

F9U-TR UAV-Teamrace

1. Target of competition

Speed competition for remote-controlled, electrically driven UAV over a long-distance in the closed circle by repeated departure of given waypoints using an automatic course stabilization or by MultiCopter with FPV video system. A maximum of 8 UAV / Multicopters can participate in one race. The model specification was left open on purpose to allow different solutions.

2. Aircraft

2.1. General specifications

The aircraft is equipped with a remote control and is operated within the sight of the ground-based controller.

The remote control must comply with the legislation applicable to the remote control of aircraft in the host country.

Position stabilization and heading and altitude stabilization via waypoints entered into the on-board electronics permissible, if the pilot is able to override them at any time and thereby avoid any dangerous situations (collision with persons, other aircraft or objects connected to the ground, leaving the assigned flight zone).

In this case the on-board electronics shall have at least 15 waypoints

The use of FPV technology is permitted (see also point 5)

The aircraft must enable the secure mounting of a tracking system provided by the organizer.

A payload (with the exception of the tracking system) is not required.

Energy Drive memory (hereafter referred to as the drive battery)– may not exceed a maximum no-load voltage of 72 volts – may be exchanged if the aircraft is on the ground during the competition.

Each aircraft used must be registered before the start of the scoring flights.

As part of the registration, judges will check the compliance of each device and the correct entries in the starting lists.

Each team may present up to two (2) aircraft at registration.

If multiple flights will be flown, the aircraft may only be changed between the rounds.

Replacement of parts of the aircraft (with the exception of the battery) between the start and the end of the competition flight is not permitted.

All parts of the aircraft or its payload shall be secured in such a way as to preclude any loss during flight.

Each aircraft shall be equipped with at least 20 LEDs, which allow color variation in the colors white, red, green, blue. On each arm 4 LEDs, and on the fuselages 4 LEDs have to be attached.

2.2. Models

2.2.1 Multicopter

Aircraft which only derive their buoyancy from the buoyancy of at least three (3) lift rotors.

2.2.2. Fixed Wing/Hybrids

Aircraft which derive their buoyancy at least partially from the action of rigid wings or due to static buoyancy.

3. Airfield

3.1. General

- a. The aerodrome must be built in a way that the aircraft can be controlled at all times within sight of the pilot.
- b. Team boxes, swap bodies and pilot / operator area shall be marked on the aerodrome (see sketch in Appendix 1).
- c. The team boxes with a side length of min. three (3) meters will be drawn at the briefing before the start of the competition.
- d. The interchangeable boxes with a side length of at least three (3) meters shall be symmetrical to the starting point / start line in the infield. It is for each starter to identify a change boxes.

3.2. Course

- a. The total flight distance must be flown by repeatedly flying a closed route over at least three (3), but a maximum of fifteen (15) waypoints given by the organizer.
- b. The necessary number of waypoints is determined by the lines of the closed circuit.
- c. The length of the course is defined by the sum of the distances between the individual waypoints and should be between 400m and 1000m.
- d. The total distance flown is calculated from the length of the circle course multiplied by the number of rounds flown.
- e. The start / finish line shall be marked by the organizer. This line shall be one of the waypoints of the circle (see Appendix 1).
- f. The surface covered by the waypoints shall be referred to as the inner surface.

3.3. Safety Area

- a. The accommodation areas of pilots, helpers and spectators must have sufficient safety distance to the flight parkour
- b. The inner surface (see 3.2 f) is defined as a no-fly zone and safety area and may only be flown for the purpose of take-off, replacement of the drive batteries and landing (see point 4).
- c. Pilots and helpers must stay in the safety area throughout the competition (except when recovering aircraft).

4. Flight task

4.1 General

- a. The aircraft must pass through the course specified by waypoints (see 3.2 a) several times, according to a predetermined number n at a given altitude. For this competition it is recommended to use stadiums with a 400m track.
- b. The flying distance should be between 5 and 10 km.
- c. The scoring flight begins with the take-off of the aircraft and ends with its landing.

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- d. The scoring period begins with the first flying over of the starting point / the starting line) in the specified height and flight direction. It ends with the n-th flying over the starting point / the starting line at the given height.
- e. The correct departure of the given course and the required total flight time are determined
 - by referees, by observing the camera image in the case of FPV models
 - after landing by Judges through reading the tracking system carried by the aircraft using a suitable device (PC).
- f. In addition, a manual timing in case of UAV is recommended, as well as the counting of completed laps and possibly the number of battery change per aircraft by one judge each. The start level is defined by a pylon with rope .
- g. For manual timing stopwatches are to be used with a display resolution of 1/100 second.

4.2. Preparation time

- a. The coordinates of all waypoints of the course must be announced to the pilot at least one hour before the start of the competition flights.
- b. Direct flight preparation begins two (2) minutes before the start of the first aircraft and is signaled by the competition management
- c. After the teams confirmed that they are ready to start, all teams are given the signal to take off by the competition management.

4.3. Start

- a. After the teams confirmed that they are ready to start, all teams are given the signal to take off by the competition management.
- b. The airplanes rise from the team box vertically upwards to their given graduation height. After the aircrafts have reached the starting position, the rating flight starts with the starting signal.
- c. The start is executed in accordance to the rules, if the aircraft is at its predetermined graduation level at the time of the start signal given. The predetermined graduation level has to be outside the no-fly zone, before starting point / start line.

4.4. Scoring circuit

- a. The scoring circuit is to be flown in the given direction and with the given number of laps outside the no-fly zone, in accordance with point 3.2.

- b. Short cuts through the no-fly zone (see section 3.3b) are not permitted.
- c. If a model cannot finish a started lap, the model may not be recovered until after the race.

4.5. Landing

- a. After flying through the predetermined number of laps, the aircraft flies in its staggering height over the respective Teambox and lands after vertical descent within the Teambox.
- b. The landing is considered to comply with regulations, if the aircraft has been placed within the team box or if at least a part of the chassis touches the border of the box, in the plan view.

4.6. Battery change

- a. A battery change must be clearly announced to the judge by the pilot or his helper.
- b. After flying through the starting point / start line, the aircraft flies horizontally in its assigned staggering height over the assigned exchange box and lands there after vertical descent. A shutdown of the engines is permitted only after landing. For the rule conformity of the landing, the conditions apply analogously as under 4.5 b.
- c. Only on the ground the change of battery is permitted. The copter / UAV must be in safe mode.
- d. After changing the battery, the aircraft takes off, rises vertically to its graduation altitude, flies horizontally to the start point / start line and continues its flight on the given course.
- d. The lap counting is interrupted when the aircraft flies to the battery change after passing the start point / start line, and continues when the aircraft has passed the start point / start line in the specified flight direction after the battery change.
- e. The scoring time is not interrupted for changing the battery.
- f. Depending on the assigned grading level, the aircraft receives a time credit for the vertical approach or departure (see point 5).

4.7. Reflight

- a. In the event of a malfunction of the tracker assigned by the host, the pilot is entitled to a Reflight.
- b. In the event an FPV pilot is affected by an image disturbance, which was not caused by the pilot, the pilot is entitled to a Reflight. In this case, the assigned judge decides on the Reflight.
- c. After detecting the malfunction, the aircraft should immediately land in compliance with the applicable regulations for the No-Flight Zone .
- d. After replacing the tracker and possibly the drive battery, the flight will be completely repeated without taking into account previously achieved flight performance, including the preparation sequence.

5. Helpers

- a. During the flight competition the pilot may have one (1) helper (assistant) who can advise and give the pilot additional information of any kind.
- b. In the case of using FPV technology, this assistant acts as a spotter and must have the aircraft in his view at all times, without the use of optical aids.
- c. The assistant may not take over the control of the aircraft itself.
- d. Further information given by third parties to the pilot or his assistant during the valuation flight through verbal, optical or radio technology, is not permitted.
- e. Only for the battery change a second helper may be on stand by in the exchange box.

6. Score

- a. An achievable performance is achieved if all elements of the scoring flight (start, scoring, landing and possibly battery change) have been complied in accordance with the rules (see also point 7).
- b. The time t_{total} required for the scoring track (including the time for any battery change) will increase rounded up full seconds.
- c. For the vertical ascent or rise of or on graduation level for changing the battery, the pilot receives a time credit t_{cred} according to the following table:

Regular height, <i>m</i>	<i>Time credit</i> <i>s</i>
20	-
30	10
40	15
50	20
60	25
70	30
80	35
90	40
100	45

- d. For determining the result t_{result} , the time credit t_{cred} is subtracted from the flight time t_{total} and, if necessary, the sum of the penalties $\sum t_{\text{Penalty}}$ (see section 7.1) is added.

$$t_{\text{result}} = t_{\text{total}} - t_{\text{cred}} + \sum t_{\text{Penalty}}$$

- e. In the event that FPV models participate in the race, the area is reserved for them up to 20 m. They always fly at a maximum height of 20 m. Time penalties according to point 7.1.c are given on these models only with a visible exceeding of the maximum height.
- f. The summation of the results of all flown runs determines the pilot's result of the competition.

7. Penalties

7.1. Time penalties

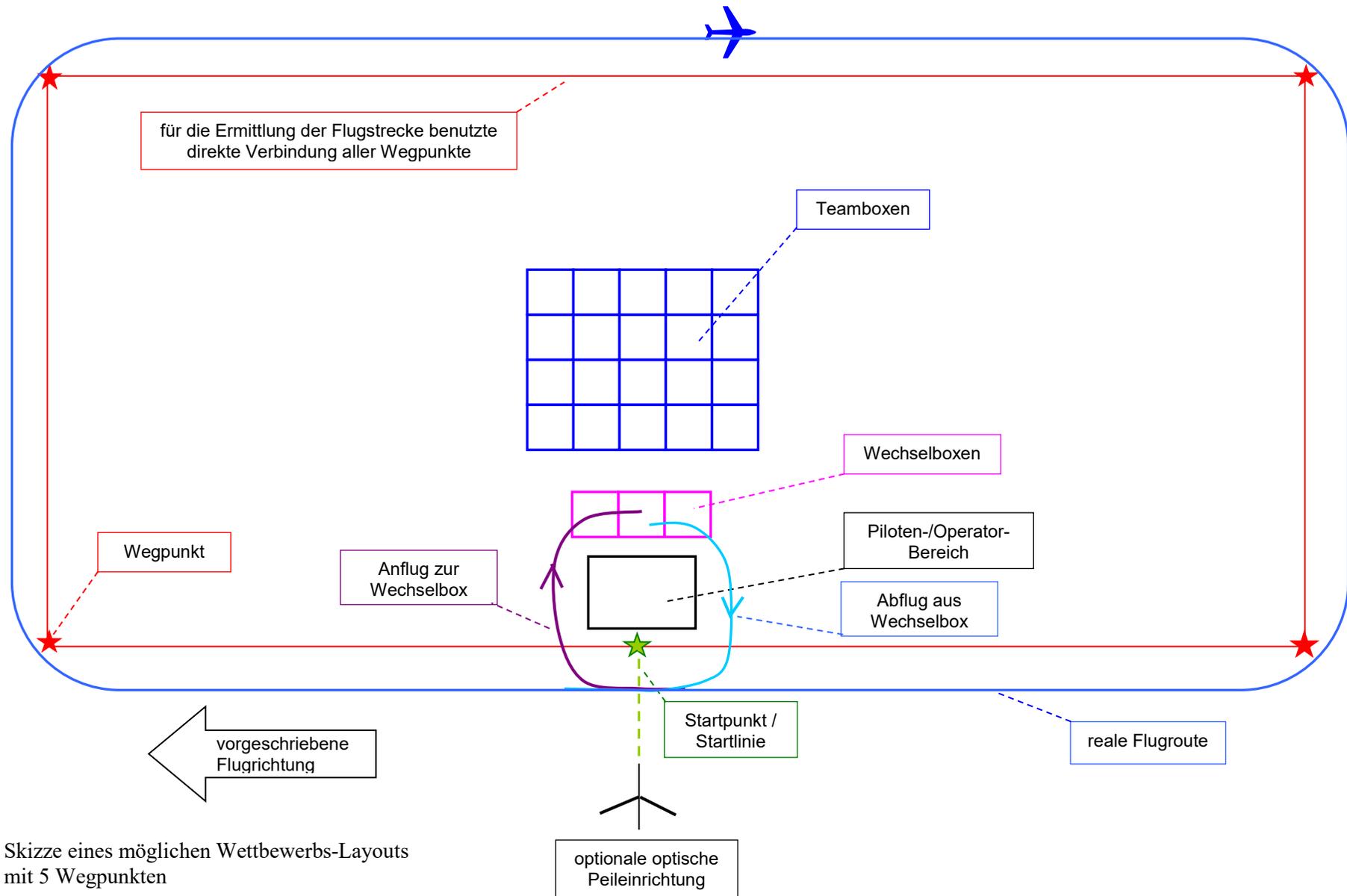
With a penalty of 10 s t_{Penalty} will be penalized:

- missed team box on landing - missed the assigned box when changing battery.
- A deviation in flight altitude from the assigned grading altitude by more than four (4) m while the aircraft is in course
- The contact between the aircraft and the pilot, assistants or assistants after take-off, before landing and when approaching or changing the battery.
- This penalty is effective for each of the previously defined events and added to any penalties previously taken.

7.2. Disqualification

Disqualification for unfair behavior will be punished:

- a. The shortening by the no-fly zone
- b. Violations of up to and including the briefing communicated safety regulations
- c. Change of the taxman during the valuation flight-with disqualification is also punished
- d. the loss of parts of the aircraft or its payload during the entire scoring flight
- e. The collision of the aircraft with persons or objects in the safety area, except for the events mentioned in point 7.1d
- f. Causing a mid-air collision as a result of deviating from the assigned altitude more than four (4) meter
- g. Crash caused by loss the connection with the model



Skizze eines möglichen Wettbewerbs-Layouts mit 5 Wegpunkten