

TECHFEST 2023-24

BOEING NATIONAL AEROMODELLING COMPETITION

The competition is launched with the vision to provide a unified national platform for students interested in aerospace and related engineering disciplines - to demonstrate their aero-modeling expertise.

Problem Statement:

A team must design, fabricate and demonstrate a fixed-wing aircraft system that can perform the tasks mentioned in the following rounds with given constraints.

Format of the Competition:

The zonal events will be conducted in **4 IITs** (East Zone: IIT Kharagpur, West Zone – IIT Bombay, North Zone – IIT Kanpur and South Zone – IIT Madras).

IIT Bombay zonal round will be on **27th-29th December during Techfest offline mode.**

Top 3 teams from this zonal round will be Invited to the National Finals at **RVCE, Bangalore.**

Theme: The theme for the zonal this time is Payload Carrying Capability.

The arena will be open ground. There will be two rounds in the zonal competition:

- A. Qualifier Round
- B. Main Round

A. Qualifier Round

The aim of the qualifier round is to select **top 30 teams** to the Main Round.

Since the theme is **payload capability**, the qualifier round's objective is to select those teams who built aircraft with good payload-carrying capability and can fly safely while carrying the payloads.

The aircraft should carry one or more than one payload (golf balls of weight - 45g, diameter 43mm - will be supplied by the organizers during the competition) as they can and fly for a minimum time of 30 seconds. The aircraft should then land with the entire payload in it. Payload should not come out of the aircraft until touchdown.

The payload should be mounted inside the aircraft and should not be exposed externally. Judges will examine the aircraft and will allow take-off only when they are satisfied with the payload mounting. A maximum time of 3 minutes will be given between the take-off and the landing and the aircraft should complete the round within the time limit.

Score: $\text{Weight of Payload Carried} \times 100 / \text{Weight of Aircraft without Payload}$

Those aircraft which will not be able to fly for 30 seconds with the payload will get a 0 score.

Each team will get 2 attempts, and the best of the two will be the team's final score.

Top 30 teams, based on the score, will qualify to Main Round from the Qualifier Round. Along with qualification to next round, qualifying teams will get a reimbursement of **INR 5000** per team towards material costs for their models.

Only aircraft that demonstrate safe flying with payload will be allowed to participate in the main round.

B. Main Round

The team should perform one round trip of payload delivery (golf balls) and return to the point of origin.

The following steps must be performed once the timer starts:

1. Load the aircraft at the point of origin:
 - Load the golf balls onto the aircraft while the aircraft is on the ground. The aircraft should be on the ground and not be touched by the team during this step. Only one team member can participate in this step, and the member should load without touching the aircraft. All the opening/closing of the doors/compartments to place the payload should be operated from the transmitter and not manually.
 - Cost of the step 1 = $C1 = \text{Time in seconds from the timer starting to the payload compartment closing}$.
2. Take off:
 - Once the aircraft payload compartment doors are closed, the aircraft should take off. The aircraft can be hand-launched in this step to avoid issues of a smooth runway as the competition is conducted in an open ground.
3. Fly for at least 30 seconds and Land at the point of destination:
 - The aircraft can land anywhere on the ground (to make it easier for the participants to achieve a safe landing). The landing point will be considered as the destination.
 - Earnings for the trip = $E1 = 10 \times \text{number of golf balls carried}$.

4. Unload the aircraft completely at the destination:
 - Only one team member can participate in this step, and the member should unload the aircraft without touching it. All the opening/closing of the doors/compartments to place the payload should be operated from the transmitter and not manually.
5. Reload the aircraft at the destination:
 - as done in step 1
 - Cost of the steps 4 & 5 = C2 = Time in seconds from touchdown to the payload compartment closing after reloading.
6. Take off at the destination. The aircraft can be hand-launched in this step to avoid issues of a smooth runway as the competition is conducted in an open ground.
7. Land after a minimum flight time of 30 seconds:
 - The aircraft can land anywhere within the ground (to make it easier for the participants to achieve a safe landing)
 - Earnings for the trip = E2 = 10 x number of golf balls carried.
8. Unload the aircraft:
 - as done in step 4
 - Cost of the step 8 = C3 = Time in seconds from touchdown to the payload compartment closing after unloading

$$\text{Score} = E1 + E2 - C1 - C2 - C3$$

A maximum time of 3 minutes will be given for the entire mission.

Judging:

- 10 points will be awarded for the successful delivery of each golf ball on each trip.
- 1 point will be deducted as cost per second on the ground.
- Net points earned by the team is the score of the team.

Scoring:

- An overall score combining the Qualifier and Final round scores will be calculated. Teams with the highest overall score will be declared as winners.
- **Overall Score = Normalized Score in Qualifier Round * 0.25 + Normalized Score in Main Round * 0.75**
- The top 3 teams will be invited to RVCE Bengaluru for the finals. The problem statement for the final round will be launched in Feb 2024.

Design Constraints:

1. The competition requires participants to design and fabricate an RC aircraft. Readymade models, like RTF, ARF, BNF etc., are not allowed.
2. **T/W <=1 without payload** (If excess thrust is measured, it will be neutralized by adding weight below the aircraft at center of gravity)
3. The aircraft should have a maximum weight of 1 Kg (without any payload being added)
4. Propeller diameter should not be greater than 13 inches.
5. Wingspan should be a maximum of 1.2 m.

6. Only electric motors are allowed. Using IC engines or any other means of providing thrust is prohibited.
7. Use of gyroscopes (gyros) and programming assistance in receivers is prohibited.
8. Programming for any step of the mission is not allowed.
9. Use of FPV or any other support for flying is not allowed.

Team Structure:

1. Minimum of 2 and maximum of 4 members can be part of a team. An additional mentor can accompany the team but will not be allowed to help them during their participation.
2. Team members of a team may be from same college/school or different (School/UG/PG).
3. Any number of teams can participate from one college/school.
4. Only students can participate in this competition.
5. Participants must get a bona fide certificate signed by the respective HoD/Dean/Principal and their school/college ID Card.
6. A safety pilot might be available at the ground (provided by the organizers) and, if needed, have control on your aircraft in case of emergency. The participant can voluntarily take the safety pilot's help or fly independently. However, if the safety pilot feels that the participant's skills are inadequate, the pilot will take over considering the safety aspects. The final decision on this will be that of the safety pilot and judges, and the participant must adhere to the same.

Abstract Submission:

1. All participants must submit an abstract on their aircraft, which should be less than 15 pages (A4 size 1.5 line spacing) with standard formatting. The Abstract must document the basic design of the aircraft (dimensions, wing areas, velocity, etc.) and explain how the design suits the given problem.
2. Along with the abstract, participants must also send a zip file containing at least 5 and no more than 10 photographs of the aircraft while it is being built.
3. The Abstract must be submitted as per the standard format
4. The shortlisted teams based on the abstract to participate in the zonal rounds would be announced **15** days before the competition date.

Rules:

1. Each team would be given two attempts in the Qualifier round and two attempts in Payload Round. Best score from both attempts will be considered as a score for each round.
2. The timer will start after 30 seconds of the previous team completing their attempt. The participants need to be prepared in time and launch without delay after entering the take-off zone.
3. The teams would lose their turn if they are not ready in time.

4. Same aircraft should be used in both the rounds and it should be the same one in the abstract. In case of damages during the competition, teams can repair the same aircraft but are not allowed to use a replacement. The repaired aircraft should be ready in time for the turn.
5. If there is a tie, winner will be decided by a separate round framed by the Judges on the spot. Judges' decisions would be considered final in all cases.

General Guidelines:

1. The same aircraft should be used in both rounds, and it should be the same one as in the abstract. In case of damages during the competition, teams can repair the same aircraft but are not allowed to use a replacement. The repaired aircraft should be ready in time for the turn.
2. Teams are suggested to carry additional components (motors, batteries, propellers, etc.) to avoid last-minute surprises at the venue. You will lose time/ attempt if you are not ready at your turn.
3. The use of 2.4 GHz radio is required for all aircraft competing. If the participants want to use any other frequency, they must inform the organizers in advance.
4. Receivers installed in the aircraft must be in 'receiver mode only'.
5. Metal propellers are not allowed.
6. Organizers will check all the systems (Servos, motors, etc.) for functionality before the competition. If found not working, teams will be dismissed from the competition.
7. Please do not share parts of your aircraft (motors, ESC, Battery etc.) with other teams. Each team is expected to carry all the equipment needed to participate in the competition.
8. The models can have powered take-off with landing gear or be launched manually by a person standing at ground level.
9. A team member cannot be a part of more than one team.
10. The timer will start after 30 seconds of the previous team completing their attempt. The participants must be prepared in time and launch without delay after entering the take-off zone. The teams would lose their turn if they were not ready in time.
11. To be eligible for the reimbursement, the qualifying team must share the bank account details that belong to one of the team members. The name on the bank account must match the registered participant's name. Reimbursement/ Prize money will not be transferred if there is a mismatch.
12. In view of stringent safety requirements, if a pilot flies out of the designated flying zone, which includes the overhead of the event organizing and control section, as mentioned at the venue, he/ she is disqualified. He/she must immediately turn back and land safely.
- 13. In case of any any disputes/discrepancies, the organisers decision will be final and binding.**
14. Change in rules, if any will be highlighted on the website and notified to the registered teams.

Participation in multiple zonal events/finals:

1. Teams can participate in only one zonal event of their choice.
2. The same team members participating in the zonal should participate in the final.

Timeline:

Abstract Submission Deadline	10th December 2023
Abstract Result Announcement	12th December 2023
IIT Bombay Zonal Round	27th-29th December 2023
Final at RVCE Bengaluru	February 2024

Certificate Policy:

1. Top three teams in the grand finale will be awarded Certificate of Excellence.
2. E-Certificate of participation will be given to the teams scoring more than the critical marks which will be decided later.

Prize Money:

The Prize money will be awarded to the **top 3** Winners via NEFT and will be processed within **30** working days after receiving the Prize Money from Sponsors.

The Winners have to mail the following information (immediately after the announcement of the results) to akshat@techfest.org.

Subject: Competition name, team id - your position (example- Boeing Aeromodelling, Boei-2309234 – 1st position)

Body of mail-

1. Account Holder's Name
2. Account Number
3. Bank name and Branch name
4. IFSC Code
5. Photo of Bank Passbook as proof