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SAF 2023

STEAM AZERBAIJAN FESTIVAL

FlyTech

GUIDELINES

BAKU 2023

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1. Introduction

The Fly Tech competition inspires young people and tech enthusiasts to acquire and use STEAM knowledge, engage in drone technology experimentation, investigate the operating principles of emerging technology, and produce outcomes by fostering engineering, design best practices, and independent thought. The principle of the competition is to learn to compete, collaborate, and have fun while also gaining knowledge.

2. Teams

2.1. Teams should consist of 3 people (1 team leader, 2 students).

2.2. The students have to be between the ages of 14 and 17, while the team leader must be older than 18. The competition zone is **off limits for leaders.**

2.3. The team's members must be students at the same institution.

2.4. Students and the team leader are each limited to joining one team.

2.5. Each school is only allowed to enter one team in the competition. The team leaders of any teams from a single school that register will be notified. The best team from each school must be selected by the team leaders, who must then submit a report to the competition's organizers.

2.6. The teams will compete in a qualification to determine the finalists after registration is complete. Following the conclusion of registration, the terms, date and time of the qualification round will be disclosed.

2.7. Anyone who wishes to compete in the event is welcome to do so as long as they follow the rules and stick to the equipment provided for drone design.

3. Competition Description

3.1. Teams must design their own drones using the necessary drone components, and then must navigate obstacles 3, 4, and 5 to reach the landing zone 2 **indoors** that is 15 meters wide, 30 meters long, and 6 meters high. After that, one of the team members must mount the drone with the parachute box and leave the area. The drone must be flown to the **Target Area No. 7 checkpoint**, where the target No. 6 must be targeted and dropped on with a parachute. The drone has to come back to landing zone #2 after deploying the parachute. In order to pilot drones accurately and securely, participants must do mathematical calculations, analyze physical processes, use flexibility, and employ other abilities.

3.2. When the box is released, the parachute should open automatically and allow the box to land on the target.

3.3. The drone must use the shortest route in order to get to the **Landing point** after the box has reached the target region (or a anywhere beyond it).

3.4. The time for the race is 5 minutes and is stopped after the drone's propellers come to a complete stop during landing.

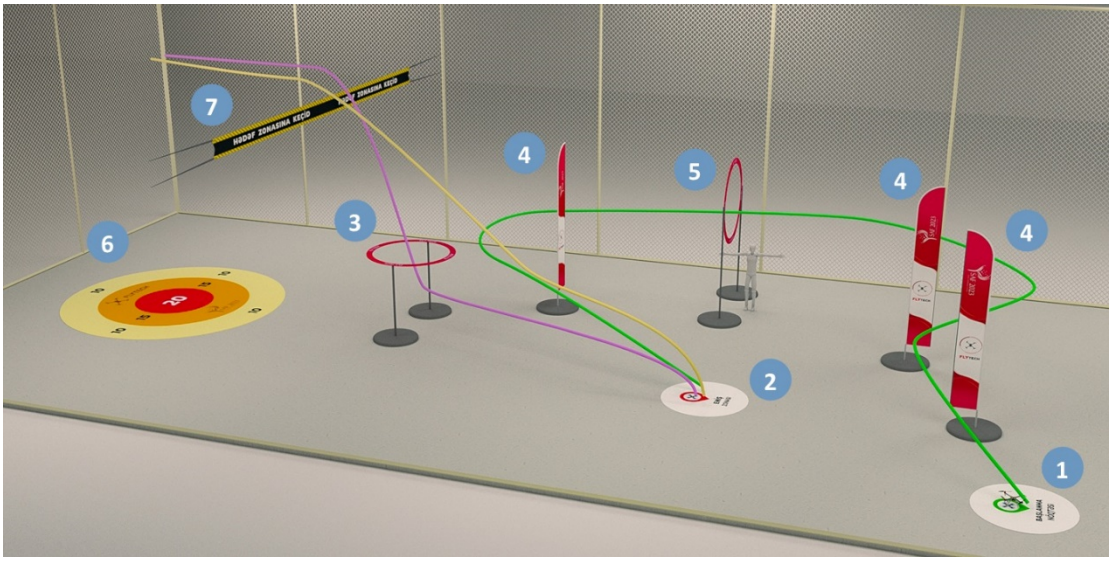


Figure 1. Competition area. The width of the competition area is 15 meters and the length is 30 meters. The competition area is covered with a net with a height of 6 meters.

Picture 2 - Drone

Picture 3 – Parachute and box (55x33cm)

4. Competition Structure

4.1. There are two stages to the competition. Teams must arrive to the Jury evaluation room individually and in pre-planned order and demonstrate their drones. The team should take a position in the flight area and wait for the flight turn after creating the drone's operating system that has been prepared there and its assesment.

4.2. The pilots will face off beyond the flight area in the second round (Fig. 1). The flight space is open to the pilots' free movement, and they can position their drones in any way they see fit.

4.3. The teams will participate individually in the competition in a set order. The squad's final score is recorded on its team account.

4.4. The teams will start the competition with the Start whistle and finish the competition by landing on the landing zone after completing the tasks on the competition field within 5 minutes.

4.5. If teams land their drones outside the landing area, time does not stop. The participants can restart their drones from the designated spot by decision of the referee (some distance away from the drone's crash point) if theirs crashes during the event are due to an obstruction or for any other cause. Each participant gets two chances; if the drone crashes into something or falls over for another cause on the third attempt, only the points the participant has accrued up to that point are preserved.

4.6. Drones must move through obstacles along a predetermined course one at a time.

4.7. Participants can land their drones in the landing zone at any point during the competition and stop the time and complete the obstacle course before the conclusion of the competition's given time limit. At this point, the participants' points up to that point are tallied, and the competition's end time is indicated as 5 minutes.

4.8. Whether a drone is completely or partially in the landing zone affects the score.

4.9. In the competition, each team is given 3 chances and the result of each chance (score and time) is recorded. The highest score obtained by the team from these 3 chances is recorded as the total final score.

4.10. If the pilot loses control during the race, he can voluntarily hand over the control to the referee. At this time, the time is kept and the score of the team is recorded.

4.11. If the parachute opened during the competition, the drone must return to the landing zone and one of the team members must deploy the parachute to the drone.

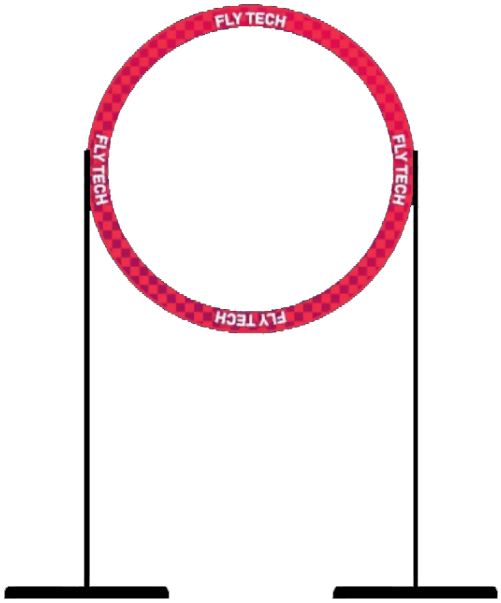
5. Obstacles and Checkpoints

1. Starting point.
Diameter 200 cm.

2. Landing point.
Diameter 200 cm.

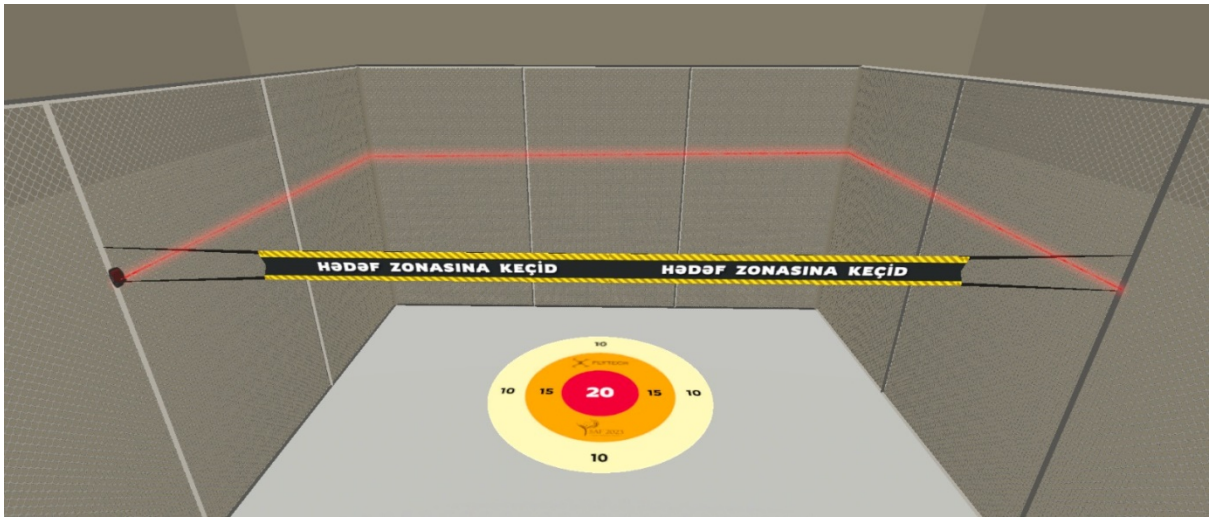
3. Horizontal Ring.
Height 200 cm,
Diameter 200 cm, Quantity 1.

4. Flag.
Height 450 cm,
Width 50 cm, Quantity 3.



5. Vertical Ring.
Height 400 cm.
Diameter 200 cm. Quantity 1

6. Target.
Central Diameter 200 cm, Middle Diameter 400 cm,
Outer Diameter 600 cm.



7. Transition Board for the Target Zone
Height is 5 meters, width is 50 cm and length is 6 meters.

6. Evaluation

6.1. The evaluation will consist of 2 stages:
6.2. Jury evaluation and execution of the task.
6.3. The team should be able to explain the drone's development technology and show its advantages. Here, the materials used to build the drone, the design, and the team's parachute launch technology are evaluated. The team's score during the evaluation is added to the score it will score in the 2nd round.
6.4. During the competition, the drones must be programmed to perform the task and controlled from a control center.

7. Jury Evaluation Criteria

Evaluation Criteria	Score
Cargo release method via parachute (must be controlled remotely)	**5-10**
The look of the drone (compatibility of arm, body, and leg sections)	**5-10**
Problem solving and creativity (protective or safety precautions)	**5-10**
Identification of parts (name and function of all elements utilized in the drone's construction)	**5-10**

8. Completion of The Task and Calculation of Points.

8.1. **Take-off**. The taking off of the participants' drones is worth 5 points. After takeoff, participants must guide the drone along a predetermined route.

8.2. **Obstacles. Flag**. Participants must maneuver through the part of the flag obstacle that contains the flag. Each flag is worth **10 points**.

8.3. **Vertical ring**. Passing through this ring earns 15 points, and it is not possible to go to the following flag obstacle without first passing through this ring. The points earned by the team are not going to be tallied if this happens.

8.4. **Landing zone**. The drone must fly along the given route, arrive at the landing zone and land. If the landing is not at least partially complete it will not be recorded as a landing. If this happens, the drone must take off and land again. The landing zone score is valid only for landings made to finish the competition.

8.5. **Parachute**. After the drone lands on the landing zone, its propellers must come to a complete stop. After the propellers come to a complete stop, a team member waiting outside the field should deploy the parachute to the drone. After the team member is completely out of the flight area, the pilot can take the drone into the air.

8.6. **Horizontal ring.** After attaching the parachute to the drone, it has to pass through this ring from bottom to top. The squad scores 15 points as a result of this. It is illegal to enter the target zone without first passing through this ring.

8.7. **Transition to the Target Zone.** With the parachute inside of the drone, it must cross ring number 3 and make transition to the Target zone. *Note: Pilot must control the drone safely as it reaches the maximum height*.

8.8. **Target.** The drone that has arrived at the target zone must release the parachutes to the target while maintaining its height in the air. The point value of the area where the cargo falls together with the parachute will be tallied to the team. If the cargo hits the line between 2 sections and a certain part touches the inner ring, the calculation will be made according to the inner ring. If the height of the drone is low during the release of the parachute, the dropped parachute will not be counted. At this point, the drone must return to the landing zone and repeat the process again. Time does not stop in any case.

8.9. **Landing.** After the parachute has fully landed, the drone must land on the landing zone by the shortest route as well. For drones to be considered fully landed in the landing zone, each of their parts in contact with the ground must touch the platform. If any part of the drone touching the ground does not touch the platform, then the drone is considered to have landed incompletely.

9. Evaluation Table of the Task Stage

№	Task	Score
1	Drone takes off	**5**
2	Crossing the flag barrier 4.1	**10**
3	Crossing the flag barrier 4.2	**10**
4	Passing through the ring barrier number 5	**15**
5	Crossing the flag barrier 4.3	**10**
6	Parachute is deployed into the drone	**5**
7	Passing through the ring barrier number 3	**15**
8	Moving into the target zone	**5**
9	Parachute opening	**10**
10	Parachute landing in a zone with a diameter of 600-400cm	**20**
11	Parachute landing in a zone with a diameter of 400-200cm	**30**
12	Parachute landing in a zone with a diameter of 200cm	**50**
13	Complete landing of the drone	**10**
14	Incomplete landing of the drone	**5**

10. Equipment list for drone design

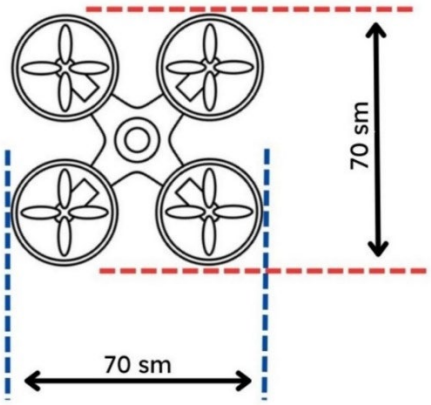
A drone with 4 or 6 motors should be designed without going beyond the list given below. Fewer elements than those mentioned below can be used when making a drone. You can find out the maximum allowed parameters of the elements by going through the links.

Name of the Product	Qt.	Link
Pixhawk 2.4.8 flight controller	**1**	https://aliexpress.ru/item/32947890087.html?sku_id=12000018133053511&spm=a2g2w.productlist.search_results.1.42614aa6cTRCon
GPS module (not obligatory)	**1**	https://aliexpress.ru/item/32748573256.html?sku_id=65325572932&spm=a2g2w.productlist.search_results.0.469b4aa6i8yppQ
Fly Sky wireless controller	**1**	https://aliexpress.ru/item/32630763392.html?sku_id=66505928739&spm=a2g2w.productlist.search_results.0.3b4d4aa6jrZlHA
1045 propeller CW/CCW	**6**	https://aliexpress.ru/item/1005001473893815.html?sku_id=12000016268768832&spm=a2g2w.productlist.search_results.0.39c64aa6RJe2IY
XXD Brushless ESC (Electronic Speed Controller)	**6**	https://aliexpress.ru/item/1005001511077102.html?sku_id=12000016406384264&spm=a2g2w.productlist.search_results.2.83eb4aa6EifvRr
950kv brushless motor	**6**	https://aliexpress.ru/item/1005001511077102.html?sku_id=12000016406384264&spm=a2g2w.productlist.search_results.2.83eb4aa6EifvRr
Servo motor 9g metal	**3**	https://aliexpress.ru/item/1005004634510404.html?sku_id=12000029915670107&spm=a2g2w.productlist.search_results.3.37514aa6g7lxRc
FPV camera and monitor (not obligatory)	**1**	https://aliexpress.ru/item/32810053781.html?sku_id=12000029707909310&spm=.search_results.0.1e0d4aa6BT6LYp
Carbon elements	**6**	https://aliexpress.ru/item/1005003030660554.html?spm=a2g2w.detail.rcmdprod.1.4d124965C6qyZj&mixer_rcmd_bucket_id=UnknownMixerAbId&ru_algo_pv_id=5e8630-40a3c7-9fc34d-
Battery 4200 mah 3s (maximum)	**1**	https://aliexpress.ru/item/4000598794681.html?sku_id=10000003740243770

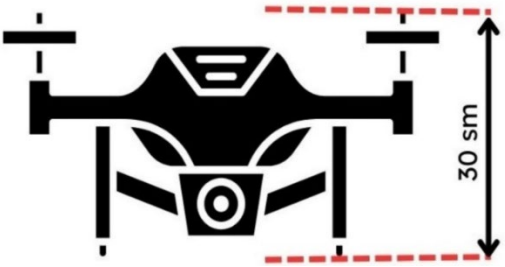
11. Drone Design Requirements

11.1. The drone must be built according to the provided **Equipment list**.
11.2. What form or function the drone takes depends on the team's thinking.
11.3. If any item fails or breaks down during the competition, it can only be replaced with the exact same item.
11.4. The body materials used must be individually designed and manufactured. Purchased finished products are not accepted.
11.5. Additionally, an auxiliary function or a decorative element can be created with 1 arduino.
11.6. The number of propellers of the drone should be 4-6. Other quanitites are not accepted.
11.7. All parts of the drone must take off as presented.
11.8. A team that does not know the names and functions of the elements of the drone is not allowed to compete.
11.9. The control of the drone should be done manually by only 1 pilot.
11.10. When the drone reaches the target zone, it must release the cargo to the target with the release mechanism. Here, the cargo must be released with a parachute attached to it, and after the parachute opens in the air, the cargo must land on the target.
11.11. If the parachute does not open, the attempt is considered unsuccessful and no points are recorded.
11.12. The height for opening the parachute starts at 5m. The pilot can release the cargo from a higher height if the parachute they have prepared requires it.
11.13. The drone must stand on its feet. The parachute mechanism must not touch the ground.
11.14. Each participant must mark team name so that it is visible on the drone.
11.15. The total weight of the drone should not exceed **1400 grams.**
11.16. The parachute on the drone should weigh **50 grams** (+-5 grams) together with the load. Here, it is important that the weight of the load is **25 grams.**

12. The allowable Dimensions of the Drone



12.1. The width of the 2 parallel propellers of the drone at the maximum opening should not exceed **70 cm**.



12.2. The distance between the plane the drone is on and highest point of the top element should not exceed **30 cm**.

13. Selection phase

13.1. Each team that wants to participate in the competition must present its drone. In this competition, different ideas and thoughts play a big role in drone development.

13.2. After the registration of the competition, the date of the selection phase will be announced. The teams participating in the selection stage will compete for the Final stage. Teams that successfully pass this stage will qualify for the Final.

13.3. The requirements of the selection stage are as follows:

13.4. **The content of the team** - Participants' name, surname, school number, position in the team.

13.5. **Introducing the Drone** - The front, back, left, right and top photos of the drone must be clearly displayed and each item used must be labeled with its name and designation.

13.6. **The parachute release mechanism** of the drone and the parachute- management, release mechanism manufacturing technology and parachute preparation should be explained.

13.7. **Preparation** - It must meet all the requirements required by the regulations.

13.8. **Targeting** - A camera or other means must be used (if a team does not need a targeting mechanism this is acceptable and must compete without a targeting mechanism on the final)

13.9. **Takeoff of the drone** - A video of the drone taking off at least 4 meters from the ground and staying in the sky for 60 seconds and landing must be sent. The video must show the pilot personally operating the drone.

13.10. **Note**: All requests must be sent in the form of 1 PowerPoint file (in English for foreigners).