SAEINDIA Bengaluru Section

Presents

Rule Book for 2018 edition

Foreword

Hello everyone! It is our immense pleasure to welcome you all to SAE IBS Aero Design Challenge 2018.

"Aero Design Challenge -2018" is a regular and micro class design competition initiated by SAE IBS for the first time with huge enthusiasm to bring and enhance good engineering approach and practice in graduates. The design constraints and scoring strategies were formulated to align with real light weight unmanned air vehicle requirements and provide a most realistic platform for undergraduate and postgraduate engineering students. The scoring calculation is made to given equal importance for both the design process and interpersonal communication skills.

First, The Regular Class is the glow engine the purpose to develop the fundamental understands of flight.

Second, Micro Class design challenge is to design light-weight, UAV style aircraft that can be quickly deployed from a small package. is an all-electric class designed to help students engage in trades between two potentially conflicting requirements, carrying the highest payload fraction possible, while simultaneously pursuing the lowest empty weight possible.

SAE IBS Aero Design Challenge competition has been at capacity in recent years. To help student's teams multiple entries from one institute/college/university has been put into effect.

This means that an institute/college/university can have a maximum Regular Class and Micro Class participation. For those institutions with larger teams we encourage you to pool resources and exercise your project management skills to bring together the larger team and execute on the project. There are many other design constraints that will only be revealed by careful reading. It should provide for easier reading and comprehension.

One last bit of advice…read the rules until you are VERY familiar with them…then read them again. The bar has now been raised. Are you up to the challenge?

SAEIBS Aero Design Rules Committee Members,
Bengaluru Section

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1 COMPETITION REQUIREMENTS

1.1 INTRODUCTION

Official Announcements and Competition Information

SAEINDIA Bengaluru Section (IBS) Aero Design features two classes of competition— Regular and Micro.

- **The Regular Class** is the glow engine the purpose to develop the fundamental understands of flight.
- **The Micro Class** is an all-electric class designed to help students engage in trades between two potentially conflicting requirements, carrying the highest payload fraction possible, while simultaneously pursuing the lowest empty weight possible.

1.2 SAE AERO DESIGN RULES AND ORGANIZER AUTHORITY

1. General Authority

SAE India Bangalore Section and the competition organizing bodies reserve the rights to revise the schedule of any competition and/or interpret or modify the competition rules at any time and in any manner that is, in their sole judgment, required for the efficient and safe operation of the event or the SAE IBS Aero Design series as a whole.

2. Penalties

SAE India Bangalore Section and the competition organizing bodies reserve rights to modify the points and/or penalties listed in the various event descriptions; to accurately reflect the operations execution of the events, or any special conditions unique to the site.

3. Rules Authority

The SAE Aero Design Rules are the responsibility of the SAE Aero Design Rules Committee and are issued under the authority of the SAE International India Bangalore Section Committee. Official announcements from the SAE Aero Design Rules Committee, SAE India Bangalore Section Committee or the other SAE Bangalore Section Organizers shall be considered part of and have the same validity as these rules.

4. Rules Validity

The SAE Aero Design Rules posted on the SAE IBS Website and dated for the calendar year of the competition are the rules in effect for the competition. Rule sets dated for other years are invalid.

5. Rules Compliance

By entering an SAE Aero Design competition, the team members, faculty advisors and other personnel of the entering university agree to comply with, and be bound by, the rules and all rules interpretations or procedures issued or announced by SAE Bangalore Section Committee. All team members, faculty advisors and other university representatives are required to cooperate with, and follow all instructions from competition organizers, officials and judges.

6. Understanding the Rules

Teams are responsible for reading and understanding the rules in its entirety effect for the competition in which they are participating. The section and paragraph headings in these rules are provided to facilitate reading: they do not affect the paragraph contents.

7. Loopholes

It is virtually impossible for a set of rules to be so comprehensive that it covers all possible questions about the aircraft's design parameters or the conduct of the competition. Please keep in mind that safety remains paramount during any SAE IBS competition, so any perceived loopholes should be resolved in the direction of increased safety/ concept of the competition.

1.3 SOCIETY MEMBERSHIP AND ELIGIBILITY

1. Society Membership

Individual team members must be members of SAE India. Proof of membership, such as a membership card, is required at the event. http://www.saeindia.org/content/student-registration

2. Team Pilots

Team pilots are not required to be students or SAE International members.

1.4 LIABILITY WAIVER AND INSURANCE REQUIREMENTS

All on-site participants and faculty advisors are required to sign a liability waiver upon registration. Individual medical and accident insurance coverage is the sole responsibility of the participant.

1.5 RINGERS PROHIBITED

In order to maintain the integrity of a fair competition, the faculty advisor must prohibit ringers. A ringer is someone that has exceptional skills related to the competition (e.g., a professional model builder) that cannot be a legal member of the team but helps the team win points.

1.6 DESIGN AND FABRICATION

The aircraft must be designed and built by the SAE India student members without direct involvement from professional engineers, radio control model experts, pilots, machinists, or related professionals. The students may use any literature or knowledge related to R/C aircraft design and construction and information from professionals or from 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 aircraft.

1.7 ORIGINAL DESIGN

Any aircraft presented for competition must be an original design whose configuration is conceived by the student team members. Photographic scaling of an existing model aircraft design is not allowed. Use of major components such as wings, fuselage, or empennage of existing model aircraft kits is prohibited. Use of standard model aircraft hardware such as engine mounts, control horns, and landing gear is allowed.

1.8 OFFICIAL LANGUAGES

The official language of the SAE IBS Aero Design series is English. Document submissions, presentations and discussions in English are acceptable at all competitions in the series.

1.9 UNIQUE DESIGNS

Universities may enter more than one team in each SAE IBS Aero Design competition, but each entry must be a unique design, significantly different from each other. If the aircraft are not significantly different in the opinion of the rules committee and organizer, then the university will be considered to have only a single entry and only one of the teams and its aircraft will be allowed to participate in the competition. For example, two aircraft with identical wings and fuselages but different empennage would likely not be considered significantly different.

1.10 AIRCRAFT CLASSIFICATION/DUPLICATE AIRCRAFT

1. Multiple Aircraft per class per competition

A university or college can register multiple aircraft per Class.

2. **Backup Aircraft**

When a team has an identical aircraft as a back-up, the back-up aircraft must go through inspection with the primary aircraft.

3. Scoring with Backup Aircraft

Team will forfeit all flight points earned with the original aircraft if the team decides to fly with an entirely new aircraft.

1. If a team decides to replace more than 50% of the original aircraft with spare parts, the team will forfeit all flight points earned with the original aircraft

2. If a team decides to replace less than 50% of the original aircraft with spare parts, the team will retain all flight points earned with the original aircraft

Once the spare parts have successfully flown with original parts of the aircraft, the spare part will no longer be classified as spare.

1.11 AIRCRAFT ELIGIBILITY

Aircraft will only be allowed to compete during a single academic year. Aircraft cannot allow using same aircraft for next year.

1.12 REGISTRATION INFORMATION, DEADLINES AND WAITLIST

Teams intending to participate in the 2018 SAE IBS Aero Design competitions must register their teams online per the open registration schedule

Table 1-1 Open Registration Schedule

Event	***Team Limit***	***Start (Open)***	***End (Closed)***
SAE IBS Aero Design	100 Teams	June1st, 2018	September 11th , 2018

The registration fee is non-refundable and failure to meet these deadlines will be considered a failure to qualify for the competition.

1. Team/Class/University Policy

   A university or college can register any number of teams without any restrictions provided that the team members should be different in each team.

2. Individual Registration Requirements – ACTION REQUIRED

   All participating team members and faculty advisors must be sure that they are individually affiliated to their respective school / university on the SAE IBS website event registration page.

   If you are not an SAE India member, go to www.saeindia.org and select the "Membership" link. Students will need to select the "Student Membership" link and then follow the series of questions that are asked. Please note all student participants must be SAE International members to participate in the events.

   Faculty members who wish to become SAE India members should choose the "Professional Membership" link. Please note: this is not mandatory for faculty advisors.

   All student participants and faculty advisors must affiliate themselves to the appropriate team(s) online. To affiliate, refer to the Online Registration Guide.

1.13 WAITLIST

Once an event reaches the 100 team capacity, remaining teams can be placed on a waitlist. The waitlist is capped at 50 available spaces per event and will close on the same day as registration. Once another team withdraws from an event, an SAE IBS Staff member will inform your team by email (the individual who registered the team to the waitlist) that a spot on the registered teams list has opened. You will have 24 hours to accept or reject the position and an additional 24 hours to have the registration payment completed or process for payment begun. Waitlisted teams are required to submit all documents by the deadlines in order to be considered serious participants and any team that does not submit all documents will be passed over.

1.14 POLICY DEADLINE

1. **Failure to meet deadlines**

   Teams registering for SAE IBS Aero Design competitions are required to submit a number of documents prior to the competition including a Design Report and Payload Predication Graph that the event judges need to evaluate the team during the competition.

2. **Late Submission Penalty**

   Late submission or failure to submit the Design Report will be penalized five (5) points per day.

   If your Design Report is received more than ten (10) days late it will be classified as "Not Submitted" and your team will not participate and the automatic withdrawn policy will be in effect.

3. **Automatic withdrawal Policy**

   Failure to submit the required Design Report and Payload Prediction Graph within 10 days of the deadline will constitute an automatic withdrawal of your team. Your team will be notified after the 9th day of no submission that we have not received your documents and after the 10 days your team's registration will be cancelled and no refund will be given.

1.15FACULTY ADVISOR

Each team is expected to have a Faculty Advisor appointed by the university. The Faculty Advisor is expected to accompany the team to the competition and will be considered by

competition officials to be the official university representative. Faculty Advisors may advise their teams on general engineering and engineering project management theory, but may not design any part of the vehicle nor directly participate in the development of any documentation or presentation. Additionally Faculty Advisors may neither fabricate nor assemble any components nor assist in the preparation, maintenance, or testing of the vehicle. In Brief - Faculty Advisors may not design, build or repair any part of the aircraft.

1.16 QUESTIONS, COMPLAINTS AND APPEALS

1. Questions

Questions must be submitted through SAE IBS Website

A team can only appeal issues related to own-team scoring, judging, venue policies, and/or any official actions. Team Captain(s) and/or faculty advisor must bring the issue to the Organizer's or SAE IBS staff's attention for an informal preliminary review before filing an official appeal A team cannot file an appeal to cause harm to another team's standing and/or score.

All rulings issued by the Appeals Committee are final.

1.17 PROFESSIONAL CONDUCT

1. Unsportsmanlike Conduct

In the event of unsportsmanlike conduct by team members or that team's faculty advisor, the team will receive a warning from a Competition Official. A second violation will result in expulsion of the team from the competition and loss of any points earned in all aspects of the competition.

2. Arguments with Officials

Arguments with or disobedience toward any competition official may result in the team being eliminated from the competition. All members of the team may be immediately escorted from the grounds.

3. Alcohol and Illegal Material

Alcoholic beverages, illegal drugs, firearms, weapons, or illegal material of any type are not permitted on the event sites at any time during the competition. Any violations of this rule will result in the immediate expulsion of all members of the offending school, not just the individual team member in violation. This rule applies to team members and faculty advisors. Any use of illegal drugs or any use of alcohol by an underage person must be reported to the local law enforcement authorities for prosecution.

4. Organizer's Authority

The Organizer reserves the exclusive right to revise the schedule of the competition and/or to interpret the competition rules at any time and in any manner which is required for efficient operation or safety of the competition.

5. Ground Safety and Flight Line Safety Equipment

1. **No open toe shoes allowed.** All team participants, including faculty advisors and pilots, will be required to wear CLOSED toe shoes during flight testing and during flight competition.
2. **Smoking is prohibited.** Smoking is prohibited in all competition areas.
3. All students in all classes involved at the flight line must wear safety glasses.
4. Micro Class must wear hard hats in addition to safety glasses at the flight line.

2 MISSION REQUIREMENTS

2.1 ROUND ATTEMPT

Teams are allowed one (1) flight attempt per round.

1. **Regular**: Without violating other take-off restrictions, a team can have multiple attempts to become airborne within the team's prescribed time limit for each respective class identified in section 2.5
2. **Micro class**: only one hand launch attempt is allowed per round.

2.2 MOTOR RUN-UP BEFORE TAKEOFF

Aircraft may be throttled up/run up for takeoff, subject to the following conditions:

1. **Regular class**: Use of a helper to hold the aircraft is allowed. Main wheels must be placed on the takeoff line for Regular class. The helper may not push the aircraft upon release.
2. **Micro class**: aircraft must be run up and hand launched within the launch circle for Micro class.

2.3 AIRCRAFT CONFIGURATION AT LIFTOFF AND DURING THE FLIGHT ATTEMPT

The aircraft must remain intact during takeoff, the circuit of the field and landing.

1. No parts of any kind may leave the aircraft during the flight attempt.
2. Exception: a broken prop during landing is allowed and does not invalidate the flight attempt.

2.4 COMPETITION CIRCUIT REQUIREMENTS

1. During departure and approach to landing, the pilot must not fly the aircraft in a pattern that will allow the aircraft to enter any of the no-fly zones
2. No aerobatic maneuvers will be allowed at any time during the flight competition in any competition class.
3. Regular and Micro Class aircraft must successfully complete a minimum of one 360° circuit.

2.5 TIME LIMITS AND MULTIPLE FLIGHT ATTEMPTS

- Multiple takeoff attempts are allowed within the three-minute window as long as the aircraft has **NOT** become airborne during an aborted attempt.
- If an airborne aircraft returns to the ground after airborne and beyond the take-off limits, the flight attempt will be disqualified for that round.

Table 3.1

Class	Time Limit (sec)	Can make multiple takeoff attempts if:			Definition of Takeoff is defined as the point at which:
		Still within the Time Limit	Bounce within required take-off distance	Bounce outside the required take-off distance	
Regular	180	Yes	Yes	No	The main wheels leave the Ground
Micro	120	No	No	No	The launcher is no longer in contact with the aircraft

2.6 TAKE-OFF

Takeoff direction will be determined by the Air Boss, and will be selected to face into the wind if possible.

1. Regular class aircraft must remain on the runway during the takeoff roll.
2. Micro class must be launched from the designated launch circle.
3. Distance requirements are defined in Table 3.2
4. Making the initial turn before passing the "distance from start before initial turn" requirement will disqualify that flight attempt. (Table 3.2)

Table 3.2

Class	Take-Off Distance Limits (ft.)	Distance from start before initial turn (ft.)	Description
Regular	200 ft.	400 ft.	Aircraft must be airborne within the prescribed take-off distance.
Micro	N/A	100 ft.	Team may use the entire launch circle per attempt to get the aircraft airborne. Only one (1) launch attempt per round is allowed

2.7 LANDING

A successful landing is defined as a controlled return to the ground inside the landing zone for that class and remaining on the ground through rollout. A failed landing attempt will result in no score for the round.

2.8 LANDING ZONE

The landing zone is a predetermined fixed area for each class for the purpose of returning a flying aircraft back to the ground. See Table 3.3 for class requirements.

1. The landing zones will be visibly marked at each event site prior to the start of the competition.
2. It is the team and team pilot's responsibility to be aware of the class specific landing zone dimensions at the event site.

1. Allowed during Landing

1. Controlled rollout beyond the landing zone is allowed provided the aircraft touches the ground inside the landing zone.
2. Controlled run-off to the side of the runway within the landing zone is allowed provided the aircraft touches the ground inside the landing zone.
3. Controlled run-off to the side of the runway beyond the landing zone is allowed provided the aircraft touches the ground inside the landing zone.

2. Not Allowed during Landing

1. Touchdown outside the landing zone for that class.
2. Uncontrolled runoff or bouncing across the boundary at the end of the landing zone is not allowed and will be judged as a failed landing attempt.
3. Touch-and-goes are not allowed and will be judged as a failed landing attempt.
4. Uncontrolled runoff or a bouncing run-off to the side of the runway is not allowed and will be judged as a failed landing attempt.

Table 3.3: Landing Distance Limit

Class	Landing Distance Limits (ft.)	Description
Regular	400 ft.	Aircraft must land in the same direction as takeoff within a designated landing zone
Micro	200 ft.	Aircraft must land in the same direction as takeoff within a designated landing zone

2.9 GROUNDING AN AIRCRAFT

1. An aircraft will be grounded if it is deemed non-flight-worthy or not in compliance with class rules by any SAE IBS official, event official or a designated technical/safety inspector.

2. Until the non-flight-worthy or out of compliance condition has been addressed and has been cleared by re-inspection, the aircraft will not be allowed to fly in the competition.

2.10 NO-FLY ZONE

Each competition will have venue-specific **no-fly zones**. The no-fly zones will be defined during the all hands briefing at the event and during the pilot's briefings.

1. At no time will an aircraft enter the no-fly zones, whether under controlled flight or uncontrolled.
2. First infraction for crossing into the no-fly zone will result in an invalidated flight attempt and zero points will be awarded for that flight.
3. Second infraction will result in disqualification from the entire event and loss of all points.
4. It is the team and team pilot's responsibility to be aware of the venue-specific no-fly zones and to comply with all venue specific rules.
5. If a team is unable to directionally control their aircraft and it is headed towards or is in a no fly zone, the Judges and/or Flight boss may order the pilot to intentionally crash the aircraft to prevent it from endangering people or property. This safety directive must be followed immediately if so ordered by the officials.

2.11 FLIGHT RULES ANNOUNCEMENT

Flight rules will be explained to all teams before the flight competition begins, either during the pilots' meeting or during activities surrounding the technical inspections and oral presentations.

2.12 FLIGHT RULES VIOLATIONS

- Violation of any flight rule may result in the team being eliminated from the competition.
- All members of an eliminated team may be escorted from the grounds.

2.13 LOCAL FIELD RULES

In addition to competition rules, the local flying club may have additional rules in place at the event flying field.

1. Club rules will be obeyed during the flight competition.
2. In the event that club rules conflict with competition rules, it is the responsibility of the team captain and/or faculty advisor to bring attention to the conflict and follow the appeals process to resolve the conflict.

3. REGULAR CLASS REQUIREMENTS

3.1 Design Objective:

The objective of Regular Class is to design an aircraft that can lift as much weight as possible while observing the available power and aircraft's length, width, and height requirements.

Accurately predicting the lifting capacity of the aircraft is an important part of the exercise, as prediction bonus points often determine the difference in placement between competing teams.

S.NO.	PHASE
1	**Design Report**
2.	**Virtual Aero Design Challenge** - Technical presentation(oral)
3.	**Final Round** - Technical Inspection - Flight Demonstration

Dates for Design report submission, Virtual Aero Design and Final round can be checked on the SAEINDIA Bangalore section website.

Design Report

Teams will electronically submit their proposals for competition detailing how their design has met or exceeded the design requirements.

Virtual Aero design Challenge

Technical Presentation – Oral (Power point presentation)

Final Round

- Technical Inspection
- Flight Demonstration

3.2 NO LIGHTER-THAN-AIR OR ROTARY WING AIRCRAFT

Competing designs are limited to fixed wing aircraft only. No lighter-than-air or rotary wing aircraft such as helicopters or autogyros will be allowed to compete.

3.3 AIRCRAFT DIMENSION REQUIREMENT

Fully configured for take-off, the free standing aircraft shall have a maximum combined length, width, and height of (L+W+H) 170 inches. Aircraft exceeding this design requirement will be disqualified from the competition.

Length is defined as the maximum distance from front to the aft of the aircraft. Width is the span or the maximum distance from wingtip to wingtip. Height is defined as the maximum distance perpendicular to the ground to the highest part of the aircraft (propeller not included).

Note: Modifications to the aircraft to meet the Length + Width + Height limitations during technical inspection are subjected to design change penalties.

3.4 Gross Weight Limit

Regular Class aircraft may not weigh more than five kilo gram (5 kg) and not less than two kilo gram (2 kg).

3.5 Aircraft Identification

Team number as assigned by SAEIBS must be visible on both the top and bottom of the wing, and on both sides of the vertical stabilizer or other vertical surface in 4-inch numbers. The University name must be clearly displayed on the wings or fuselage. The University initials may be substituted in lieu of the University name provided the initials are unique and recognizable.

3.6 Name and Address

Regular Class aircraft must be identified with the department/school name and address either on the outside or the inside of the aircraft.

3.7 Material Restriction

The use of Fibre-Reinforced Plastic (FRP) and other composite materials are allowed on all parts of the aircraft. The only exception is the use of a commercially available motor mount and propeller. Exploration of other materials and building methods are greatly encouraged.

In addition, the use of lead in any portion of the aircraft (payload included) is strictly prohibited.

3.8 Aircraft System Requirement

3.8.1 Propulsion Requirements

Regular class aircraft are restricted to IC Engine (Glow Engine) propulsion only, not allowed to make or model on the electric motor. Only a single IC Engine configuration is allowed (no multiple engines).

3.8.2 Gear boxes, Drives, and Shafts

Gearboxes, belt drive systems, and propeller shaft extensions are allowed as long as a one-to-one propeller to motor RPM is maintained. The prop(s) must rotate at motor RPM

3.8.3 Radio System Batter

If a separate battery is used for the radio system, the battery pack must have enough capacity to safely drive all the servos in the aircraft, taking into consideration the number of servos and potential current draw from those servos.

1. A battery pack with a minimum capacity of 1000 mAh must be used for the radio system
2. The battery pack must be a Li-Po type battery.
3. Battery voltage regulators or Battery Eliminator Circuit (BEC) are allowed.

3.9 Aircraft Ballast

Aircraft ballast is allowed to be used as team's desire with the following exceptions:

- Ballast can never be used in the closed payload bay.
- Ballast stations must be indicated on the 2D drawings.
- Cannot use lead as ballast.
- Ballast must be secured so as to avoid shifting or falling off the aircraft and causing a CG problem.
- Ballast will never be counted as payload.

3.9 General Requirements

3.10.1 Radios

The use of 2.4 GHz radio is required for all aircraft competing.

3.10.2 Spinners or Safety Nuts Required

All aircraft must utilize either a spinner or a rounded safety nut.

Prop savers are not allowed in regular Class due to the high power propulsion system used.

3.10.3Metal Propellers Prohibited

Metal propellers are not allowed.

3.10.4Control Surface Slop

Aircraft control surfaces must not feature excessive slop. Sloppy control surfaces lead to reduced controllability in mild cases, or control surface flutter in severe cases.

3.10.5 Servo Sizing

Analysis and/or testing must be described in the Design Report that demonstrates the servos are adequately sized to handle the expected aerodynamic loads during flight.

3.10.6 Regular Class Competition Scoring

In order to participate in the flight portion of the competition, each team is required to have submitted and received a score for their Design Report and Technical Presentation.

Any penalties assessed during Design Report Submission, Technical Inspection, and Aircraft Modifications will be applied to the overall competition score.

Overall Competition Score = Design report + Virtual Design Challenge round (Technical presentation) + Flight Demonstration – Penalty Points

Regular Class	
Description	**Maximum Score**
Design report	150
Technical Presentation	150
Flight Round	200
Penalty for Late Submission of Design Report	
For One Day	5
Penalty during Oral Presentation	
Oral presentation exceeds 10 minutes	25
Penalty during Technical Inspection	
1. Deviation from Design (Aerodynamic & Structures Changes)	
a) 1 - 5 %	5
b) 6 - 10 %	10
c) 11 - 20 %	25
d)Greater than 20%	50
2. Electronics	20

4. MICRO CLASS REQUIREMENTS

4.1 Design Objectives:

The objective of Micro Class is to design light-weight, UAV style aircraft that can be quickly deployed from a small package. Reliability to perform the mission is measured by an operational availability bonus. Payload fraction is still at the core of the class and may be considered as a measure of performance.

S.NO.	PHASE
1	**Design Report**
2.	**Virtual Aero design Challenge** - Technical presentation
3.	**Final Round** - Technical Inspection - Flight Demonstration

AIRCRAFT DIMENSION REQUIREMENT IS ALIKE AS REGULAR CLASS EXCEPT THE CONSTRAINTS GIVEN IN THE MICRO CLASS

4.2 AIRCRAFT REQUIREMENTS AND RESTRICTIONS

4.2.1 No lighter-than-air or rotary wing aircraft

Competing designs are limited to fixed wing aircraft only. No lighter-than-air or rotary wing aircraft such as helicopters or autogiros will be allowed to compete.

4.2.2 Aircraft Identification

Team number as assigned by SAE IBS must be visible on both the top and bottom of the wing, and on both sides of the vertical stabilizer or other vertical surface in 3-inch numbers. The University name must be clearly displayed on the wings or fuselage. The University initials may be substituted in lieu of the University name provided the initials are unique and recognizable.

Micro Class identification shall include both of the following:

1 School name, address, and contact phone number either inside or outside of the aircraft fuselage.

2 School name, address and contact phone number on the outside of the shipping and storage container

4.2.3 Propulsion Requirements

Micro class aircraft are restricted to electric motor propulsion only.

4.2.4 Propeller and Gearbox

Gearboxes on a Micro class aircraft where the propeller RPM differs from the motor RPM is allowed. Multiple motors, multiple propellers, propeller shrouds, and ducted fans are allowed in Micro class.

4.2.5 Aircraft propulsion system battery

The maximum flight battery pack allowed for Micro class is a 3 cell lithium polymer battery pack. Batteries having fewer cells are also permitted.

4.2.6 Gyroscopic Assist Allowed

Gyroscopic assist and other forms of stability augmentation are allowed in Micro class.

4.3 PAYLOAD REQUIREMENTS

4.3.1 Payload and Payload Support

The payload must consist of a support assembly and payload plates. All payloads carried for score must be carried within the cargo bay. The support assembly must be constructed so as to retain the weights as a homogeneous mass. There is no required configuration for the payload plates. The design of the support assembly will depend upon the configuration of the payload plates. The total payload consists of the plates plus the support assembly. It is the responsibility of each team to provide its own payload plates.

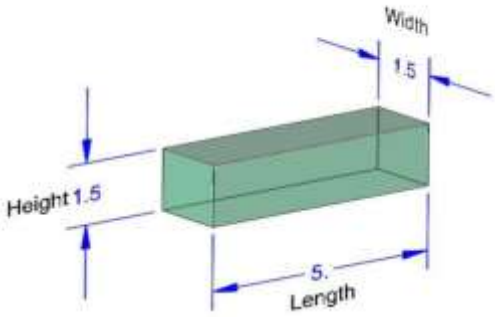
4.3.2 Payload Distribution

The payload cannot contribute to the structural integrity of the airframe, and must be secured to the airframe within the cargo bay so as to avoid shifting while in flight.

4.3.3 Payload bay dimensions

Enclosed Payload Bay Interior Dimensions , **Payload should be Made of MILD STEEL.**

Length	Width	Height	Tolerance
5.00"	1.50"	1.50"	+/- 0.100"



The payload shall not contribute to aircraft structural integrity.
The payload bay may be adjusted forward or aft to adjust aircraft stability.

4.3.4 Payload Material

The use of lead in any portion of the aircraft (payload included) is strictly prohibited.

4.4 AIRCRAFT LAUNCH METHOD

The Micro Class shall be hand tossed (launched) by throwing the aircraft using one (1) hand grasping the fuselage. There is no limit on number of steps taken during the launching action, but the person must remain inside the launch zone before and after releasing the aircraft.

- ✓ Only one (1) member of the team can enter pre-marked launch zone.
- ✓ The pilot must be outside the pre-marked launch zone during the tossing action.
- ✓ The aircraft can only be tossed by one (1) person; team member.
- ✓ The aircraft cannot be tossed by the pilot.

The following actions are not permitted and will invalidate the flight attempt and score for the round:

- ✓ Using more than one hand to toss the aircraft
- ✓ Tossing the aircraft from any other part of the aircraft other than the fuselage
- ✓ Running with the aircraft during launch
- ✓ Pilot launching (tossing) the aircraft

4.5 MICRO CLASS HAND-LAUNCH SAFETY REQUIREMENTS

Safety gears must be used by the designated person performing the aircraft toss. Safety gear shall consist of:

- ✓ Safety Glasses
- ✓ Hard hat
- ✓ Shoes (open toe shoes are not allowed)

4.6 GENERAL REQUIREMENTS

4.6.1 Radios

The use of 2.4 GHz radio is required for all aircraft competing in SAE Aero Design competition. The radio system must have an automatic failsafe function on the throttle channel that causes the aircraft to go to throttle off if the radio signal is lost.

4. 6.2 Spinners and Safety Nuts Required

All Micro Class must utilize either a spinner or a rounded model aircraft type safety nut.

4. 6.3 Metal Propellers Prohibited

Metal propellers are not allowed.

4. 6.4 Control Surface Slop

Aircraft control surfaces must not feature excessive slop. Sloppy control surfaces lead to reduced controllability in mild cases, or control surface flutter in severe cases.

4. 6. 5 Servo Sizing

Servos must be adequately sized to handle the expected air loads during flight. Qualification flights are not required.

4.7 MICRO CLASS COMPETITION SCORING

In order to participate in the flight portion of the competition, each team is required to have submitted and received a score for their Design Report and Technical Presentation.

Any penalties assessed during Design Report Submission, Technical Inspection, and Aircraft Modifications will be applied to the overall competition score.

ADDITIONAL RULE { VERY IMPORTANT }

4.8 Extra points in Scoring if Aircraft weight v/s Payload weight ratio is less.

This rule shows the robust build of the aircraft having a minimum / lesser weight within the specified rules described in the previous points.

For the same payload carrying capacity, the aircraft having a minimum weight will be awarded the maximum point in this section.

4.9 Extra points in Scoring for Zero Thrust maneuverability

The aircraft must climb to a maximum height based on its transmitter~ receiver range. After achieving this, without any throttle (ZERO THRUST), the aircraft must glide using only other controls and try to stay in the air as long as possible or up to the time set up by the judges.

The Aircraft model gliding up in the air for prescribed Maximum time without throttle / thrust will be awarded maximum point allotted in this section.

If the aircraft tends to be unstable and seemingly like to crash, then thrust can be given by using the throttle and can be controlled to bring back safely the aircraft.

Overall Competition Score = Design report + Technical Presentation + Flight Demonstration – Penalty Points

Micro Class	
Description	**Maximum Score**
Design report	150
Technical Presentation	150
Flight Round	100
Aircraft weight v/s Payload weight (more points if its less) (max upto 50point)	50
Zero Thrust maneuverability (max upto 50point based on the timings)	50
Penalty for Late Submission of Design Report	
For One Day	5
Penalty during Oral Presentation	
Oral presentation exceeds 10 minutes	25
Penalty during Technical Inspection	
1. Deviation from Design (Aerodynamic & Structural Changes)	
a) 1 - 5 %	5
b) 6 - 10 %	10
c) 11 - 20 %	25
d)Greater than 20%	50
2. Electronics	20

5. DESIGN REPORT

The Design Report is the primary means in which a team conveys the story of how their aircraft is the most suited design to accomplish the intended mission. The Design Report should explain the team's thought processes and engineering philosophy that drove them to their conclusions.

Some topics that are important to cover are: selection of the overall vehicle configuration, wing plan form design including airfoil selection, drag analysis including three-dimensional drag effects, aircraft stability and control, power plant performance including both static and dynamic thrust, and performance prediction. Other topics as appropriate may be included.

5.1 SUBMISSION DEADLINES

The Technical Design Report, 2D drawing, and supplemental Tech Data Sheet (TDS) must be electronically submitted.

5.2 DESIGN REPORT REQUIREMENTS

The deliverable content of the Technical Design Report is specified

1. The Technical Design Report shall not exceed thirty (30) pages. If the design report exceeds thirty (30) pages, the judges will only score the first thirty (30) pages.
2. The Technical Design Report shall be typewritten and double-spaced.
3. The report font shall be 12 pt. proportional; or 10 char/in. non-proportional font.
4. The report margins shall be: 1‖ Left, 0.5‖ right, 0.5‖ top, and 0.5‖ bottom.
5. All report pages will be LETTER (81/2 x 11 inches) page format.

5.3 2D DRAWINGS

5.3.1 2D Format and Size

The 2D drawing must be A3 sized page (PDF) format (11 x 17 inches).

1. Drawing shall consist of one (1) page
2. Markings Required

The 2D drawing must be clearly marked with:

1. Team number
2. Team name
3. University / College name

5.3.2 Views Required

The 2D drawing must include a standard aeronautical three-view of the aircraft arranged as described below:

- ✓ Left side view in the lower left with the nose pointing left.
- ✓ Top view above the left side view also with the nose pointing left.
- ✓ Front view in the lower right.

5.3.3 Dimensions Required

At a minimum, all aircraft drawings must have the following dimensions clearly shown:

1 Aircraft length, width and height.

2 Drawing shall have CG locations clearly dimensioned in reference to the aircraft datum.

3 All drawing dimensions must be in inches and decimal inches, to an appropriate level of precision.

5.3.4Summary Data Information Required

The 2D drawings must contain a table with a summary of pertinent aircraft data. The minimum data to be shown in the table is:

- Wingspan
- Empty weight
- Specifications of Motor and Propeller (Including make and model)

5.3.5 Weight and Balance Information

The drawing shall contain the required weight and balance information listed below, including a weight and balance data table with a summary of pertinent aircraft equipment and other data as indicated below. All 2D aircraft drawings must have a designated aircraft datum clearly indicated on the 2D drawings.

Minimum list of equipment to be shown in the weight and balance table is:

Motor or engine, battery (s), fuel if applicable, payload, ballast (if used) and electronics.

1. Each item listed in the table must show its location from the aircraft datum in inches, moment arm and resultant moment of force. See —Rules and Important Documents‖ section of the SAE Aero Design website for additional information.

2. The following Center of Gravity (CG) information must be clearly shown in the drawing:

a) Forward CG limit
b) Aft CG limit
c) Empty CG, ready to fly (no payload, no fuel if applicable)

d) Fully loaded CG (maximum expected payload and fuel, if applicable)

5.4TECH DATA SHEET: WEIGHT BUILDUP (MICRO CLASS ONLY)

The Micro Class Weight & Balance Build-up schedule will help teams understand the important of managing aircraft weight to achieve safety of flight at the desired payload fraction.

Each team shall supply a one (1) sheet summary list of pertinent aircraft parts and weight (kg)

6. TECHNICAL PRESENTATION

Like all professionals, engineers must possess a well-developed ability to synthesize issues and communicate effectively to diverse audiences. The technical portion of the aero-design competition is designed to emphasize the value of an ability to deliver clear, concise and effective oral presentations. Presentation score shall be comprised of scores from the presenter's delivery technique and the judges' evaluation of technical content, empirical analysis, Innovation and quality visual aide.

6.1 TECHNICAL PRESENTATION REQUIREMENTS

1. Technical presentation shall last ten (10) minutes and followed by a five (5) minute "Question and Answer" (Q&A) period.
2. Technical presentation shall be delivered in English.
3. Technical presentation shall address, but are not limit to, trade studies performed, design challenges, and manufacturing techniques.
4. Technical presentation is limited to student team members only. Non-team member pilot, faculty advisors, and/or parents can attend the technical presentation but are prohibited from participating in the setup, delivery, and/or the Q&A.
5. Assistance in the use of visual aids is advisable; Film clips, if used, may not exceed one-minute total duration; Film clips may not be accompanied by recorded narration.

7. TECHNICAL INSPECTION

Technical and Safety inspection of all aircraft will be conducted using the published Technical and Safety Inspection checklists for each class for the current year.

Technical and Safety Inspection is the process of checking all aircraft for:

1 Compliance with all General aircraft requirements.

2 Compliance with all aircraft configuration requirements for their class.

3 Overall safety and airworthiness.

All aircraft must pass the Technical and Safety Inspection in order to compete. It is strongly inspection checklist before arriving at the competition.

7.1 AIRCRAFT CONFORMANCE TO 2D DRAWING

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

1. At a minimum, aircraft length, wingspan and height dimensions will be measured and compared to the 2D drawing.

2. All teams must have a hard copy of their design report with them during technical inspection.

3. Aircraft will have their actual empty CG compared to the empty CG presented in the design report 2D drawing.

7.2 DEVIATIONS FROM 2D DRAWING

Any deviation in construction of the aircraft 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).

B. Only one design change may be submitted per CR form.

C. Judges will assess penalty points for design changes as stated in Regular and Micro score tables.

7.3 SAFETY AND AIRWORTHINESS OF AIRCRAFT

Technical and Safety Inspection will be also be used to assess the general safety and airworthiness aspects of each aircraft by seeking any problems that could cause an aircraft to depart controlled flight.

This assessment includes but is not limited to:

- Unintentional wing warps
- Control surface alignment
- Correct control surface response to radio transmitter inputs
- Structural and mechanical soundness

7.4 INSPECTION OF SPARE AIRCRAFT AND SPARE AIRCRAFT COMPONENTS

- All spare aircraft and spare aircraft components (wings, fuselages and tail surfaces) must be presented for inspection at the same time as the primary aircraft.
- Any spare aircraft or spare aircraft components presented for inspection after the team has had their primary aircraft inspected may not be used in the competition.

7.5 AIRCRAFT MUST MEET ALL INSPECTION REQUIREMENTS THROUGHOUT THE COMPETITION

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

7.6 TECHNICAL AND SAFETY INSPECTION PENALTIES

No points are available to be scored as a result of the Technical and Safety Inspection:
Teams may only lose points as a result of errors and problems encountered during the inspection process. Any penalties assessed during Technical Inspection will be applied to the overall competition score.

APPENDIX A

SAE IBS AERO DESIGN

STATEMENT OF COMPLIANCE

Certification of Qualification

Team Name _____ Team Number _____

School _____

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, constructed and/or modified the radio controlled aircraft they will use for the SAE IBS Aero Design 2017-2018 competition, without direct assistance from professional engineers, R/C model experts or pilots, or related professionals.

_____

Signature of Faculty Advisor

Team Captain Information:

Team Captain:
Captain's E-mail:
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 (ECR) and Penalty chart

Team Number:				
School Name:				
Team Name:				
Discovery Method	☐Tech Inspection ☐Safety Inspection ☐Test Flight ☐Design Analysis	**System Affected**	☐Wing (area +/-) ☐Fuselage (area +/-) ☐Horiz. Stabilizer (area +/-) ☐Vertical Tail (area +/-) ☐Engine Mount assembly	☐Mechanical ☐Landing System ☐Structural ☐Electronics (avionics) ☐Payload bay Assembly
Surface Area	**AREA ADDED:**_____ **AREA REDUCED:**_____ *If surface area was impacted by the modification, specify total area added or reduced. Show calculations:*			
Describe the Modification				
Reason for Modification				
Other Considerations				

	*** OFFICIAL USE ONLY ***
ECR #	
Penalty Applied	