

Swarm

Challenge Booklet 2027

Organised by:

DSO NATIONAL LABORATORIES

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SAFMC 2027 CATEGORY SWARM 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 Swarm[1], teams made up of **TWO (2)** to **TEN (10)** members are expected to bring, or design and build, a swarm of **TEN (10)** to **TWENTY-FIVE (25)** drones to compete in a search-and-rescue mission.

At least 30% of the team members must be Singapore Citizens. For example, a team of SEVEN (7) members must include at least THREE (3) Singapore Citizens.

2. CATEGORY SWARM 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, and 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 Swarm is listed in the subsequent sections.

2.1. CHAMPIONSHIP AWARD

This is the pinnacle award any team can win and is bestowed on the team that achieves the highest total score across all areas. For Category Swarm, there will be **FIVE (5)** Awards: **ONE (1)** Championship Award

[1] Each team must comprise at least 30% Singapore Citizens to be eligible to participate..

winner and **FOUR (4)** runners-up. The scoring and weightage can be found in Section 4.

2.2. JUDGES' COMMENDATION

This award is given out to Category Swarm teams exhibiting a high quality in design and/or performance but did not win the Championship Award or the 1st and 2nd runners-up prizes. Teams that have won any of the top three prizes will not be considered for the Judge's Commendation Prizes. Overall scores may be taken into consideration for this award. Up to **TWO (2)** Judges' Commendation awards may be given for the whole Category Swarm.

2.3. INSTAGRAM REEL CHALLENGE

2.3.1 CHALLENGE OVERVIEW

The Instagram Reel Challenge is a supplementary challenge and will **not** contribute to the teams' overall competition scores.

Show off your team's SAFMC experience through a viral Instagram reel! The reel with the most likes when the challenge concludes at the end of **9 April 2027** wins S$200 in vouchers!

2.3.2 REEL THEMES

Your reel must focus on **ONE (1)** of the following themes:

- Our Biggest Fail
- Our Biggest Challenge
- Our Innovation Journey

For a more engaging reel, teams are encouraged to:

- Keep the reel under **ONE (1)** minute
- Ensure a good hook within the first **TWO (2)** seconds

2.3.3 PARTICIPATION REQUIREMENTS

Participating teams are invited to showcase their SAFMC experience by creating and posting an Instagram reel. The qualifying reel with the highest number of likes as at **2359hrs on 9 April 2027, Singapore time**, will win the Instagram Reel Challenge.

The winning team will receive **S$200 in vouchers**.

The Instagram Reel Challenge is open only to teams participating in any of the following SAFMC 2027 categories:

- Man-Machine
- High-Speed Drone Flock
- Swarm

To qualify for the challenge, teams must fulfil **ALL** of the following requirements:

1. The reel must be posted using an Instagram account belonging to a member of the participating team.
2. The Instagram account must be set to **public**. Reels posted from private accounts will not be eligible, as the relevant engagement statistics cannot be viewed by the SAFMC organising committee.
3. The Instagram account must follow **@safmc_official**.

4. The reel must be posted on the account's feed from **15 to 24 March 2027, Singapore time**. **Reels posted outside this period will not qualify.**
5. The reel caption must include the team name.
6. The reel caption must include both hashtags: **#safmc** and **#safmcigchallenge**
7. When posting the reel, teams must use Instagram's collaboration function by selecting **Tag people > Invite collaborators** and inviting **@safmc_official** as a collaborator.
8. @safmc_official will accept qualifying collaboration invitations on **25 March 2027**.
9. The qualifying reel with the highest number of likes as at **2359hrs on 9 April 2027, Singapore time**, will be declared the winner.

Posting earlier within the submission period may provide teams with more time to receive likes before the challenge closes.

2.4. PRIZES

CATEGORY SWARM				
Awards	**Medals**	**Trophy**	**Prize**	**Remarks**
Championship Award	✓	✓	$20,000	Cash
1st Runner Up	✓		$15,000	Cash
2nd Runner Up	✓		$10,000	Cash
3rd and 4th Runner Up	✓			
Judge's Commendation	✓		$500	Voucher; Up to two teams can win this award.
Instagram Reel Challenge			$200	Voucher

3. CATEGORY SWARM MISSION

Teams are required to design a system of **TEN (10)** to **TWENTY-FIVE (25)** drones to navigate through an indoor environment and search for victims and fires, using either a centralised or de-centralised fully autonomous control system. The system must possess localisation, obstacle sensing and obstacle avoidance capabilities. The drones and localisation system may be customised or commercial off-the-shelf (COTS) products and need not be homogenous.

The description of the mission tasks and scoring criteria will be detailed in Section 3.1 and Section 3.4 respectively. Teams are advised to read through these sections in detail to develop a strategy and identify key design requirements, before designing the drones to execute the mission. The technical requirements for the drones are found in Section 6.

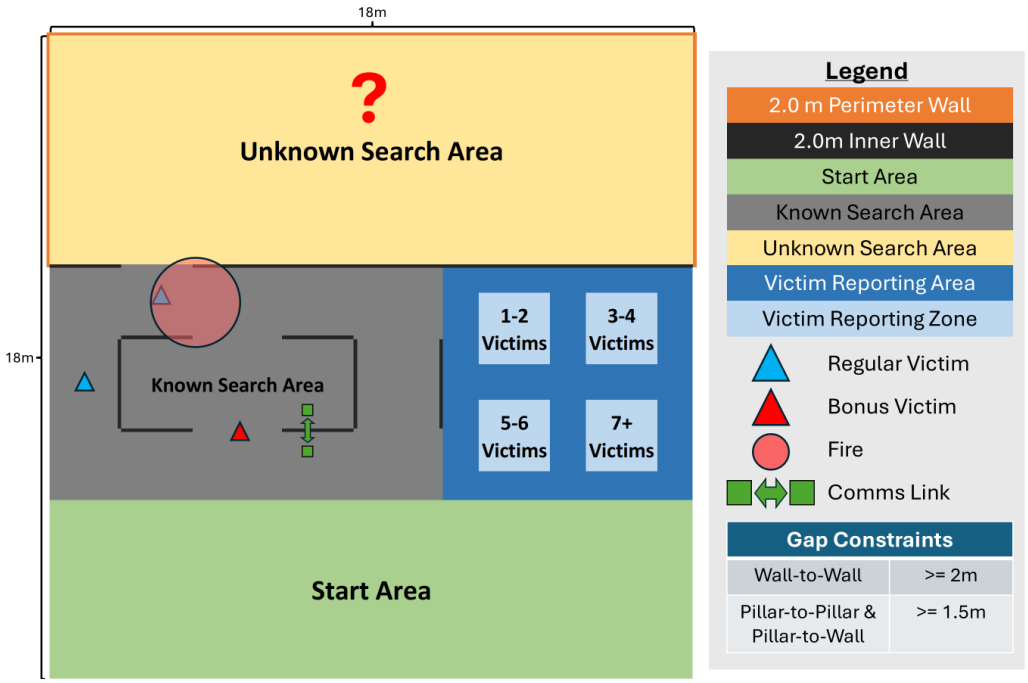
3.1. MISSION TASKS

The mission requires a swarm of drones to collaboratively explore an indoor environment in a search-and-rescue setting.

The key aspects of the mission are:

- **Take off** simultaneously within the Start Area.
- **Search** for all victims and fires as quickly as possible.
- **Extinguish** fires by landing next to them.
- **Rescue** victims by landing next to them.
- **Establish communications** by landing next to each terminal of the comms link.
- **Signal** the number of rescued victims by landing within the relevant victim reporting zone.

3.2. PLAY FIELD



The layout of the play field is shown above. The play field is approximately 18m x 18m. It is surrounded by a perimeter wall on three sides, and netting on all sides.

When referring to the above diagram, note that:

- The layout is **not drawn to scale**.
- The placement and number of victims, fires and comms link shown are for **illustration purposes only**.
- The placements of the inner walls will follow the diagram, but the **exact positions and dimensions will NOT be given**. There may be an unknown number of inner walls in the unknown search area.
- The layout within the Unknown Search Area is **intentionally NOT shown**.

The approximate dimensions of the play field elements are shown below.

Play Field Element	Approximate Dimensions
Start Area	18m x 5m
Known Search Area	11m x 6.5m
Unknown Search Area	18m x 6.5m
Victim Reporting Area	7m x 6.5m
Victim Reporting Zone	2m x 2m
Perimeter Wall	2.0m tall
Inner Wall	2.0m tall
Pillar Obstacle	0.3m diameter, 2m height (Includes a weighted circular base of 0.5m diameter and 0.15m height)
Gaps Between Walls	At least 2m

Gaps Between Pillar Obstacles and Walls / Other Pillar Obstacles	At least 1m

3.3. MISSION RULES

3.3.1 GENERAL

1. Teams will be given setup time prior to each run. The time is allocated as follows:

Setup (25 min)	Run 1 (10 min)	Setup (15 min)	Run 2 (10 min)

2. Every team will be given **TWO (2)** runs.
3. A minimum of **TEN (10)** and maximum of **TWENTY-FIVE (25)** drones are required to participate in each run.
4. A run starts when any part of any drone has exited the Start Area. It ends when all drones have landed, or the mission time has been exceeded, whichever happens first.
5. During setup time, teams are allowed to take off the drones for testing, but the drones must stay within the Start Area. (Note safety rules Section 5.4)
6. If teams complete their setup earlier, the remaining setup time will not be carried over to the run time. In such cases, teams must inform the officials that they are ready to start their run, after which setup is over.
7. When the team is ready to start their run, officials will place the field elements. These elements include, but are not limited to, the markers for victims, fires, comms link. Only when the field is fully set would teams be signalled to start the run.
8. If a team exceeds its allotted setup time, its run time will be penalized by the amount of time by which the setup time was exceeded. (See Section 3.5)
9. During mission time, teams may reset and re-attempt take-off as long as no part of any drone has exited the Start Area.

10. Teams are not allowed to repair or troubleshoot the drones during a run. Any drones that malfunction during a run will be out for that run. The run may continue if the remaining drones are deemed to be safe by the referee.
11. Teams are allowed to repair their drones outside of runs. There is no restriction on the number of spare drones the team can prepare as long as they have passed the inspection. See Section 5.3 point 2 for details about the technical inspection conducted before the competition for drone guidelines.
12. The system must be fully autonomous. After a team completes setup, it is not allowed to input commands during the run, unless informed or permitted by the referees.
13. Drones are not allowed to be physically connected to each other (e.g. tied together).
14. Ground robots are not allowed to be used during the run.
15. Drones are not allowed to fly over walls. The maximum flight height is 1.4m.
16. Any navigation aids (e.g. ultra-wideband systems, fiducials) must be:
    a. Placed during setup time.
    b. Placed within the perimeter walls.
    c. Easily removable without leaving a mark.
    d. Properly secured, e.g. will not topple over.
    e. Cannot be secured to overhead structures.
    f. Within 1m x 1m (Height limit of 2m).
17. A combined maximum of **TEN (10)** navigation aids is allowed in the Known Search Area and Victim Reporting Area. Teams are allowed to enter the Known Search Area only during setup time.
18. There is no limit on the number of navigation aids within the Start Area.

19. Navigation aids are **NOT** allowed in the Unknown Search Area. Teams are **NOT** allowed to enter the Unknown Search Area at all times.

3.3.2 TAKE-OFF

1. Drones are to take off only within the Start Area.
2. Each run has a maximum of **TWO (2)** simultaneous take-offs. A simultaneous take-off is defined as a group of drones taking off, with the last drone of the group taking off within **TEN (10)** seconds after the first drone of the group had taken off.
3. There are no restrictions to the number of drones participating in a simultaneous take-off.
4. After the **TWO (2)** simultaneous take-offs, no other drones are allowed to take off.
    a. An exception is made if no drone has left the Start Area. (See Section 3.3.1 Rule 9)

3.3.3 VICTIMS

1. For each run, the number of victims and their positions will be unknown to the teams.
2. There are 2 types of victims: Regular Victims and Bonus Victims. Bonus Victims are likely to be placed in regions that are harder to rescue but are worth more points than Regular Victims.
3. Teams shall provide **FOUR (4)** markers to be used as Regular Victims, and **FOUR (4)** markers to be used as Bonus Victims. The markers must be non-electronic, be within 30cm x 30cm x 100cm (L x B x H), and weigh less than 1kg.

4. Officials will simply place the markers on the floor. Special instructions (e.g. taping markers down) must be made known to the officials before the run. Officials may reject the special instructions if they are deemed unsafe, time-consuming, or damage the play field.
5. There is a possibility that the placement of victims may overlap with any navigation aids placed by the teams.
6. The rescue of a victim is done by having at least **ONE (1)** drone land within 1m of the victim until the end of the run, within Line-of-Sight (LOS), i.e. when drawing a straight line from the drone to the victim, there must be no walls or pillars on the line.
7. When measuring the distance between a drone and a victim, the start point of the measurement will be the position of the victim, as set by the SAFMC organising committee.
8. The start point will remain the same even if the victim markers are dislodged (e.g. by drones flying over). Teams must indicate on each drone where the end point of the measurement will be, e.g. with a sticker or marking.
9. If a victim is within 2.5m of a fire (See 3.3.4), the fire must be extinguished for the rescue to be considered successful. Otherwise, the rescue is worth no points. However, if the drone lands within 1m of the victim and 1m of the fire, the fire is considered extinguished and the victim is considered rescued.

3.3.4 FIRES

1. For each run, the number of fires and their positions will be unknown to the teams.
2. Teams shall provide **FOUR (4)** markers to be used as the fires. The markers must be non-electronic, be within 30cm x 30cm x 100cm (L x B x H), and weigh less than 1kg.
3. Officials will simply place the markers on the floor. Special instructions (e.g. taping markers down) must be made known to the officials before the run. Officials may reject the special instructions if they are deemed unsafe, time-consuming, or damage the play field.
4. There is a possibility that the placement of fires may overlap with any navigation aids placed by the teams.
5. The extinguishing of a fire is done by having at least **ONE (1)** drone land within 1m of the fire, within Line-of-Sight (LOS), i.e. when drawing a straight line from the drone to the fire, there must be no walls or pillars on the line.
6. When measuring the distance between a drone and a fire, the start point of the measurement will be the position of the fire, as set by the SAFMC organising committee.
7. The start point will remain the same even if the fire markers are dislodged (e.g. by drones flying over). Teams must indicate on each drone where the end point of the measurement will be, e.g. with a sticker or marking.

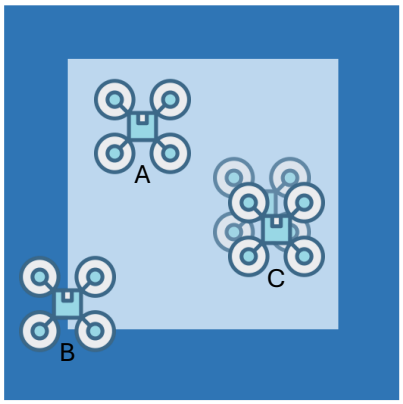
3.3.5 COMMS LINK TERMINALS

1. There will **ONLY** be **ONE (1)** pair of comms link terminals.
2. For each run, the position of the **TWO (2)** comms link terminals will be unknown to teams. A comms link will always **ONLY** have **TWO (2)** terminals.
3. A comms link is considered established if there is a drone within 1m of each comms link terminal, within Line-of-Sight (LOS). I.e. when drawing a straight line from the drone to the comms link terminal, there must be no walls or pillars on the line.
4. Teams shall provide **TWO (2)** markers to be used as each terminal of the comms link. The markers must be non-electronic, be within 30cm x 30cm x 100cm (L x B x H), and weigh less than 1kg.
5. Officials will simply place the markers on the floor. Special instructions (e.g. taping markers down) must be made known to the officials before the run. Officials may reject the special instructions if they are deemed unsafe, time-consuming, or damage the play field.
6. There is a possibility that the placement of comms link terminals may overlap with any navigation aids placed by the teams.
7. A single drone may simultaneously rescue victims, extinguish fires, and establish a comms link, provided it is within 1 m of each target.

3.3.6 VICTIM REPORTING

1. The swarm should report the number of rescued victims by landing in the relevant victim reporting zone in the Victim Reporting Area.
2. There will be **FOUR (4)** victim reporting zones in the Victim Reporting Area, corresponding to **1-2** victims, **3-4** victims, **5-6** victims, and **7 or more** victims rescued.

3. Each victim reporting zone will have dimensions of about 2m x 2m. The zones will be clearly demarcated within the Victim Reporting Area.
4. Teams are expected to use their swarm localisation solution to find and land within the appropriate victim reporting zone.
5. For scoring, only the final state of the play field is considered to determine the actual number of successfully rescued victims.
6. A drone is considered within the victim reporting zone if it lies fully within the zone's boundaries and is fully supported by the floor, i.e. is not landed upon or otherwise supported by another drone. Drones which do not meet these criteria will not count towards the scoring for the Victim Reporting task.



An example is given in the image above.

- Drone A lies fully within the victim reporting zone's boundaries.
- Drone B does not lie within the victim reporting zone's boundaries.
- While Drone C lies fully within the victim reporting zone's boundaries, it has landed atop of another drone.

Only Drone A counts towards the scoring for the Victim Reporting task.

3.3.7 LANDING

1. The swarm must decide when it has sufficiently completed the tasks and end the mission by landing. Teams are also allowed to send a command to land the remaining drones with permission from the referees.

3.3.8 UNKNOWN SEARCH AREA

1. The swarm may enter the Unknown Search Area via the open doorway shown in the diagram in Section 3.2. The doorway will be closed during setup time to prevent teams from entering the Unknown Search Area.
2. The Unknown Search Area will contain Bonus Victim(s), wall(s), pillar obstacle(s), fire(s) and comms link terminal(s).

3.4. MISSION SCORING

The possible points and penalties that a team may receive are listed in the table below. The referees will make all scoring decisions, and their decisions are **final**. For arbitrary cases, the **Chief Referee** will have the **final** say.

Scoring Criteria	Points Awarded / Subtracted
Regular Victim rescued (At least 1 drone lands within 1m of the victim within LOS)	+2 for each victim
Bonus Victim rescued (At least 1 drone lands within 1m of the victim within LOS)	+4 for each victim

Fire not extinguished	0 points awarded for any victims within 2.5m of the fire
Comms link established (At least 1 drone within 1m of each of the two ends of the comms link within LOS)	Multiply the total victim rescue score by 1.5. This multiplier is applied before victim reporting points are added.
Correct number of victims reported by landing the drone within the victim reporting area (See Section 3.3.6)	+1/+2/+3/+4 points per drone (**up to 3 only**) within the victim reporting zone for reporting 1-2 / 3-4 / 5-6 / 7+ rescued victims respectively
Incorrect number of victims reported	-4 points per drone within the incorrect victim reporting zone
The **highest score** attained across the runs will be taken as the mission score. If teams have the same total score, the **run time will be used to break ties**. In this case, the run with the shorter run time would rank higher. Each victim/fire can only be rescued/extinguished **once**, e.g. if multiple drones rescue the same victim, only one rescue is acknowledged. The minimum number of points scored from the Victim Reporting task is 0.	

Example Calculation 1:

Two regular victims and two bonus victims are successfully rescued. One additional bonus victim is not counted because the associated fire was not extinguished. A comms link is established, and two drones land in the correct victim reporting zone corresponding to 3-4 rescued victims.

Scoring	Points Awarded / Subtracted
Victim Rescue Score	(2 × 2) + (2 × 4) = 12 points
Comms link multiplier	12 × 1.5 = 18 points
Victim reporting score	2 drones × 2 points = 4 points
Total Score	18 + 4 = 22 points

Example Calculation 2:

Two regular victims and two bonus victims are successfully rescued. A comms link is established, and one drone lands in the incorrect victim reporting zone corresponding to 5-6 rescued victims and one drone lands in the correct victim reporting zone corresponding to 3-4 rescued victims.

Scoring	Points Awarded / Subtracted
Victim Rescue Score	(2 × 2) + (2 × 4) = 12 points
Comms link multiplier	12 × 1.5 = 18 points
Victim reporting score	(1 drone * 2 points) + (1 drone x –4 points) = -2 (Rounds off to 0 points)
Total Score	18 + 0 = 18 points

3.5. PENALTIES

The referees will make all penalty decisions, and their decisions are **final**.

For arbitrary cases, the **Chief Referee** will have the **final** say. Further correspondences will not be entertained. The list of mission penalties is shown below.

S/N	Description	Penalty
1	Exceeding the setup time.	The run time will be decreased by the amount of time that the setup time limit is exceeded.

2	Less than 10 drones in the Start Area.	The mission run will be forfeited.
3	Drones exceed flight bounds.	Referee's discretion or **disqualification**.
4	Drones taking off and leaving the Start Area during Setup Time.	Referee's discretion or **disqualification**.
5	Additional take-offs after two simultaneous take-offs have occurred.	Referee's discretion or **disqualification**.
6	Use of external markers outside of the play field.	Referee's discretion or **disqualification**.
7	Internal markers within the play field that are unable to be removed or leave a mark after being removed, e.g. damage to structures.	Referee's discretion or **disqualification**.
8	Internal markers within the play field that cause harm to persons, e.g. tripod stands toppling due to improper securing.	Referee's discretion or **disqualification**.
9	Interrupting the competition by potentially interfering with other competitors, e.g. switching on your platform's VTX, transmitters, etc.	Referee's discretion or **disqualification**.
10	Attempting to subvert competition rules or gain an unfair advantage over other teams, e.g. receiving assistance from spectators, etc.	Referee's discretion or **disqualification**.

4. SCORING

The scoring components for the competition are:

1. Team Challenge **V**ideo (V)
2. Team Live **P**resentation (P)
3. **M**ission (M)

The first 2 components (V and P) will be assessed by our Category Swarm Judges, while the Mission (M) component will be computed from the highest attained score from the challenge attempts. Scores will be awarded relative to the performance of other teams. Further details on the scoring components can be found below.

The weightage of the scoring components is listed as follows:

Component	Weightage
Team Challenge **V**ideo	10%
Team Live **P**resentation • Strategy – 30% • Presentation Quality – 10%	40%
Mission	50%
Total	**100%**

For Category Swarm the total score **T** is computed as T = V + P + M.

4.1. TEAM CHALLENGE VIDEO (V)

The Team Challenge Video provides a proof-of-flight insight into how the swarm performs before the challenge day. The video should include:

1. Flight Worthiness
    a. Drones must be shown to perform stable, sustained flight.
    b. At least **FIVE (5)** drones must be shown to take off simultaneously.
2. Mission Readiness
    a. Explain the on-board sensor suite for each unique drone used in the challenge segment.
    b. At least **TWO (2)** drones must be shown avoiding static obstacles.

c. At least **TWO (2)** drones must be shown to search a room containing at least **TWO (2)** victims, and land next to them when detected.

3. Creativity
   a. Resourcefulness in re-creating competition layout to showcase similar mission requirements.

Further details about the video are provided in Section 5.2.

4.2. TEAM LIVE PRESENTATION (P)

During the presentation, teams are suggested to share about their **proposed strategy** and their **learning outcomes**.

Proposed Strategy:

Teams should explain how their drones, sub-systems, and swarm algorithms help in their mission strategy. These include:

1. Choice of sensor suite used to tackle the mission.
2. Obstacle and collision avoidance method.
3. Positioning method.
4. Search strategy.
5. Method of communication between drones and ground control station (GCS).
6. Task allocation method.
7. Any other algorithms used in completion of the mission.

Teams are also encouraged to utilise and present unique concepts, which may include:

1. Robust and intelligent methods of swarm control.
2. Effective utilisation of different kinds of drones in the swarm.
3. Unconventional ideas and methods to complete the mission.

4. Methods to reduce time taken to complete the mission.

Learning Outcomes and Insights

Teams are to share about their experience preparing for the competition. These include:

1. Challenges faced and lessons learnt.
2. Key decisions made during the design process and their rationale.

In the spirit of building shared camaraderie amongst competitors, teams are encouraged to share their approaches with one another, as time permits.

Further details about the live presentation are given in Section 5.1.

4.3. MISSION (M)

The challenge segment scores on the challenge day will form the **Mission (M)** score. Please refer to Section 3.4 and Section 3.5 for the mission scoring and penalties.

5. FLOW OF EVENTS

Similar to real-world scenarios, teams may face unexpected issues during the competition. 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 may also influence competition results.

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**
   Teams are to report to Science Centre Singapore, Annexe Hall at 0830hrs on 9 April 2027 for the Presentation Segment.

2. **Presentation Booth**
   Each team will be allocated a booth within the presentation 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 at least 20 minutes to set up their presentation booth on the presentation day.

   Presentation judging will commence after 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 **FIFTEEN (15) minutes per visiting judge**, comprising:

- **TEN (10) minutes** for the team presentation; and
- **FIVE (5) 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.

6. **Presentation Requirements**
   During the Presentation Segment, teams are required to:

   1. Bring each unique drone used for the challenge segment.
   2. Teams are to prepare **ONE (1)** presentation in the form of **TWO (2)** A0 posters OR up to **FIFTEEN (15)** slides. The time limit for the presentation is 10 minutes.

Teams may bring their own external monitor(s) for the presentation, provided that the setup is deemed **logistically feasible and does not pose any safety concerns.**

5.2. TEAM CHALLENGE VIDEO

Teams are to submit **ONE (1)** Team Challenge Video to the SAFMC organising committee. The video length should be no longer than **TEN (10)** minutes and should include the key components as stated in Section 4.1.

Videos should be uploaded to YouTube and set as “Unlisted”. The link to the video should be sent to SAFMC@science.edu.sg with title subject: “[CATEGORY SWARM] - [Team Name] – Challenge Video” before the deadline.

The deadline for submission is **28 February 2027, 2359hrs**. The video should be uploaded before the deadline, and any re-upload of the video detected past the deadline may result in **penalisation** or **disqualification**. You may write in to the SAFMC 2027 organising committee to request for a re-upload of the Team Video if necessary.

The weightage of penalisation is listed below:

Submission Period	**Penalty**
Submission between **01 March 2027, 0000 to 07 March 2027, 2359** **(Both dates and time inclusive)**	50% deduction of Team Challenge Video score
Submission on **08 March 2027, 0000 and beyond**	Zero score for Team Challenge Video

The submitted video should adhere to the following guidelines:

1. Drones in the video are **NOT** to be animated.
2. Computer-aided simulations may **NOT** be used to prove flight worthiness and mission-readiness.
3. Video must **NOT** be produced by a professional, or with professional assistance. It should be a product of the team's own effort.
4. No offensive images or audio.
5. Narration and/or subtitles are allowed.
6. All videos must be original work conceived and created by the participants. No copyright materials (images, music, etc.) may be used in the video unless the participants own the copyright or have a license to use the material in the video.

7. If the participants have gained formal permission to use any copyright materials (images, music, etc.) under terms and conditions stipulated by the copyright owners, acknowledgements/credits must be included at the end of the video.
8. The use of logos including known commercial brands, institutional crests or trademarks, unless integral to the project, is not allowed.
9. Ownership of the underlying intellectual property of the video remains with the participant(s) of the individual/team project, with the following exceptions:
    a. Participant(s) grant the SAFMC organising committee the right to use, distribute and display their videos without further compensation or notification to the participant(s).
    b. Participant(s) grant the SAFMC organising committee the right to use their images and videos for publicity and advertising without further compensation or notification to the participant(s).

5.3. CHALLENGE SEGMENT

Teams are expected to comply with the following during the challenge segment:

1. Teams are to arrive at their designated reporting time.
2. At the allocated competition schedule, the team shall report to the safety inspection point. An SAFMC official will check the drones for any violation of the category rules and regulations. Teams who do not pass the inspection will **not** be allowed to fly their drones for the mission and may face **immediate disqualification** from the competition. The inspection will include, but is not limited to, the following checks:
    a. The maximum take-off weight (MTOW) and size of the drones.

b. RC / datalink / video link transmitter and receiver are operating on allowed frequencies.
c. Electrical harnessing should be appropriately insulated and should not be chafed or broken. No exposed wires and connectors are permitted.
d. All major assemblies and critical components must be securely fastened to the drones; loose items should be tied down and kept away from the propellers.
e. For drones operating on semi-autonomous / autonomous modes, it should allow complete manual pilot override on demand via RC or GCS.
f. The drones must demonstrate **failsafe capability** in the **event of a loss of link** between the RC/GCS and the drones. The failsafe check procedure is as follows:
    i. All propellers and releasable payloads are to be removed from the drones.
    ii. Flight motors will be armed and throttled up.
    iii. While the motors are still spinning in the same flight mode, the Wi-Fi router(s) will be switched off to simulate a link loss.
    iv. All motors should come to a **complete stop immediately**. The drones should **not** attempt a hover / controlled descent / to return home.
g. An SAFMC official will be with the operator during the mission attempt. The official may give instructions to the operator depending on the behaviour of the swarm (e.g. to land immediately if the drones appear to be uncontrollable). The operator is to comply immediately with all such instructions, which may include the activation of the failsafe to ground the drones.

h. The drones must demonstrate **failsafe capability** upon **operator command**. The failsafe check procedure is as follows:
    i. All propellers and releasable payloads are to be removed from the platform.
    ii. Flight motors will be armed and throttled up.
    iii. While the motors are still spinning in the same flight mode, the operator must be able to activate a kill-switch.
    iv. All motors should come to a **complete stop immediately**. The drones should **not** attempt a hover / controlled descent / to return home.

i. Failsafe capability for the DJI Tello and Hula drones will be the OEM default failsafe logic. Any tampering or modifying of the OEM failsafe logic (unless to meet Point 2(e), Point 2(f) and Point 2(h)), will result in a disqualification. These drones are exempt from Point 2(e), Point 2(f) and Point 2(h), because:
    i. The SDK does not allow for the expected failsafe behaviour to be configured.
    ii. The drones do not allow motors to function when propellers are removed.

j. At the end of each mission attempt, the radio control transmitter, datalink transceiver, video receiver and any other wireless device for the drones must be switched off.

5.4. KEY RULES TO NOTE

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

1. Only members of the participating team are allowed to be inside the play field during their allocated 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. Teams who violate this rule may be **disqualified**. Communication amongst teammates is allowed. The Referee may require teams to surrender all communication devices for the duration of their challenge attempt.
3. The netted play field **must** be clear of persons whenever any drone(s) are armed or in flight.
4. If any drone(s) are **connected to batteries**, persons entering the netted play field **must** don the appropriate Personal Protective Equipment (PPE), which will be provided.
5. Team members may enter the field to collect their drones, or to bring them out of the play field to modify or repair (including changing batteries) **after** they have landed and have been disarmed. Entry into the play field is only allowed upon confirmation with SAFMC officials.
6. Multiple video **receivers** are allowed. Only **ONE (1)** video transmitter is allowed for each drone.
7. No radio control transmitters, datalink transmitters and video transmitters and receivers are to be switched on within the competition venue, unless permitted to do so in the holding area or play field. All repairs / maintenance / troubleshooting should be done in Raceband channel 8 with VTX set to either 25mW or pit-stop mode. Non-compliance may lead to **disqualification**.
8. There will be a charging space allocated for teams to charge their batteries. Teams will have to bring their own charger / charging equipment should they plan to charge their batteries. At any point, there **MUST** be at least **ONE (1)** team member overseeing the charging. Failure to do so will result in **disqualification**.

9. Teams shall make sure that their designated representatives are contactable and should arrive at least **TEN (10)** minutes before any allocated timing. Latecomers may have their mission times shortened or may be **disqualified**.

6. TECHNICAL RULES & REGULATIONS

Each team is to design and build a swarm based on the following guidelines:

1. Off-the-shelf products and components are allowed in the competition.
2. For safety considerations, the total weight of each drone **must not exceed 1.0kg**.
3. Each drone, including propellers, must fit within a **30cm x 30cm x 30cm box.**
4. Participants are only allowed to use up to **TWENTY-FIVE (25)** drones for each mission attempt. Teams can bring similar backup drones to replace any drones that have become incapable of flight. Teams can only change drones between runs.
5. Only electric-based flight propulsion is allowed. Both brushed and brushless motors are allowed. No modification to the motors is allowed.
6. No internal combustion or gasoline engines are allowed.
7. No tethering or umbilical wires to the drones are allowed during flight.
8. External aids such as markers, indicators, etc. will be allowed **only** in the play field, and can only be placed when there are no drones armed or in flight.

9. For safety considerations, the swarm must be able to stop the mission and power down.

6.1. AVIONICS SYSTEM

There is no limit on the number of inertial measurement units (IMUs), flight controllers (FCs), and other electronics used in the drones.

6.2. BATTERY

There is no limit on the number of batteries used, in series or parallel. Participants should size their batteries and drones appropriately for the mission. Lithium-Polymer (LiPo) batteries are preferred.

Batteries must be properly strapped or locked onto the drones before launch.

6.3. RADIO FREQUENCY COMMUNICATIONS

The system must not wirelessly transmit data in the 5.7 to 5.9GHz frequency band. This includes, but is not limited to, video transmission over 5.8GHz WiFi or VTX. However, the use of ultra-wideband systems is acceptable. **Violation of this rule will result in immediate disqualification.**