



# STUDENT AIRRACE

## Rulebook

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v0.0.1  
Munich



Technische Universität München

# Contents

# 1 Sporting Regulations

## 1.1 Generssal

### 1.1.1. Objective of the competition

1.1.1. *What are our values? What is the ultimate goal of the competition? What do we want to achieve?*

## 1.2 Registration Process

1.2.1. *TO ADD: Registration Sign up process*

1.2.2. Only one team per individual university may register for the competition.

1.2.3. There is no registration fee in order to enter the competition.

1.2.4. If in the opinion of the organizer, a competitor is likely to not meet the requirements or standards of the competition, they are allowed to reject them after the registration process.

1.2.5. The maximum number of attending teams might be limited by the organizers. A waiting list for the competition will be put in place if this is the case.

1.2.6. The participating teams will be chosen by the organizer. This will partly happen on a "First Come First Served"-Base but also on the perception and opinion of the organizers whether a team will be able to meet the requirements and standards of the competition.

## 1.3 Participants

1.3.1. Only enrolled university (or of comparable institutes) students are allowed to actively take part in the competition.

1.3.2. If a team member has graduated during six months before the competition, they may still participate.

- 1.3.3. If a team member has graduated during the eighteen (18) months before the competition and has played a significant role within the team, the team may send an application to the organizer, requesting their participation.
- 1.3.4. Students attending other universities which are within a reasonable distance of a participants university (e.g. in the same city) may join a student team from said university.
- 1.3.5. If a students university already has a competing team, the student is not allowed to join a competing team of another university.

## 1.4 Student Competition

- 1.4.1. *This is supposed to explain the rules for a student competition. What roles do students play? Are they allowed to seek professional help? Are PhD candidates allowed to join?*

## 1.5 Penalties

- 1.5.1.

## 1.6 Protests

- 1.6.1. Teams are allowed to launch a protest against any decisions, rules or penalties imposed by the organizer.
- 1.6.2. They must do so within 6 hours of the decision.
- 1.6.3. The protest must be sent to the organizer in written form, this can happen digitally. It must state the decision, the reason for protest and contacts from the team.
- 1.6.4. Along with the protest the team will be deducted 10 Points from their final score. If the organizers agree with the protest, the teams receive those points back.

## 1.7 Liveries

- 1.7.1. The Logo of the University which operates the UAV must be clearly visible from the front, left and right side. It shall not be smaller than onehundredfifty (150) mm in its smallest dimension.
- 1.7.2. The competitors' number must be clearly readable from any the front, left and right. It shall not be smaller than onehundredfifty (150) mm in its smallest dimension.

## 1.8 Team Documentation

- 1.8.1. The teams are required to document all flights with their prototypes in physical and digital flight books. They must note at least location, flight time, pilot flying as well as observations, abnormal events or incidents during the flight.
- 1.8.2. The teams are required to document their pilots personal flight time on aircrafts comparable to the competition (e.g. Racing Quadrocopters) for each individual flight and in a cumulative manner.
- 1.8.3. The teams must keep up to date records about the equipment installed on the UAV. This includes all electronic and mechanical subassemblies on the UAV. Changes must be clearly marked and recorded.
- 1.8.4. Teams are required to keep up to date records of any damages or problems on the UAV. Even if the aircraft might still be flightworthy. Any repairs will have to be documented, stating the reason of the repair and the process of the repair.

## 1.9 Feedback for the organizer

- 1.9.1. The teams are asked to inform the organizers about any obstacles or issues they run into, which might be caused by too strict or too lenient regulations. The organizers will gladly receive any feedback and integrate it into the regulations.
- 1.9.2. Teams are required to inform the organizers about any incidents, which lead to loss of the UAV, damage to ground structures, injury, or death.
- 1.9.3. *Do teams have to send us logs of all their flights?*

## 1.10 Just Culture

- 1.10.1. The teams and the organizer commit to adopting a so called "Just Culture". This is important to ensure the safety of the competition and its participants.
- 1.10.2. The team leaders commit themselves to learning about Just Culture and to educate their team members about it.
- 1.10.3. Participants who notice safety related issues in their team or within the competition are able to report them anonymously to [safety@student-airrace.com](mailto:safety@student-airrace.com). This will not bear any negative consequences for them nor their team.

## 1.11 Spare parts

- 1.11.1. *How many spare chassis or even spare UAVs is each team allowed to have?*
- 1.11.2. *How many spare parts or parts of different specification (e.g. different propeller pitches) is each team allowed to have?*

## 1.12 Rating

- 1.12.1. A team can achieve a maximum of twohundred (200) points which can be collected during different events.
- 1.12.2. At the end of the competition and after the deduction of any penalties, the team with the most cumulated points is declared as the winner.
- 1.12.3. If two teams achieve the exact same amount of points, also known as a dead heat, after all points have been awarded the winner will be declared by who has scored more points in the efficiency discipline. If both of them have also equally scored equally in this discipline this process repeats for the safety, design maturity and innovation sustainability disciplines in the hereby mentioned order. If this doesn't deliver any result the organizer will make a decision.
- 1.12.4. The following table shows how the total points are distributed across the individual disciplines.

Discipline	Points	Awardment Process
Hotlap Races	75	Time measured by organizer
Effeciency	25	Time measured by organizer
Safety	50	Jury Decision
Design Maturity	25	Jury Decision
Innovation and sustainability	25	Jury Decision

### 1.13 Practice during development

- 1.13.1. During development, testing practice of their UAVs the teams are required to meet all the laws and requirements of their flight location.
- 1.13.2. There is no limit on how much time the teams invest into flying before the competition.

### 1.14 Scruteneering

- 1.14.1. *The organizers will randomly weigh vehicles.*

### 1.15 Team Briefings

- 1.15.1. At each day of the competition, there will be a team briefing.
- 1.15.2. Each them must send all of their members which will be presen at the flightsite during the flights to the briefing.
- 1.15.3. One point can be deducted by the organizer for each member which is missing during the briefing.

### 1.16 Parc Ferme

- 1.16.1.

### 1.17 Flight Operations

- 1.17.1. During the flights, the teams must assign different roles within the team at the track, which are defined in the latter regulations.

- 1.17.2. Each person which fulfills a required role must be able to fluently communicate to the organizers in english.
- 1.17.3. A minimum of four (4) persons are required at the track to be allowed to conduct the flights.
- 1.17.4. A maximum of ten (10) persons by a team are allowed at the track. For clarification: This does not affect the amount of persons each team is allowed to have in the paddock.
- 1.17.5.

## 1.18 Required roles during Flight

### 1.18.1. **PL: Pilot**

The pilot is the person responsible for flying the UAV.

### 1.18.2. **AO: Airspace Observer/Spotter**

The AO stands next to the PL and has an unobstructed view of the airspace around the drone. They talk to the PL directly in person. The PL and AO are allowed to communicate via intercom if they stay right next to each other.

### 1.18.3. **FE: Safety Engineer**

The safety engineer is the one who was responsible for the safety report. Their task is to constantly monitor the situation and warn the others if they are getting into any problematic situations.

### 1.18.4. **FOL: Flight Operations Lead**

The FOL makes the tactical decisions during the flight. They request for Takeoff Permission from CL (Competition Lead). They manage contingency and emergency procedures. They are essentially the boss of the teams operation.

## 1.19 Optional roles during Flight

### 1.19.1. **FE: Flight Engineer**

The Flight Engineer reads the data which is streamed down by the Aircraft in real time. They monitor battery temperatures, voltages, vibration sensors etc. and can give advise to the pilots.



**1.19.2. AOGX: Additional Airspace Observers/Spotters**

Not yet defined number of Airspace and Ground Observers according to the terrain and track layout. According to the terrain it might be useful to place additional observers on the field to have an external look at whether the air or ground situation changes. They can be equipped with radios and talk to FOL.

**1.19.3. PCX: Pit Crew**

The pit crew is there to make changes on the eVTOL which are permitted by the rules within the time limit. They also get the AC ready for the flight and make sure it is transported away afterward. Only they are allowed to touch the aircraft during the flights.

## **1.20 Requirements for the pilots**

- 1.20.1. Each team must have at least three different designated pilots. The names of those pilots must be sent to the organizer at least 30 days before the competition.
- 1.20.2. Each pilot must have flown and documented at least twenty (20) hours on comparable UAVs (e.g. Racing Quadrocopters) in the past 12 months.
- 1.20.3. The pilots must be able to fluently communicate with the organizers in english, in order to be able to follow safety relevant commands during flight.

## **1.21 Parc Fermé**

- 1.21.1. Parc Fermé begins at the moment the Team starts the Thrust-Stand-Event for the first time during the competition days. It ends with the completion of all three competition flights.
- 1.21.2. While Parc Fermé is active teams are not allowed to work on the UAVs. Only the following works are allowed to be carried out:
  - Balancing of propellers
  - Cleaning of any parts of the aircraft
  - Exchange of batteries
  - Charging of batteries

- Reading logs and taking measurements
- Tightening of any loose screws
- Repair of accident damage as long as the crash is deemed by the organizer to not have happened on purpose.

1.21.3. Work on safety related systems may be done after submitting a written request to the organizer and getting it accepted by the organizer.

## **1.22 Hotlap Sessions**

1.22.1.

## **1.23 Start of a Session**

1.23.1. Each team gets a certain time slot during which they are allowed to takeoff. They choose the timing of their takeoff during this time on their own. If they do not start within this time limit a DNS (Did not start) is called and the run invalid and will not be retaken. This is comparable to the process ski jumpers undergo during their competitions.

## **1.24 Suspension of a Session**

1.24.1.

## **1.25 Resumptions of a Session**

1.25.1.

## **1.26 Finish of a Session**

1.26.1.

## 1.27 Comparability between runs

1.27.1. To ensure comparability between the runs, the organizers are going to set limits on the metrological conditions during which the runs can happen. If the organizer is calling the conditions to be fine for takeoff the takeoff time window rule applies.

The organizers will monitor the following conditions at the track during the flights:

- Precipitation
- Temperature
- Windspeed
- Humidity
- Air Pressure
- GNSS Connectivity and satellite number at fixed position on site (GPS only)
- Frequency jamming

## 1.28 Disciplines

### 1.28.1 Hotlap races

- There will be a total of three (3) hotlap races on different tracks during the competition.
- Each team will be given a fifteen (15) minute time window during which they can conduct their flights.
- Each team is only allowed to fly a maximum of three timed (3) laps during their time window.
- Each laptime will be logged by the organizer. It counts as the time from which the start lights turn off until the aircraft has crossed the timing/finish line.
- Teams can earn up to 25 Points during the competition. The exact point distribution is subject to change and will be affected by many factors such as the number of participants. The teams will be notified as soon as there is more information available.

## *1 Sporting Regulations*

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- The points will be awarded in order of fastest hotlaps achieved by the teams during their time window.
- If two or more competitors achieve the exact same finish time, their points will be added together and divided equally across the them.

## **2 Technical Requirements**

### **2.1 Powertrain**

2.1.1. Number of motors min 6

2.1.2. bbb

2.1.3. ccc

### **2.2 Battery**

2.2.1. Max voltage

2.2.2. bbb

2.2.3. ccc

### **2.3 Safety switch**

2.3.1. Max voltage

2.3.2. bbb

2.3.3. ccc

### **2.4 Radio Frequencies**

2.4.1. aaa

2.4.2. bbb

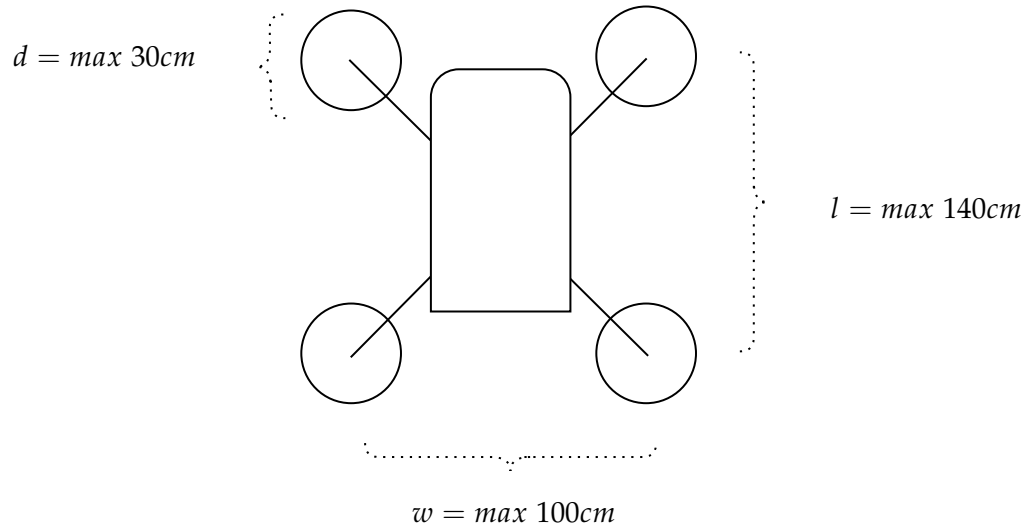
2.4.3. ccc

## 2.5 Dimensions

2.5.1. aaa

2.5.2. bbb

2.5.3. ccc



## **3 Event**

### **3.1 Static Event**

3.1.1. Whight lifting demonstration

3.1.2. Safty check

3.1.3. ccc

### **3.2 Dynamic Event**

3.2.1. Race tracks

3.2.2. Time race(fastest wins)

3.2.3. ccc