

IMAV 2022 Security and Safety Regulations

Security and safety regulations documents with a version number lower than 1.0 can be subject to major modifications.

Version	Changes
0.1	First version
1.0	Removed general maximum linear momentum requirement.

Introduction

The *outdoor flight competition* of the International Micro Aerial Vehicle 2022 Conference will take place at the old military airport Valkenburg near the city Leiden. Visiting address: Marinevliegkamp 356, 2236 ZZ Katwijk aan Zee.

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

Security and Airworthiness check

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

Basic safety rules

Basic security principles are:

- Failure to comply with the security and safety rules will lead to disqualification of the team and grounding of all the team's MAVs for the remainder of the event.
- Equipment and operations must comply with the Dutch law.
- Only electric propulsion MAVs are allowed to participate in the competitions.
- Only airworthy MAVs will be allowed.
- Maximum size: 150 cm.
- Maximum weight: 5 kg.
- Transmitting of electromagnetic radiation (RC, data link, video link) is only allowed on frequencies and with power and modes legally allowed in the Netherlands. See (<https://wetten.overheid.nl/BWBR0036378/2021-12-15>) for a full description.
- Frequency management:
Competing teams must provide the organization with a list of all radio equipment and frequencies that they wish to transmit on. They must also provide alternative frequencies that they can use.
- Aircraft (including separable parts) must be clearly identified with name and address information of a team member.
- If the MAV uses a GPS, the GPS coordinates of the MAV have to be shown on the ground station.

- 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 normal propellers and helicopter-blades.
- The team is always responsible for the safety of its MAVs and is liable for any accidents caused by their MAVs. See 'liability' below.
- The main ground station screen must be shared via a VGA output (to a beamer or flat screen delivered by the organization).

Flight safety

- GPS loss
If a MAV relies on GPS for navigation, it must take into account a GPS loss or otherwise unreliable fix. In such a case the MAV should immediately perform an emergency landing as described below. The team should provide details on how they prevent the MAV from ever crossing the geofence (see below) under the actual weather conditions. The last reliable GPS signal must be stored on the ground station, to enable localization of the MAV.
- Loss of other navigation means
If a MAV relies on other than GPS navigation means (e.g., the video system under video-based flight) loss of this navigation means must be considered. In such a case the MAV should immediately perform a safety landing as described below. The team should provide details of how they prevent the MAV from ever crossing the geofence (see below) under the actual weather conditions. The team must convince the jury that the MAV can be retrieved upon loss.
- Every MAV needs to have an observer following the MAV constantly. When needed he must be able to take action to comply with the safety rules.
- 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.
- A human safety pilot must always be able to take over the MAV in case of an emergency by means of a reliable data link which will result in an immediate action of the MAV imposed by the safety pilot over this reliable link, especially near the launch zone and spectators.
- Flight zones:
The organization 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 three zones which have a maximum height and maximum boundaries:
The Yellow zone: All flights start from the yellow zone. This zone is close to the spectators, so the maximum height is 50 meters (164 ft). There is a maximum speed limitation in this zone of 10 meters per second ground speed.
The Green zone: This zone contains most of the mission elements. The height limitation is max 120 meters (390 ft). There is no speed limitation in this zone.
The Red line: MAVs must **terminate flight** upon crossing the red line immediately in the following manner:
 - Motors must stop spinning, such that no thrust is provided, and the vehicle is 'killed'.
 - Any control surfaces that the vehicle may have must deflect such that the vehicle does not keep flying (e.g. opposite aileron deflection).

Teams are advised to implement an automatic and immediate landing functionality upon leaving the combined green and yellow zone, to prevent loss of the vehicle and disqualification.

- MAV's may never cross the Red Line. Teams crossing the Red Line will be disqualified for this competition. The team must provide the jury panel with details about how they implement this zone in their MAVs and ensure the MAVs will never cross the Red Line.
- Teams must respect the general applicable safety rules for open category A3 (<https://www.easa.europa.eu/domains/civil-drones>), particularly those related to: flight in the vicinity of spectators according to the 1:1 rule for height (start, landing), roads and buildings that are not a part of the competition green zone, and not to fly over the spectators.
- If a team cannot guarantee the security to satisfaction of the day's security officer, the organization may exclude the team from participation.
- Every flight can be aborted by the day's "Flight Boss".

Flight operation

- Flying and transmitting is only allowed with the consent of the day's "Flight Boss". Teams must follow the flight operation instructions of the "Flight Boss".
- Entrance to the green zone is only permitted for team members of the scheduled competing team.
- Shortly before the allotted flight period, transmitters can be switched on. Directly after flight all transmitters must be switched off.
- 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 Boss" is always right. Escalation is only possible to the IMAV2022 organization, at the competition which takes the final decision. Decisions of the IMAV2022 organization are binding and not subject to discussion.

Liability

- Participating teams fly under open category A3 of the European drone rules <https://www.easa.europa.eu/domains/civil-drones> . Teams must show their A3 license before participating. (Non-EU teams can contact the organization)
- 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 IMAV2022 organization and the organizing team members will never be held responsible nor liable for any incidents and / or accidents caused by participating teams or their equipment.

Photographs and Videos

Photographic and / or video material is allowed.

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.

Appendix A: Safety zones



The following table shows the coordinates of the red line. Several coordinates are provided, see the table below for details. On the practice day the teams will receive the final GPS coordinates of the vertices.

Geofence

Vertex	Latitude	Longitude
C1	52.171809°	4.416234°
C2	52.171331°	4.416569°
C3	52.169403°	4.410566°
C4	52.166762°	4.412007°
C5	52.165493°	4.415941°
C6	52.169922°	4.425183°
C7	52.173795°	4.423437°

Yellow zone

Vertex	Latitude	Longitude
C1	52.171776°	4.416351°
C2	52.171129°	4.416806°
C3	52.171774°	4.419118°
C4	52.172424°	4.418636°

Green zone

Vertex	Latitude	Longitude
C1	52.17113°	4.4168182°
C2	52.16936°	4.4120445°
C3	52.16694°	4.4133713°
C4	52.16622°	4.4157881°
C5	52.17013°	4.4240597°
C6	52.17278°	4.4227404°