

Radio Control (RC) Flight Fixed Wings

Challenge Booklet 2027

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SAFMC 2027 CATEGORY RADIO CONTROL (RC) FLIGHT FIXED WINGS CHALLENGE BOOKLET CHANGE LOG

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1. INTRODUCTION

Competition Schedule, General Rules and Regulations can be found in the “General Rules and Regulations” Booklet.

For Category RC Flight Fixed Wings, teams made up of **TWO (2)** to **FIVE (5)** members are expected to **design and build their own radio-controlled fixed-wing plane or kite plane** to navigate an obstacle course in the playfield.

Each participating team shall be allowed to bring up to **TWO (2) IDENTICAL fixed-wing planes or kite planes**. If the fixed-wing planes or kite planes are not identical, only one plane is allowed to be brought into the competition venue.

2. CATEGORY RC FLIGHT FIXED WINGS AWARDS

Award winners will be selected based on either presentation scores, performance on the competition’s challenge day, or a combination of both.

There is no limit to the number of awards that a team can win, but there may not be a winner for every award.

All scoring decisions made by the judges are **final**. For cases that require arbitration, the Singapore Amazing Flying Machine Competition (SAFMC) organising committee will have the **final** say.

The list of awards for Category RC Flight Fixed Wings is listed in the subsequent sections.

2.1. CHAMPIONSHIP AWARD

Award	Weightage
Creativity	15%
Theory of Flight	15%
Presentation	15%
Best Flight	55%
Total	**100%**

This is the pinnacle award that any team can win. It is bestowed on the team that embodies the spirit of SAFMC. Teams are considered for the Championship Award based on their overall excellent performance during the presentation and actual challenge.

2.2. THE MOST CREATIVE AND THEORY OF FLIGHT AWARD

Criteria	Areas of Consideration
Creativity	• Uniqueness in Appearance • Innovative Design • Environmental Considerations • Functionality
Theory of Flight	• Lift Generation • Stability & Control • Weight and Balance • Overall design and Aerodynamics

For the team that shows the most innovative and original design in their remote-controlled fixed wing or kite platform and demonstrates a sound understanding and application of aerodynamic design principles.

2.3. THE BEST PRESENTATION AWARD

Criteria	Areas of Consideration
Presentation	• Creativity • Fluency • Confidence and Flair

For the teams that best exhibit creativity, fluency, confidence, and flair in the presentation and demonstrate "WOW" factors during the interview sessions.

2.4. THE BEST FLIGHT AWARD

This is awarded to the team that attains the highest score in the challenge segment. The best score attained among the two attempts shall be taken as the final score for the mission. If there is a tie in score, the judges will decide on the winner based on flight performance (stability and handling).

2.5. PRIZES

CATEGORY RC FLIGHT FIXED WINGS				
Awards	**Medals**	**Trophy**	**Cash Prize(s)**	**Remarks**
Championship Award	✓	✓	$ 1200	
1st Runner Up	✓		$ 800	
2nd Runner Up	✓		$ 400	
Best Flight Award	✓	✓	$ 500	1st and 2nd Runner up will receive **only** Medals.
Best Presentation Award	✓	✓	$ 400	
Most Creative and Theory of Flight Award	✓	✓	$ 200	

3. CATEGORY RC FLIGHT FIXED WINGS CHALLENGE

For Category RC Flight Fixed Wings, it comprises:

a. A physical presentation.
b. An actual in-venue flight challenge.

3.1. TEAM LIVE PRESENTATION

On the scheduled date of presentation, a specific time slot shall be allocated to each team to present their flying machine. The team shall present the work they have done, such as flying machine design and their learning journey, to the judges.

The team is expected to be ready for presentation at their assigned venue and designated time.

3.2. CHALLENGE SEGMENT

The team is expected to design and build its own radio-controlled fixed-wing plane or kite plane. The built flying machine is to fly and manoeuvre through an obstacle in the playfield. The obstacle is a 30 cm tunnel painted in bright orange or another similar colour.

Figures 1 and 2 show the competition setup for Category RC Flight Fixed Wings. The flying machine must be hand-launched from the designated launch zone (red). Should the flying machine touch the ground or get stuck in the obstacle or netting, the flying machine must be re-launched at any of the re-launch zones (red or yellow).

Teams are reminded that the netting surrounds the playfield. Please navigate carefully to avoid entanglement and ensure you have a retrieval plan in place in case your flying machine gets stuck.

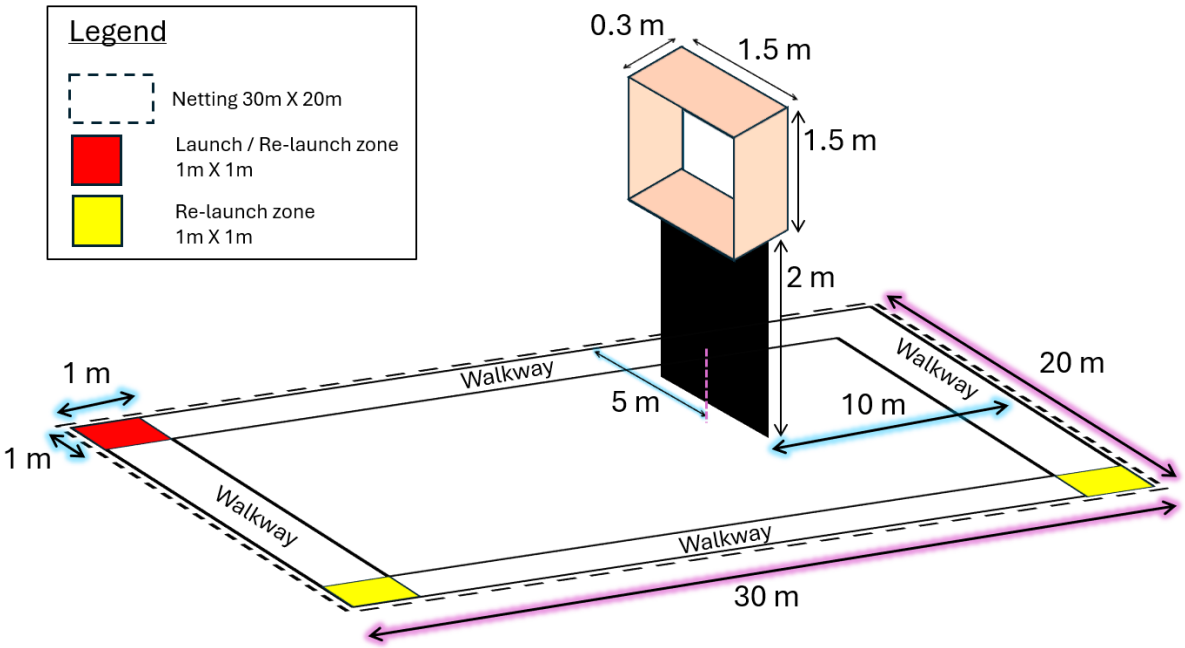


Figure 1 Competition Setup of Category RC Flight Fixed Wings

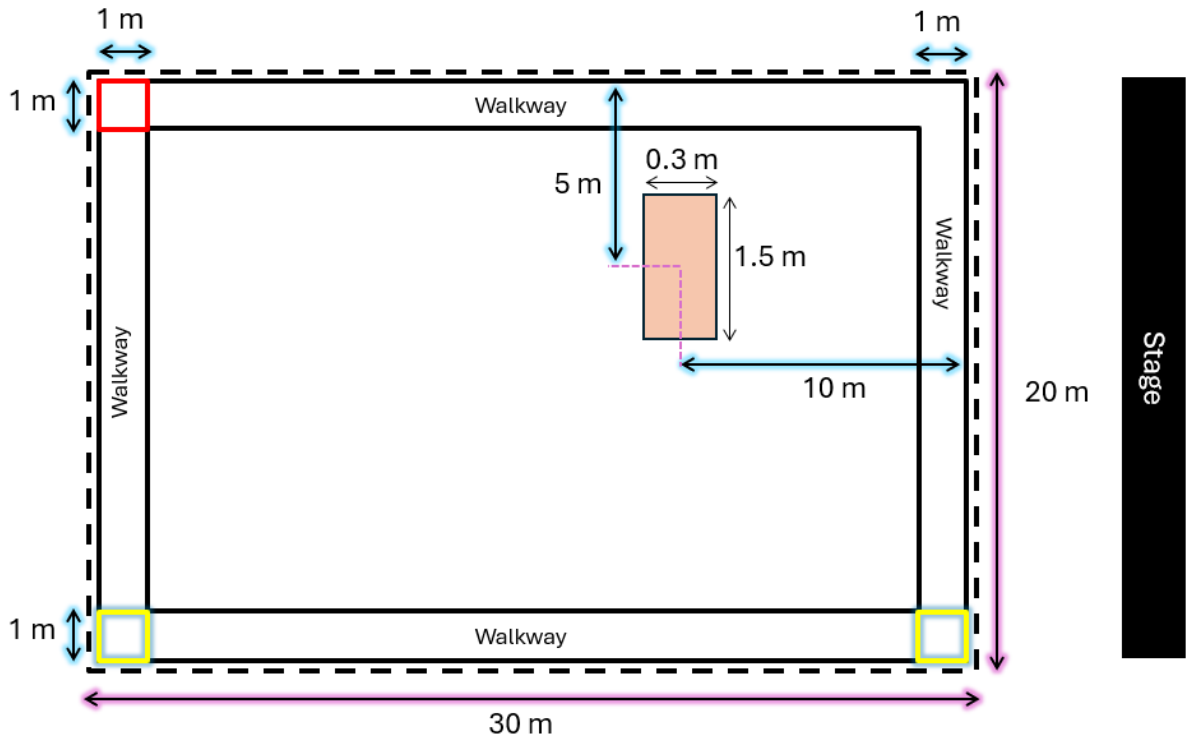


Figure 2 Competition Setup of Category RC Flight Fixed Wings (Plan View)

Similar to real-world scenarios, teams may face unexpected issues during the challenge segment. They should not expect the conditions or layout of the challenges to be fully defined beforehand or to remain identical for each attempt between competitors. Factors such as venue conditions and other uncontrollable elements can also influence competition results.

Each team has **TWO (2) attempts ONLY** to challenge the flying circuit. Each attempt is allocated **THREE (3) minutes**.

NO exchanging of identical flying machines is allowed during the attempt.

The team will challenge the flying circuit by navigating the flying machine through an obstacle in the playfield as follows:

a. The assistant will perform a hand-launch from the designated launch zone. Both feet of the assistant must remain in the launch zone during launch.

b. Fly through the obstacle from any direction. For example, the pilot may fly the flying machine through the obstacle in one direction, followed by a sharp turn and then fly through the obstacle in the opposite direction. This counts as flying through the obstacle twice.

c. In the event that the flying machine flies in from one side of the obstacle and gets stuck in the obstacle, but somehow manages to fall out of the obstacle onto the other side without anyone physically touching the flying machine, it is deemed to have passed through the obstacle.

d. Points shall be awarded each time the flying machine passes through the obstacle. The flying machine should fly through the obstacle as many times as possible. There is no limit to the number of times it can fly through the obstacle.

e. If any team cannot get their flying machine airborne within 1 minute of reaching the launch zone, the attempt will be deemed to have taken place and a score of zero will be recorded for that attempt. They will leave the playfield and return later if they still have another attempt.

f. The timer continues to run even if the flying machine gets stuck in the netting or obstacle.

g. If the flying machine touches the floor or gets stuck in the obstacle, the assistant must re-launch the flying machine from any of the re-launch zones. Both feet of the assistant must remain in the re-launch zone during re-launch.

h. The pilot is not allowed to launch or re-launch the flying machine.

Once the **THREE (3) minutes** of flight time has elapsed, the pilot shall land the flying machine immediately.

4. SCORING

All scoring decisions made by the judges and referees are **FINAL**. For arbitrary cases, the organising committee will have the **FINAL** say.

4.1. PRESENTATION SEGMENT (45 %)

The presentation plays an integral part for teams who wish to compete for the SAFMC Championship Award. In addition, the teams will be assessed for different awards listed in Section 2.

The judging criteria for the presentation are as follows:

Criteria	Areas of Consideration
Creativity	**Uniqueness in Appearance** - Originality in the design of the flying machine, being one of its kind design. - Visually different, distinct, or appealing. **Innovative Design** - Effort to brainstorm other ideas or ideas from unusual sources and trying to be different **Environmental Considerations** - Knowledge of structural design that incorporates eco-friendly features or materials. **Functionality** - Workable flying machines with unique features and designs.

Theory of Flight	**Lift Generation** - Wing Design that is able to generate sufficient lift such as the shape, size, and airfoil design. **Stability and Control** - Intelligent use of flight control surfaces in maintaining stability and control in flight. **Weight and Balance** - Consideration of the centre of gravity and Centre of lift. **Overall Design and Aerodynamic** - Knowledge of structural design and aerodynamic efficiency. - Show a video clip to showcase its flying capability.
Presentation	**Creativity** - "WOW" Presentation - Poster design **Fluency** - Time management and presentation sequence. **Confidence and Flair** - Savviness and knowledgeable responses to queries - Nervous/state of ease and relaxation - Showmanship and Presentation style

4.2. CHALLENGE SEGMENT (55 %)

Scores shall be awarded to the team based on the sum of all points allocated to tasks completed by the flying machine during the flying mission.

There are **TWO (2) attempts ONLY** for the flying mission and the best score among the two attempts shall be taken as the final score.

Flying Tasks	Allocated Points
Hand-launch from designated take-off/landing area.	10 points
Number of times flying machine passes through the obstacle.	10 points per time
Final Score	Hand-launch points + (10 X number of times flying machine passes through the obstacle.)

To calculate the score for Championship Award, each team's Final Score is normalised to a maximum of 55%, using the top-performing team's score as the baseline.

Example:

Team 1 Score: 150 points

Top Performing Team: 210 points

Calculation: (150 ÷ 210) × 55% = 39.29%

Team 1 earns a weighted score of 39% (rounded to the nearest whole number) toward the Championship Award.

5. FLOW OF EVENTS

The presentation segment and the challenge segment will be on different days. Teams will follow the scheduled date and time for both segments. All teams shall be ready and report 15 minutes before their designated timeslot. Teams shall be guided by the SAFMC usher to their respective areas after they have reported for the competition.

5.1. PRESENTATION SEGMENT

Teams are required to deliver their presentation **in person to the assigned judges on the presentation day**. Teams are expected to be present in-person for the **full day**. All teams must participate in the Presentation Segment to receive a score for the presentation component of the competition.

1. **Reporting Details**

Reporting timing will be provided during the Q&A clinic session at a later date.

2. **Presentation Booth**

Each team will be allocated a booth within the hall. The exact booth dimensions and specifications will be provided during the Q&A clinic session at a later date.

3. **Presentation Booth Set-up**

Teams will be given **one (1) hour** to set up their presentation booth **on the presentation day.**

Presentation judging will commence after the stipulated time limit for the booth set-up**.** Teams are required to complete their booth set-up before judging begins.

4. **Power Supply**

Each booth will be provided with **ONE (1) two-gang power socket**, allowing teams to connect up to **TWO (2) electrical devices** at any one time. For electrical and fire safety reasons, teams are strictly **not allowed to connect additional multi-plugs, power strips, or any other forms of electrical extensions**.

Failure to comply with this requirement will result in disqualification.

5. **Presentation and Judging**

Judges will visit each team's booth individually. Each team will be allocated a maximum of **SEVEN (7) minutes per visiting judge, comprising:**

- **FIVE (5) minutes for the team presentation; and**
- **TWO (2) minutes for Questions and Answers (Q&A).**

Upon completion of each presentation and Q&A session, the visiting judge will award the team **ONE (1) completion stamp** to indicate that the session has been completed. The Presentation Segment will be considered complete only after the team has **collected ONE (1) completion stamp from each judge assigned to evaluate the team**.

Failure to obtain a completion stamp from every assigned judge will result in zero score for the Presentation Segment.

Please refer to **Section 4.1** for the scoring factors for the Presentation Segment.

6. Presentation Requirements

The team may present either in PowerPoint slides format **or** hard copy poster format. If the team is presenting in PowerPoint format, the slides should not be more than 4 slides (including the cover slide). The team must ensure their laptop is fully charged and equipped with an HDMI output socket. Alternatively, each team shall be allowed a maximum of TWO (2) A1-size posters as a visual aid for their presentation.

Teams are also **required to**:

1. Bring the flying machine to showcase to the panel.

Present a video clip (20 seconds) to showcase the flying capability of the flying machine. The team shall bring their own laptop or tablet to showcase the short video clip and presentation.

5.2. CHALLENGE SEGMENT

All teams shall be ready and report 15 minutes before their designated timeslot. Teams shall be guided by the SAFMC usher to their respective areas after they have reported for the competition.

Inspection

1. At the Inspection station, an SAFMC official shall check the flying machine for any violation of the category rules and regulations. Refer to Section 6 for more details provided.
2. The team will demonstrate to the SAFMC official the functionality of "[1]Fail-safe" mode. Testing of "Fail-safe" mode is as follows:
    a. Power up the system and verify the flying machine is functional.
    b. Advance the throttle to allow the propeller(s) to start spinning and ensure normal control stick movements are observed.
    c. Two conditions to trigger "Fail-safe" mode to stop the propeller(s) from operating:
        i. Power off the R/C transmitter.
        ii. Trigger "Fail-safe" mode switch on the R/C transmitter.
3. The team shall demonstrate to the SAFMC official the "Fail-safe" Test to qualify for the challenge segment.
4. After passing the "Fail-safe" Test inspection, the R/C transmitter shall be quarantined at the storage area.
5. At the Challenge Holding Area, the SAFMC referee will hand the R/C transmitter back to the team for preparation while waiting for their turn for the competition.

[1] A Fail-safe mode is a setup to disable the propeller(s) from operating when an emergency condition occurs. When "Fail-safe" mode is triggered, the servomotor driving the propeller is power-off and stopped spinning.

DO NOT power on the R/C transmitter and flying machine until the team is told to set up the flying machine.

6. The team is given **THREE (3) minutes** to complete each attempt. The start of the attempt is defined as the flying machine performing a hand-launch from the launch zone of the playfield.
    a. Points will be awarded according to Section 4.
    b. During the attempt, **ONLY TWO (2) members** (the pilot and one (1) assistant) are allowed in the playfield.
    c. During each attempt, the team is given a maximum of **ONE (1) minute** to launch its flying machine. If the team does not launch its flying machine within the given time, the team is deemed to have executed and completed the attempt.
    d. When the first attempt is completed, the team shall be given **THREE (3) minutes** to repair or prepare the flying machine for the second attempt.

An SAFMC referee will be with the pilot during the challenge attempt. The referee may give instructions to the pilot depending on the behaviour of the flying machine. The pilot is to comply immediately with all such instructions, which may include the activation of the failsafe to ground the flying machine.

7. During an attempt, the team is allowed to change the direction of flight.

8. If the flying machine touches the ground or hits any object within the playfield during the attempt, the team can recover the flying machine and continue the challenge until it is non-airworthy.
9. During the recovery of the flying machine, the flight crew shall observe the following:
    a. The pilot stationed in the pilot zone (walkway) is to ensure the flying machine is throttled down (propeller(s) stopped spinning).
    b. **ONLY** the assistant is allowed to enter the flight zone of the playfield. The assistant can only relaunch the flying machine from any of the re-launch zones.
10. The completion of an attempt is defined as when the flying machine has:
    a. not become airborne ONE (1) minute after arriving at the launch zone, or
    b. landed outside the playfield, or
    c. hit the safety net or barrier and cannot resume flight, or
    d. been declared non-airworthy by the challenging team, or
    e. completed **THREE (3) minutes** of flight time.
11. Once the **THREE (3) minutes** of flight time is up, the pilot shall land the flying machine immediately.
12. If there is a tie in score, the judges will decide on the winner based on flight performance (stability and handling).
13. At the end of the challenge, the R/C transmitter of the flying machine MUST be switched off immediately. The team shall vacate the competition area immediately.

5.3. KEY RULES TO NOTE

Rules for personnel movement and communication during the setup time and the challenge attempt are dictated in the following points:

1. **ONLY TWO (2) members** of the participating team are allowed to be inside the playfield at any one time.
2. **NO outside communication or assistance** from the audience/spectators is allowed at any point. **NO headphones or earpieces** are allowed to be worn by the operator/pilot. Communication among teammates is allowed. Teams that flout this rule may be removed from the competition.
3. During the recovery of the flying machine, the referee may follow the assistant into the flight zone to observe the safety of the assistant.
4. The other teammates are required to remain outside of the playfield and be behind the safety net when the aircraft is airborne.
5. The team is responsible for the safe flying of its flying machine(s) for the duration of the entire competition. The referees reserve the right to ground the flying machine(s) of any team at any point in the competition.
6. All repairs/maintenance/troubleshooting should be done in the Repair Area. The teams who flout this rule may be removed from the competition.

6. TECHNICAL RULES & REGULATIONS

6.1. GENERAL RULES

Each team consists of **TWO (2) to FIVE (5)** students.

Each team is to design and build a radio-controlled flying machine based on the following guidelines:

1. Most parts of the fixed-wing plane or kite plane must be fabricated by the teams. **NO kits or off-the-shelf flying models** are allowed.
2. The fixed-wing plane or kite plane must be radio-controlled by off-the-shelf radio systems.
3. Only electric flight is allowed. Both brushed and brushless motors are allowed. **NO MODIFICATION to the motors** is allowed.
4. **NO internal combustion or gasoline engines** shall be allowed.
5. Each participating team shall be allowed to bring up to **TWO (2) IDENTICAL fixed-wing planes or kite planes** into the competition hall.

6.2. RULES ON FIXED-WING PLANE OR KITE PLANE

Teams with interesting designs that may potentially infringe the written rules are strongly encouraged to send enquiry emails with pictures and descriptions to SAFMC@science.edu.sg with the title **"[CAT RC FLIGHT FIXED WINGS] - Enquiries on Rules".**

6.3. DESIGN

- **NO Vertical Take-off and Landing (VTOL)** flying machine is allowed.
- **NO balloon and airship design** will be allowed. No gaseous substance lighter than air will be allowed.
- The flying machine must **NOT EXCEED a maximum all-up weight (AUW) of 250 grams**.
- All flying machines **MUST be hand-launched** at the playfield.

6.4. FLIGHT CONTROLLER

- A flight controller with built-in gyros supporting 3-axis stabilisation and an Accelerometer is permitted.
- 'Auto-level' / 'Attitude hold' mode is permitted.

6.5. BATTERY

- There is no limit on the number of batteries used, in series or parallel.
- **ONLY** Lithium Polymer (Li-Po), Nickel Metal Hydride (Ni-MH) or Nickel Cadmium (Ni-Cd) batteries are allowed.

6.6. SPEED CONTROLLER

- **ONLY** Electronic Speed Controllers are allowed.

6.7. SERVO

- **ONLY** standard R/C servos are allowed. There is no limit on the number of servos used.