# IMAV 2024 – Micro Aerial Vehicles Competition

*Security and Safety Regulations*

Changelog:

| Version | Changes |
|---|---|
| 1.0 | First distributed version |
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## 1. Introduction

This document describes the safety requirements and rules for the participants of the competition, which are meant to ensure the safe operation of the MAVs during the preparations and competition.

## 2. Document version

The following version of this document may be issued with additional and/or changed security rules. All participating teams must have a thorough understanding of the content of the latest version of this document before starting the competition.

## 3. Security and airworthiness check

All participating MAVs (rotary, fixed, hybrid or flapping wing) are allowed to fly only after passing a security and airworthiness check. This check will be performed before the first flight and covers all points listed below. Teams will present orally how their MAVs comply with the security measures of this document in front of the security panel. The airworthiness examination of the MAVs is performed by the day's flight manager.

## 4. Frequencies

Every team has to ensure, that the used frequencies and technology agree with the UK regulations.

**Frequency management:**

Competing teams must provide the organization with a list of all radio equipment and frequencies that they wish to transmit during security checks.

**Exampled allowed frequencies:**

| Transmitter | Frequency | Maximum transmission power |
|---|---|---|
| RC | 35 MHz | 100 mW |
| Data link / RC | 2.4 GHz | 100 mW |

The above list is not exhaustive. For more information: https://www.ofcom.org.uk/

## 5. Aircraft limitations

- The maximum take-off weight for the Outdoor-MAV (including payload) is limited to 4 kg.
- The maximum take-off weight for the Indoor-MAV (including payload) is limited to 3 kg.
- Only electric propulsion MAVs are allowed
- Only airworthy MAVs are allowed
- Only 1 MAV is allowed to fly at a time

## 6. Basic safety rules

Basic security principles are:

- Failure to comply with the security and safety regulations, will lead to disqualification of the team and grounding of all the team's MAVs for the rest of the event.
- Equipment and operations must comply with UK law.
- Transmitting of electromagnetic radiation (RC, data link, video link) is only allowed on frequencies and with power and modes legally allowed in UK.
- Aircraft (including separable parts) must be clearly identified with the name and address of a team member.
- It is the responsibility of the competing teams to locate and find their MAVs in case of loss or a field landing, in cooperation with the day's safety officer. Teams may only attempt recovery of their MAV under the guidance of the officially designated search & recovery team. There is no guarantee that lost MAVs will be found and returned to the team.
- MAVs may not have sharp or potentially dangerous protrusions, excluding commonly used propellers and rotor blades.

## 7. Flight zones - outdoor competition

The IMAV2024 organization committee will provide a specification of the flight area for the competition missions where all GPS coordinates are included, and height limitations are mentioned. The flight area will consist of two zones that have a maximum height and maximum boundaries:

**Green zone**: In this zone, all mission elements are located. The complete flight must be performed inside this green zone. The height limitation is 120 m above the starting point.

**Red line**: MAVs must terminate their flight upon crossing the red line immediately in the following manner described in section 8

Teams are advised to implement an automatic and immediate landing or return to green zone functionality upon leaving the combined green zone.

## 8. Flight safety

- If a MAV relies on GPS for navigation or other means than GPS navigation (e.g., the video system under video-based flight), it must take into account a GPS loss or otherwise unreliable fix. In such a case the MAV should immediately perform an emergency landing. The team should provide details on how they prevent the MAV from ever crossing the geofence under the actual weather conditions. The last reliable GPS signal must be stored on the ground station, to enable localization of the MAV. The team must convince the jury that the MAV can be retrieved upon loss.
- Each MAV needs to have a human Safety Pilot following the MAV constantly. When needed they must be able to take action to comply with the safety rules.
- The human safety pilot must be able to take control of the MAV at any time by means of a reliable data link which will result in an immediate action of the MAV imposed by the safety pilot.
- During the outdoor flight session (outdoor competition or outdoor practice day), all MAVs should remain within the limits of the flight zone. MAVs may never cross the red line. If a MAV crosses the borders of the flight zone, the MAV must terminate flight immediately in the following manner:
    - Motors must stop spinning, such that no thrust is generated
    - Any control surface must deflect such that the vehicle does not keep flying (e.g maximum elevator deflection)
- Teams must respect the general applicable safety rules for the open category A3 operations, particularly those related to rotating propellers and rotors, not to start, land and fly low in the direction of spectators, roads and buildings that are not a part of the competition´s green zone, and not to fly over the spectators.
- If a team cannot guarantee the security to satisfaction of the flight manager, the team is excluded from participation.
- Every flight can be aborted by the flight manager.

## 9. Flight operation

- Flight operations fly under the open category A3 details of which can be found within CAP722. https://www.caa.co.uk/our-work/publications/documents/content/cap-722/
- Each operator needs to be registered following the EU regulations. Every MAV needs to be labeled with the operators ID
- Outside the red line there is absolutely no start of any motors allowed. Any tests or lift-offs have to take place at the preparation day within the green zone following day's schedule.
- A team starting motors within spectator areas or outside the red line will be grounded for the rest of the competition
- Flying and radio transmitting is only allowed with the consent of the flight manager. Teams must follow the flight operation instructions of the flight manager
- Entrance of the green zone is only permitted for team members of the scheduled competing team.
- Switching on transmitters and transmitting (RC, data, video) is only allowed according to the schedule (team, time, frequencies) published by the organization at the competition.
- The flight manager is always right. Escalation is only possible to the IMAV2024 organization, at the competition which takes the final decision. Decisions of the IMAV2024 organization committee are binding.

## 10. Liability

- Participating teams fly under open category A3 of UK CAA regulations, details of which can be found within CAP722. https://www.caa.co.uk/our-work/publications/documents/content/cap-722/
- There are two routes for flight operations:
    - The University of Bristol assumes responsibility for your aircraft with the Bristol Designated person being the Operator. Operation is then also covered by University of Bristol third party liability. There is no cover provided for the drone system itself.
    - An individual team provides proof of CAA registration, Operator ID and third-party liability insurance and can therefore be the designated Operator of the system for flight.
- Participating teams remain responsible for their own actions and the IMAV 2024 organization committee and the organizing team members will never be held responsible or liable for any incidents and / or accidents caused by participating teams.
- Please do contact the IMAV2024 operators if you have any questions on Liability.

I am familiar with the contents of the latest version of this document and comply with it. Furthermore, all participants of my team are familiar with the contents of the latest version of this document and comply with it.

| Team Name | Team Captain | Signature of Team Captain |
|---|---|---|
| _____ | _____ | _____ |