

IMAV 2016 Security and Safety Regulations

Introduction

The *flight competition* of the International Micro Aerial Vehicle 2016 Conference will take place at the campuses of Beijing Institute of Technology.

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 China 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. Additionally, for safety at the competitions a maximum allowed momentum is set: $(m * V_{cruise}) < 20$ [kg m/s]
- Transmitting of electro magnetic radiation (RC, data link, video link) is only allowed on frequencies and with power and modes legally allowed in China.
- 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 has to 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 how they prevent the MAV from going out of the operation zone 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 an MAV relies on other than GPS navigation means (e.g., the video system under video based flight) loss of this navigation means must be taken into account. In such a case the MAV should immediately perform a safety landing as described below. The team should provide details how they prevent the MAV from going out of the operation zone under the actual weather conditions. The team must convince the jury that the MAV can be retrieved upon loss.
- Every MAV need to have an observer following the MAV constantly. When needed he has to be able to take action to comply with the safety rules.
- Every MAV need 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 be able to take over the MAV at all times 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 flight zone is defined by four waypoints as defined in Figure 2. In this zone all mission elements are located. The complete flight must be performed inside this zone with a Height limitation is **60 meters**.
MAVs must perform an **emergency landing** immediately upon touching the edge of the operation zone in the following manner:
 - o All MAVs have to perform emergent landing buy slowly reducing the throttle signal.
 - o Fixed wing: land without propulsion (throttle cut)
 - o Rotary wing, flapping wing and Hybrids: land with minimal power setting resulting in rapid but safe descent.
- MAV's may never cross the operation zone. Teams crossing the edge will be disqualified for this competition. The team must provide the jury panel with detail about how they implement this zone in their MAVs and ensure the MAVs will never cross the Red Line.
- In the preflight check, each team need to demonstrate to the jury that their MAV is capable of reducing throttle once cross the operation edge. The angular stability of the MAV must be maintained while reducing the throttle.
- 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 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 of the operation zone is only permitted for team members of the scheduled competing team.
- Shortly before the allotted flight period, the "frequency tokens" may be collected from "frequency management". Directly after flight all transmitters must be switched off and the "frequency tokens" must be returned to the "Flight boss".
- 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 Boss" is always right. Escalation is only possible to the IMAV2016 organization, at the competition in consultation with the Defense authorities, which takes the final decision. Decisions of the IMAV2016 organization are binding and not subject to discussion.

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 IMAV2016 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.

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: Mission Elements

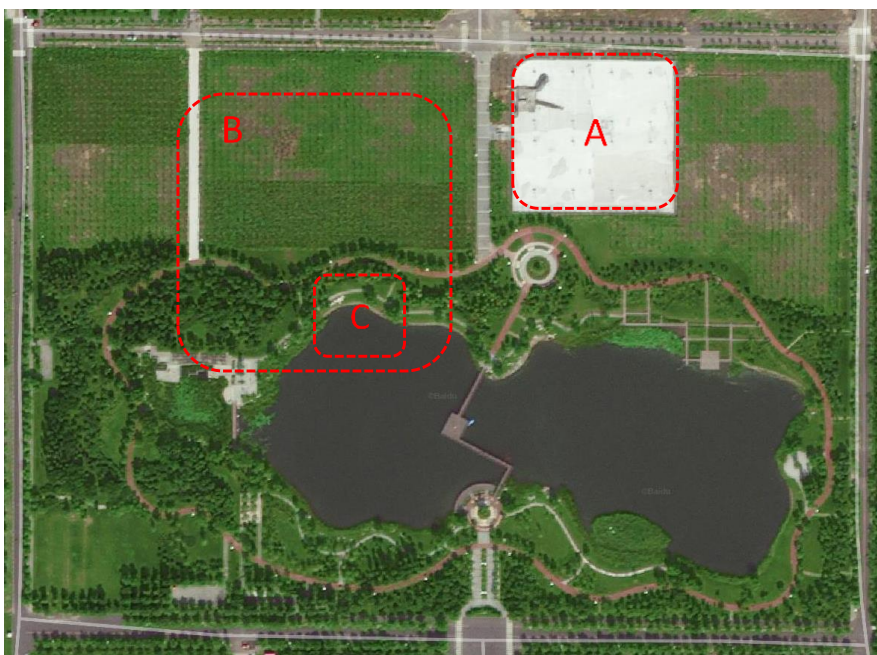


Figure 1: Mission zone definition

Appendix B: Safety zones

The following picture shows the operational zones. Several waypoints are provided, see the table below for details. On the practice day the teams will receive the final GPS coordinates of the waypoints.

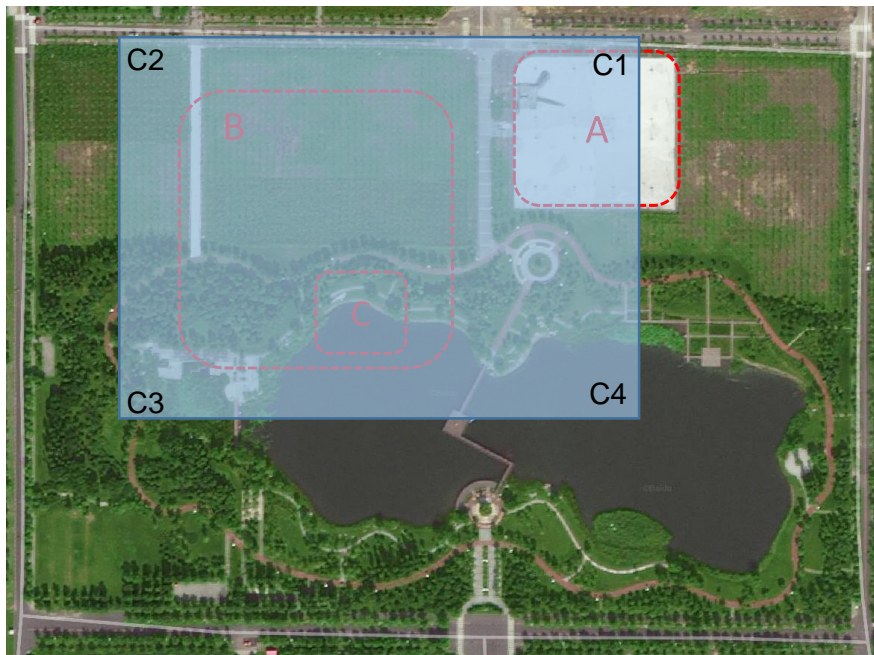


Figure 2: Operation zone definition

Waypoint	Lat	Lon
C1		
C2		
C3		
C4		