

IMAV 2015 – Micro Aerial Vehicles Competition

Security and Safety Regulations

Changelog:

Version	Changes
0.1	First draft version
0.2	Increased maximum take-off weight (5 kg), Update flight zones
0.3	Maximum power for data/video transmission defined
1.0	Final version: Frequencies specified
1.1	Important Update: Chapter 9 – Parallel MAV operations are not allowed

Security and safety regulations documents with a version number lower than 1.0 may have not been authorised by the German authorities. So it can be subject to major modifications.

1. Introduction

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

The outdoor flight competition will take place at the firefighter-training-village **Floriansdorf** in the northwest of Aachen, while the indoor flight Competition will take place at **Sportpark Kohlscheid**, 6.3 km north of Aachen.

2. Document version

A 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 last 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 agree with the European/German regulations.

Frequency management:

Competing teams must provide the organization with a list of all radio equipment and frequencies that they wish to transmit on during security check. Switching on transmitters and transmitting (RC, data, video) is only allowed if the team is in possession of "frequency tokens" for the concerned frequencies.

Allowed frequencies:

Transmitter	Frequency	Maximum transmission power
RC	35 MHz	100 mW (ERP)
	40 MHz (Ch. 50, 51, 52 & 53)	100 mW (ERP)
	2.4 GHz	10 mW (EIRP)
Data link	433 MHz	10 mW (ERP)
	868 MHz	25 mW (ERP)
	2.4 GHz	10 mW (EIRP)
Video link	2.4 GHz	10 mW (EIRP)
	5.8 GHz	25 mW (EIRP)

Please note: All other frequencies (also 433 MHz and 900 MHz) are not allowed!

5. Sizes and weight limitations

- The maximum horizontal size of the MAV (including blades) is limited to 1.5 m.
- The maximum take-off weight of the MAV (including payload) is limited to 5 kg.
- The maximum allowed momentum during flight is set to 20 [kg m/s]
 - this implies:

$$(m \cdot V_{cruise}) < 20 [kg m/s]$$

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 the German law.
- Only electric propulsion MAVs will be allowed to participate in the competitions.
- Only airworthy MAVs will be allowed.
- Aircraft (including separable parts) must be clearly identified with name and address information 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 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.
- The team is always responsible for the safety of its MAVs and is liable for any accidents caused by their MAVs. See Chapter 10. Liability below.
- If the MAV uses a GPS, the position of the MAV has to be shown on the ground station.
- The main ground station screen has to be shared via a VGA output (to a beamer or flat-screen delivered by the organisation).

7. Flight zones - outdoor competition

The IMAV 2015 organization committee will provide a specification of the flight area for the competition missions by means of a Google earth file (.kmz) (www.earth.google.com) where all GPS coordinates are included and height limitations are mentioned. The flight area will consist of two zones which 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. Height limitation is 40 m.

Red zone: MAVs leaving the green zone and entering the red safety zone must immediately return to the green zone. The mission may be continued only after landing inside the green zone. The boundaries of the red zone are between green zone and red line. Height limitation is 40 m.

Red line: MAVs must perform an emergency landing upon crossing the red line immediately in the following manner:

Emergency landing: Is always performed by the safety pilot.
All MAVs have to direct themselves to the green zone immediately
Fixed wing: land without propulsion (throttle cut)
Rotary wing, flapping wing and hybrids: land with minimal power setting resulting in rapid but safe descent.

A first impression of zone dimensions can be gained with help of appendix A.

8. Flight safety

- Each MAV needs to have a human Safety Pilot following the MAV constantly.
- During multi-UAV operations every MAV needs to be clearly distinguishable. This can be done on shape or on color, so the observer knows which MAV to follow when they operate respectively in the area seen from the observer standpoint.
- 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 technical demonstrations), 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 pilot must immediately recover the MAV. Teams crossing the red line will be disqualified for the entire outdoor competition.
- Teams must respect the general applicable safety rules for model aircraft, 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

- Mission elements can be attended by one or more MAV(s), but only in series (no parallel tasks, no parallel MAV operations).
- 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 excluded from participation.
- 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.
- Shortly before the scheduled flight period, the “frequency tokens” may be collected from the flight manager. Directly after flight all transmitters must be switched off and the “frequency tokens” must be returned to the flight manager.
- 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 and only allowed if the team is in possession of the “frequency tokens” for the concerned frequencies.
- The flight manager is always right. Decisions of the IMAV 2015 organization committee are binding and not subject to discussion.

Please note: Parallel MAV operations are not allowed! Only one airborne MAV at a time is permitted.

10. Liability

- Participating teams are always responsible for the safety of their MAVs and are liable for any accidents caused by their team members and their MAVs.
- The IMAV 2015 organization committee and the organizing team members will never be held responsible or liable for any incidents and / or accidents caused by participating teams or their equipment.

<p>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.</p>		
<p>Team Name</p>	<p>Team Captain</p>	<p>Signature of Team Captain</p>

Appendix A: Safety zones

