AR, planform selection)	5
1.6	Rotor/Propeller Sizing (Disk loading, placement, interference considerations)	5
1.7	Energy System Sizing (Battery/Hybrid system, power budget, endurance validation)	4
1.8	CG Estimation & Mass Distribution (with loading cases)	4
1.9	Stability Analysis (Static stability in cruise + qualitative hover stability)	4
2	Aerodynamics & Flight Physics	20
2.1	Aerodynamic Analysis (Lift, Drag, polars, drag breakdown)	6
2.2	Multi-Regime Aerodynamics (Hover, transition, cruise interaction effects)	5
2.3	Propeller–Wing / Rotor Interaction Effects	3
2.4	Performance Estimation (Range, endurance, climb, cruise efficiency)	4
2.5	Design Optimization (Trade-offs: wing loading, power vs endurance, efficiency)	2
3	Computational Analysis (CFD & Simulation)	20
3.1	CFD Analysis Quality (Mesh, boundary conditions, solver approach)	6
3.2	Aerodynamic Results (Pressure contours, flow behavior, drag/lift validation)	5
3.3	Correlation with Analytical Results	3
3.4	Structural Analysis (FEM for wing, arms, critical joints – (loads, free body diagrams))	3
3.5	Flight Simulation / Mission Modeling (Using any Simulation Software)	3
4	Propulsion, Systems & Integration	10
4.1	Propulsion System Architecture (Lift + cruise integration)	3
4.2	Control Strategy (Control allocation: rotors vs control surfaces) Avionics & System Integration (basic architecture clarity)	4
4.3	Transition Strategy (VTOL ↔ Cruise mechanism and control logic)	3

5	Safety, Reliability & Feasibility	5
5.1	Redundancy & Fail-Safe Strategy (motor failure, power loss, control failure)	3
5.2	Risk Assessment & Operational Feasibility	2
6	Innovation	5

Participants must bring innovative solutions to address challenges in the Hybrid VTOL industry, such as battery life, safety, and regulations. Innovation should span the UAS life cycle—design, manufacturing, testing, operations, and maintenance—focusing on efficiency, autonomy, and sustainability. Solutions should leverage advanced materials, AI, and smart systems to enhance performance and overcome current limitations.

4.2 PHASE 1 - TECHNICAL PRESENTATION

PHASE 1 - TECHNICAL PRESENTATION – 50 Marks		
Parameter		Score
1	Aircraft Design & Configuration	10
Assessment of overall Hybrid eVTOL configuration, system architecture, and justification of design choices in alignment with mission requirements.		
2	Engineering Calculations & Sizing	12
Evaluation of the accuracy and completeness of weight estimation, thrust and power calculations, wing and rotor sizing, and energy system design.		
3	Aerodynamics & Flight Performance	10
Assessment of aerodynamic analysis across hover, transition, and cruise regimes, including performance estimation and design trade-offs.		
4	Computational Analysis & Design Validation	7
Evaluation of CFD and simulation work, including methodology, result interpretation, and correlation with analytical calculations.		
5	Flight Mechanics, Control & Transition Strategy	3
Assessment of VTOL—cruise transition approach, control strategy, and stability considerations for Hybrid eVTOL operation.		
6	Presentation Quality & Technical Communication	8
Evaluation of clarity, structure, use of visuals, and the team’s ability to effectively communicate and defend their design.		

4.3 PHASE 1 - TOTAL SCORE

PHASE 1 - TOTAL SCORE – 150 Marks		
EVENTs		Score
1	TECHNICAL DESIGN REPORT	100
2	TECHNICAL PRESENTATION	50
TOTAL SCORE		150

5.0. DESIGN REPORT GUIDELINES FOR PHASE 1

5.1 INTRODUCTION

Technical report writing is a skill that is different from informal writing – letters, notes, email – and, like all skills, needs the practice to master them. The SAEINDIA AEROTHON – NEXT GEN AIR MOBILITY CHALLENGE (HYBRID VTOL UAS) – DESIGN EVALUATION CONTEST 2026 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.

5.2 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 – NEXT GEN AIR MOBILITY CHALLENGE (HYBRID VTOL UAS) – DESIGN EVALUATION CONTEST 2026, 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 – NEXT GEN AIR MOBILITY CHALLENGE (HYBRID VTOL UAS) – DESIGN EVALUATION CONTEST 2026 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.

5.3 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.

5.4 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.

5.5 DESIGN REPORT SPECIFICATIONS

5.5.1 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.

5.5.2 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.

5.5.3 Font

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

5.5.4 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.

5.5.5 Page size

All report pages shall be A4 portrait format.

5.5.6 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.

5.5.7 Submission of Reports

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

5.6 ELECTRONIC DOCUMENT SPECIFICATIONS

5.6.1 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.

5.6.2 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.

5.6.3 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!)

5.6.4 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.

5.6.5 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.

5.6.6 Other Required Markings

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

5.7 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.

6.0. PRESENTATION GUIDELINES FOR PHASE 1

6.1 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 – ROTORCRAFT SYSTEMS CHALLENGE (UAS) – DESIGN, BUILD AND FLY CONTEST 2026 provides an excellent opportunity for students to master their presentation skills and showcase their project to Jury.

6.2 GENERAL

Presentation slides should effectively capture the work of the team. Follow a logically 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 overwhelming 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.

6.3 ORGANIZATION OF CONTENTS

Similar to 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
 - ❖ 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

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

1. CAD files of the UAS

2. FEA input file along with format details
3. CFD input file along with format details.

6.4 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 the end of 15 minutes. Post completion of the presentation, there will be 10 minutes of Q&A with Jury Panel.

7.0. REFERENCE BOOKS

Participants are encouraged to refer to the following standard textbooks and technical resources for developing a rigorous and engineering-driven Hybrid eVTOL aircraft design:

1. Aircraft Design & UAS Systems

Introduction to UAS 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

2. Aerodynamics & Flight Mechanics

Introduction to Flight – John D. Anderson

Fundamentals of Aerodynamics – John D. Anderson

Aircraft Performance and Design – John D. Anderson

3. Stability, Control & Flight Dynamics

Flight Stability and Automatic Control – Robert C. Nelson

4. Structures & Stress Analysis

Airframe Stress Analysis and Sizing – Michael Chun-Yung Niu

Aircraft Structures (4th Edition) – T. H. G. Megson

5. **Flight Control & Autopilot Systems**

PX4 Developer Guide – Flight control architecture and system integration

(Reference: Ty Audronis, “Designing Purpose-Built Drones for Ardupilot Pixhawk 2.1”)

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 2026 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