

U-ROCK2024



The Importance of Safety

Safety is one of the most important elements in the sustainable development of the UNIVERSITY ROBOT COMPETITION. The safety of the robots themselves is the first and foremost issue for the safe holding of the contest. The participating teams, as the robot designers, are responsible for the safety of their robots. The teams must work and cooperate closely with the organizers to ensure that the contest is safely conducted. Safety must always be the top priority and it must consider all of the people involved in the contest including officials, participants and spectators. Teams are required to give utmost attention to the safety of their robots before applying to take part in the contest.

Outline of the contest

School Drone Challenge (SDC) is a time attack game that required a drone pilot to complete an obstacle course in minimal possible time. A drone needs to be piloted through a sequence of obstruction designed by organizer and land safely in the designated area to complete the task.

Game field

The general dimensions of the game field are 37 meter (long) x 32 meter (wide) and surrounded with a divider as shown in Figure 1.

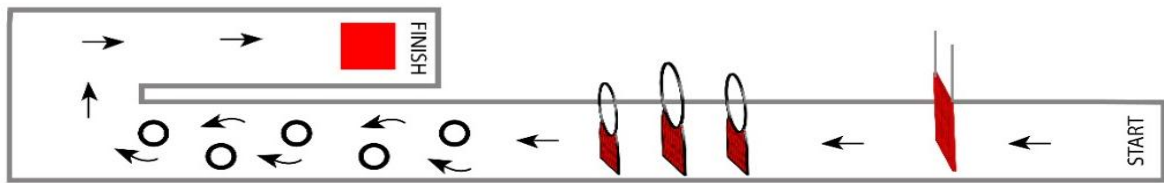
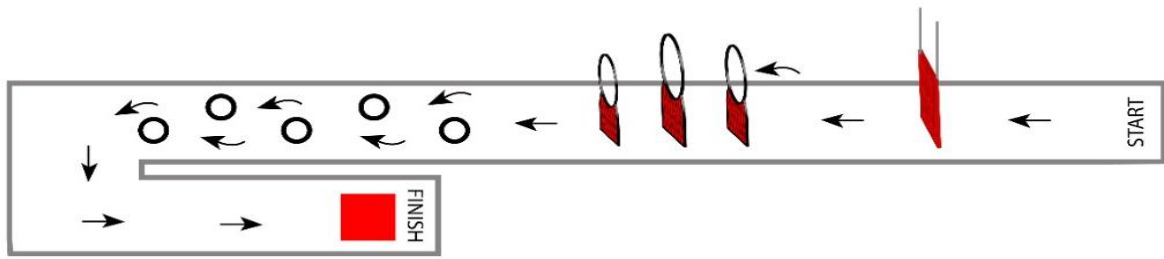


Figure 1a. Game field

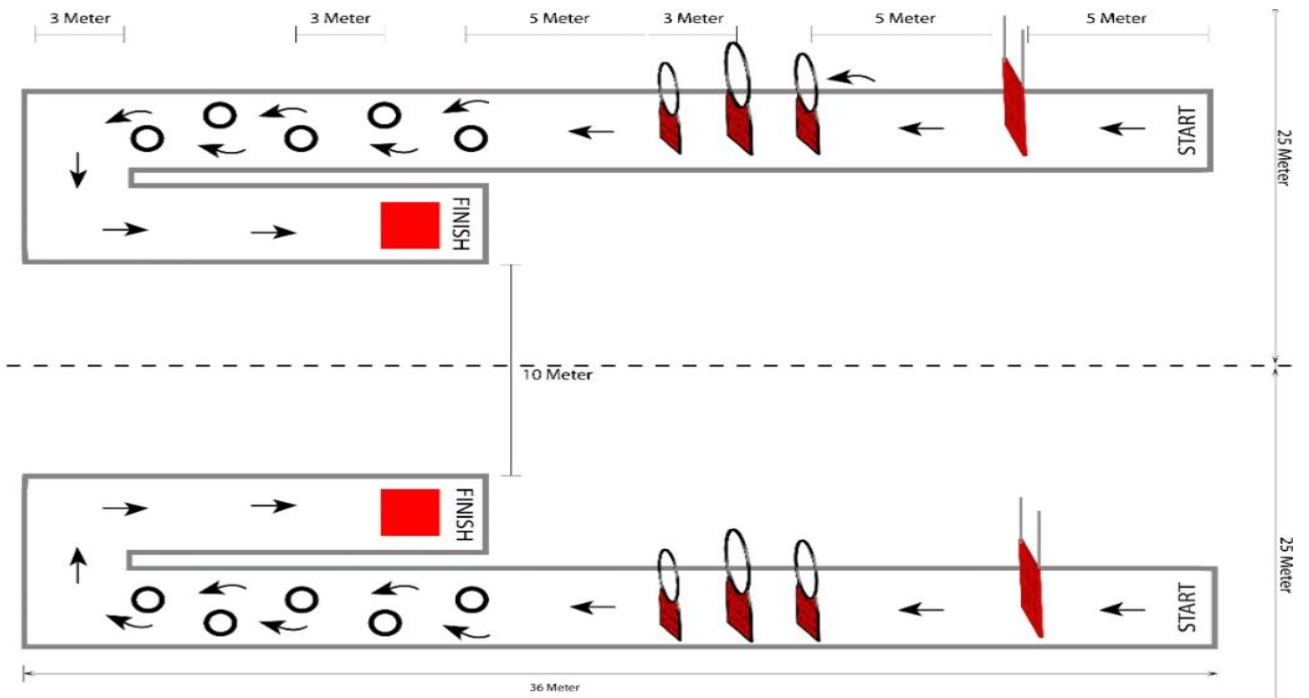


Figure 1b. Dimension of Game field

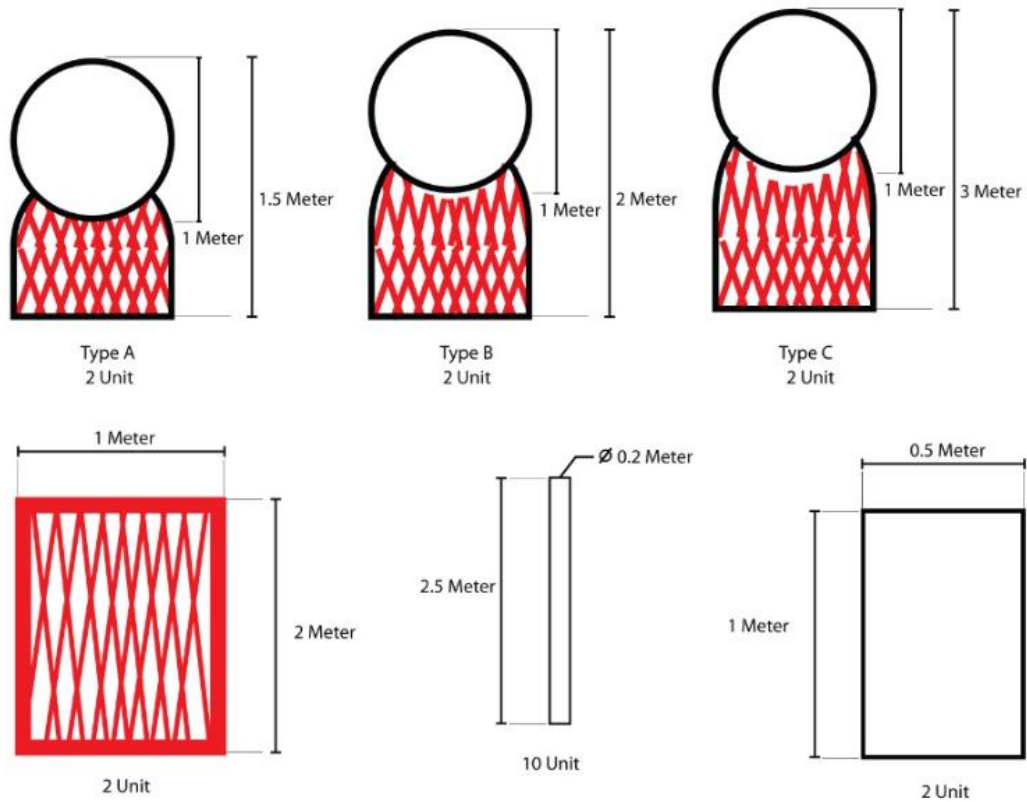


Figure 1c. Probe Dimension of Game field

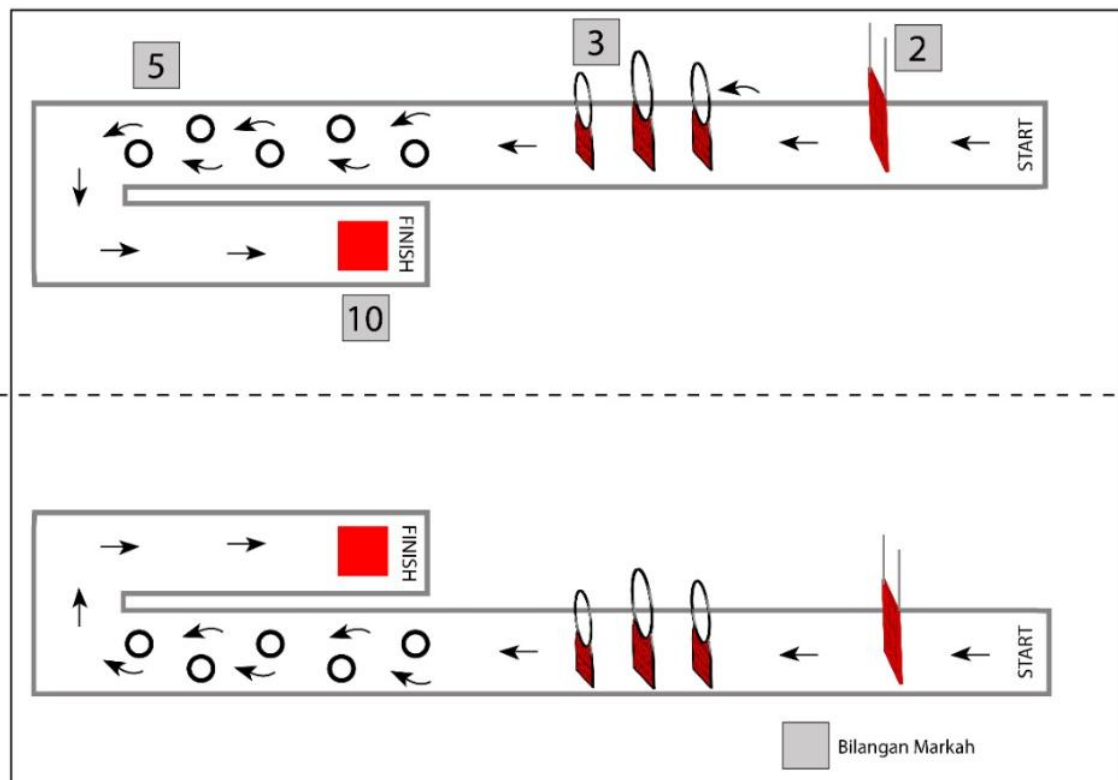


Figure 1d. Marking points

1. Definition of terms

- **DNS:** Did Not Start – Drone fail to cross start gate.
- **DNF:** Did Not Finish – Drone fail to complete all requirements set out by the respective competition guidelines.
- **DQ:** Disqualified – Disqualification parameters outlined herein.
- **OOB:** Out of Bounds – The aircraft exceeds the specified area for each respective track design.

2. General piloting guidelines

- All pilots have to attend a general safety briefing and sign the appropriate waivers from the race organizer and venue.
- All pilots must demonstrate effective Fail-Safe procedures defined by the Field Marshall and Race Director. In most cases this is a “Power Down, no pulse”/ “Drop” method, where the aircraft will immediately cease flight by stopping all motors and operation if it loses contact with the radio transmitter.
- All pilots must have an “ARMING” position switch or sequence on their radio. The aircraft should not power up by any accidental controls from the radio. Aircraft arming may be executed by a specific switch on the radio, or by a sequence (i.e. yaw right) to actively arm the radio.
- All pilots must demonstrate an air-worthy airframe and pass a general mechanics and electronic
- All pilots must demonstrate basic piloting skills (could include Line of Sight tests) and must successfully fly a controlled flight around the course within a certain amount of time exhibiting the ability to pilot and navigate their airframe through all obstacles.
- All batteries must be transported and stored in LIPO-safe bags or an approved fire resistant container.

3. Venue operations

- Pilots must adhere to all rules within the competition venue, and will not fly in any other part of the venue unless it is a designated flight zone.
- Pilots must contain all equipment and, airframes within the designated pilot pit area.
- A public charging area will be available and 240v outlets will be supplied. It is recommended that racers bring personal chargers and extension cord.
- General charging of electronic devices including radios or any device with a self-contained power supply is permitted.
- ALL batteries must be stored in a LiPo-safe bag or in an approved, fire resistant container.
- ALL adjustment and repairing the Drone MUST be held at the registration area and ALL Team MUST located/placed their Drones at registration area (to avoid the disturbing of channel system during others team fly their Drone).

- ALL teams MUST get the permission from organizer before bring their Drone to pit stop.

4. Judging and marshalling

- All races will be managed by an appointed team of judges.
- Each race will be monitored by judges/field marshals via cameras or timing/lap systems to maintain fair and accurate competition.
- In the event of a mid-air collision, pilots can resume the race if they are able to take off again without intervention; otherwise their heat is considered a DNF.
- Any practice or behavior deemed unsafe, (i.e. flying above the max ceiling height) will result in an immediate disqualification.
- Pilot Responsibilities
 - Pilots are responsible for operating and maintaining their own equipment.
 - Pilots are responsible for ensuring proper flight operations through timing gates and recording all official times. If timing is not recorded in the official timing system, or inaccurately recorded, it is the pilot's responsibility to prove the accurate time (via an original DVR recording) or other method.
- Race Commencement
 - Premature start before the official tone: Pilot will lose 3 second
 - Non launch on starting tone, arming timeout, flip, etc. – DNF, no rerun.
- Discretionary Reruns
 - Pilots may request a reschedule to another heat due to technical difficulties if the pilot notifies the Race Director prior to the start of his or her heat. Maximum one request per event.
 - Pilot may request a rerun due to technical difficulty beyond the pilot's control during qualifying semi-finals and finals only.
 - The Race Director has absolute discretion over approval or denial of any request listed above.
- Disqualifications
 - Any pilot not physically present on the flight line fully prepared to race at the time of their scheduled heat will receive a DNF for that heat and will not receive a rerun. Two or more DNFs for no-shows will result in disqualification of the event.
 - Missing a gate, flag or required obstacle: If a pilot misses a gate or obstacle, pilot will receive a DNF. Pilots may have one attempt at retrying the gate or obstacle while race is active.
 - Flying out of bounds: any pilot flying out of bounds, including maximum height will receive a DNF for the current run. Pilots receiving two infractions will be completely disqualified.
 - No celebration laps or excessive displays of celebration while race heat is still active. Any interference caused by a pilot or airframe will result in a DNF for that heat. Two or more DNF's will result in disqualification from the event.
 - Un-sportsman like conduct will not be tolerated.
 - All team were disturbing the drone system for other teams who are performing their game with connecting the battery of drone are disqualified.

All decisions made by the Race Director or Judge/Marshal are final.

5. Drone general guidelines

- All drones must pass a safety and airworthiness inspection. Once the drone has been checked and approved, it must not be modified or changed, or it will require being re-inspected. Drone should be repaired with equivalent parts that were originally used during check-in. The inspector has the final decision on whether an airframe is accepted and/or requires changes or modifications in order to be approved for racing. All teams are allowed to bring **TWO (2)** drones for their teams. But **ONLY ONE (1)** drone are permitted in the ALL matches. **EXCEPT** if the Drone is broken/malfunction. Permission must get from Judge/Marshal before used the new drone for new game.

*Note: Changing the new drone is allowed for new game only.

6. Drone size (General dimensions Figure 2.)

- 12 cm maximum diameter propeller size
- 3-bladed and 4-bladed propellers allowed
- Maximum frame size 400 mm (L) x 400 mm (W) x 350 mm (H) motor to motor (full diameter, not center of motor), no minimum size.
- Multirotor craft with 4 motors
- 4 or 6 cells LiPo battery, maximum 4.2 volts per cell

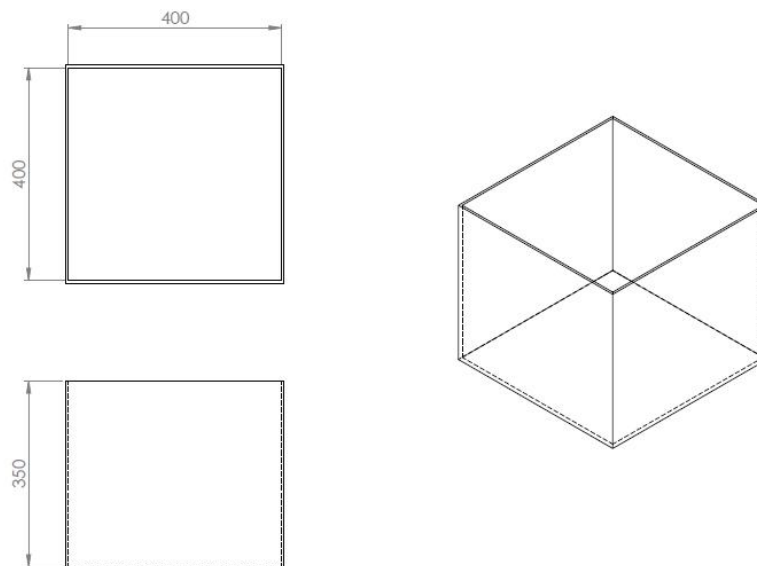


Figure 2. Drone Inspection Box (all dimension in mm)

7. Take OFF/Landing Table (Start/Finish)

- Drone must be on the table for Take OFF and Finish.

- Dimensions of table as shown in Figure 3.

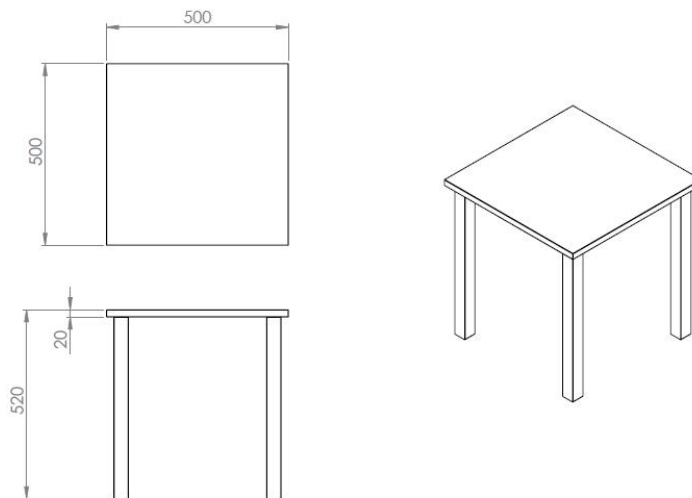


Figure 3. Take OFF/Finish stand/table (all dimensions in mm)

8. Game Procedure

- Each match **MUST** in three (**3**) minutes.
- In the following cases, a match ends even before the passage of 3 minutes.
 - i. When a drone completing the task.
 - ii. In the event of disqualification.
 - iii. When the referees judge that continuation of the match is impossible.

9. Setting of Drone

- Only one drone is allowed to enter the game field. However, reserve drone (1 only) is allowed (during the setup time) if the main drone cannot work before the game started.
- One minute is provided for setting of drone at START point.
- Two members of each team may engage in setting of drone.
- Any team that fails to complete setting of drone in one minute shall be able to resume the setting work once the match has begun.

10. Starting the Drone

- A team member shall start the drone by single switch operation or connection of battery.
- After switching or connection, the team member who performs the starting operation shall immediately leave the drone.

11. Competition Tasks

Once the match has begun, each team shall complete the tasks in the following order:

- The task of drone to fly in the middle top of first mesh obstacle. (The task of mesh obstacle).
- The task of drone to fly in the middle of three circle obstacle. (The task of circle obstacle).
- The task of drone to fly in between five cylinder pipe obstacle. (The task of cylinder pipe).
- The task of drone to landing properly at the Take OFF/Finish table. (The task of landing).

12. Deciding the Winner

- I. The team, who's their drone, has completed all tasks and landing properly at the Take OFF/Finish table in three (3) minutes will be a winner.

If neither team has achieved the all tasks at the end of the 3-minute match, the winner shall be decided in the following order of priority:

- i. The team whose have the higher points is the winner.
 - ii. If the points are the same, the team who's their drone has faster or shortest time to complete the all tasks. Lest match time.
- II. Points. See Figure 1d.
 - i. The task of mesh obstacle. (2 points)
 - ii. The task of circle obstacle. (3 points)
 - iii. The task of cylinder pipe. (5 points)
 - iv. The task of landing. (10 points)

*If the drone did not perform anywhere **(i)** to **(iv)** tasks, the time will be added for penalty.

Example 1. Drone did not fly in the middle top of mesh obstacle. 1 s will be added for penalty.

Example 2. Drone just flies in the middle of circle obstacle for one circle only. 2 s will be added for penalty.

- III. If the winner has not been settled by any of the above, the match shall be replayed or the winner shall be chosen by the judges.

13. Official course dimensions and boundaries

- Course is contained within an established format, e.g. soccer field, football field or other suitable area.
- Flight path should have a safety buffer zone with a minimum of 1 meters from any spectator or building area to reduce the amount of energy force and impact to the netting.
- Course designs should take into consideration flight and energy direction. Flight paths should not direct 100% energy force of the airframe directly at the audience unless there is substantial distance and barriers to protect the audience.
- Accidents yaw spinouts and other impacts that cause the aircraft to alter from its flight path should be considered and implemented into the design.
- Spectators are allowed for viewing purposes. However, spectators must not stand within 3 meters of the netting.

14. Course timing systems

A timing system is based on a digital time watch.

15. Flight deck race count-down procedures

There is a four-stage process for this competition. Each stage is designed to check for the various conditions, and have all pilots organized and ready for racing. Each stage is staffed by a specialist who will review each pilot and airframe. All pilots will proceed through each stage before game. The stages for Obstacle Course are as follows:

Stage 4 (6 minutes before start): Pre-flight airworthiness check. All airframes will be checked for valid seals and marks from initial safety checks. If they are not present, the pilot must go through the safety check and receive a new seal or mark. At this time all cables, connectors, stops and electronics will be checked by the Stage specialist.

Stage 3 (4 minutes before start): Pilots will be assigned a race position. The aircraft should not be powered up at this time.

Stage 2 (2 minutes before start): Pilots will hand over their airframe to their spotter and the spotter will take it to the start/finish area. Pilots may power up their goggles or displays (if any) but may not power up their radio at this time.

Stage 1 (1 minute before start): Pilots will proceed to power up their radios within the specified timeframe. Spotters will power up the airframes. The pilot must give a "Thumbs Up" to the Pilot Line Director when they have successfully powered up. Pilots must not arm until directed by the Pilot Line Director.

All pilots not ready within the specified timeframe will receive a DNS designation for the specified heat. Once all pilots have given the Thumbs Up sign, the race start countdown will commence. It will proceed as follows by the Race Announcer:

- I. Pilots ready (signaled through pilot thumbs up)
- II. Pilots, arm your aircraft
- III. Race will begin in less than 5 seconds
- IV. Air horn short blast or other specified starting announcement will signal commencement of the race
- V. If a race is ordered stopped for any reason, pilots will be instructed by the Pilot Line Director and must follow all procedures prescribed. Pilots failing to adhere to Flight Line Director, Race Commissioner or Race Director declarations may result in an immediate disqualification from the event.

16. Emergency or Fail-Safe Procedures

- Should a pilot lose control of their aircraft, the pilot must attempt a safe landing, fly into a prescribed, crash, 'catch' zone net, cut throttle in a safe area or execute a fail-safe procedure in a safe area.
- Spotters must maintain visual line of sight of the corresponding pilot's airframe at all times and must provide verbal directions or situational awareness details to the pilot. If the aircraft breaches the max ceiling height or goes out of bounds, a judge will indicate to the pilot the

infraction and the spotter must immediately assist the pilot in maintaining control and safely landing the aircraft.

17. Racing competition structure

Practice: Pilots may practice at the designated practice fields before the event.

Qualifiers: Competitions may include one or more rounds of qualifiers, with either seeding or advancement as a result of best single lap time or best complete race time.

Finals A and B : Pilots who advance from the mains complete in finals, with best complete race time.

Summary

These rules and regulations are developed through the UROCK 2018 Technical Committee. It is our intention that these rules will help guide and act as a clear definition for competitive drone obstacle race.