



CUBESAT

CATEGORY

FINAL STAGE RULES
BAKU 2025

1.Introduction

The CubeSat competition encourages young people and technology enthusiasts to learn and use STEAM skills, experiment with space technology, explore the working principles of future technology, and develop engineering, design practices, and independent thinking skills to achieve results. The goal is to gain knowledge, collaborate, learn to compete, and have fun at the same time .

2.Teams

- 2.1.** Teams must consist of 3 people (1 team leader, 2 students).
- 2.2.** The team leader must be over 18 years old, and the students must be between **13 and 17** years old.
- 2.3.** Each team leader and student can only participate in one team.
- 2.4.** After registration is complete, a selection round will be held among the teams and the teams that will advance to the final will be determined. The terms and time of the selection round will be announced after registration is complete.
- 2.5.** Anyone who wishes to participate in the competition can join, subject to the conditions and the equipment designated for the preparation of a CubeSat (hereinafter referred to as Sat).

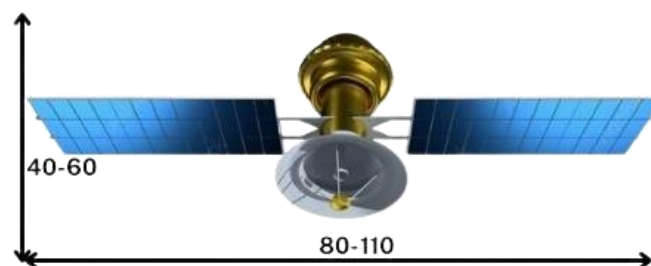
3.Race description

- 3.1.** The competition consists of two parts. In the first part, each team will be evaluated by presenting the design and technology of the carrier satellite on which the Sat will be located. You can use this QR link for examples:



Figure 1. Carrier satellite model (example)

- 3.2.** The size range given for the model here should be between 80-110cm in length, 40-60cm in width, and 40-60cm in height, with the wings and outer devices unfolded.



- 3.3.** The satellite model should consist of 3 parts:

- 3.4. Body** - The body part should be made of gold or aluminum colors. There should be a separate space in the body part for placing the Sat.
- 3.5. Wings** – Sun panels should be visible. Both real and decorative photo paper panels can be used here.
- 3.6. Antenna** - Each model must have at least 1 and a maximum of 3 antenna models.
- 3.7. Note** : The prepared model must be placed on a stand in the central part during presentation.
- 3.8.** In the second phase, each Sat will be lifted 6 meters up by helium balloons provided by us. Then, each team must establish a wireless connection and send the following information:
- Air temperature,
 - The humidity value of the air,
 - Gyroscope (measures tilt angles along the X, Y and Z axes)
 - GPS coordinates
 - One photo
- 3.9. The Sat, attached to a helium balloon, will first be launched with the start whistle. After the whistle, the team must attempt to establish contact with their Sat.**
- 3.10.** After sending the data, Sat must release one of the five helium balloons carrying it and land on the ground.
- 3.11.** The time calculated for the task will be stopped and credited to the team's account when the Sat launcher is launched again.
- 3.12.** Sat, which was damaged during landing, can fix the problems that arose until the next attempt.
- 3.13.** The team will be given 2 minutes to complete all these tasks.
- 3.14.** For a Sat who does not land within 2 minutes, the task will be considered incomplete.
- 3.15.** Each team will be given 3 games and the points scored by the team in the 3 games will be added together to calculate the overall average coefficient.
- 3.16.** The team's task completion time will be the average of the total of the 3 times.

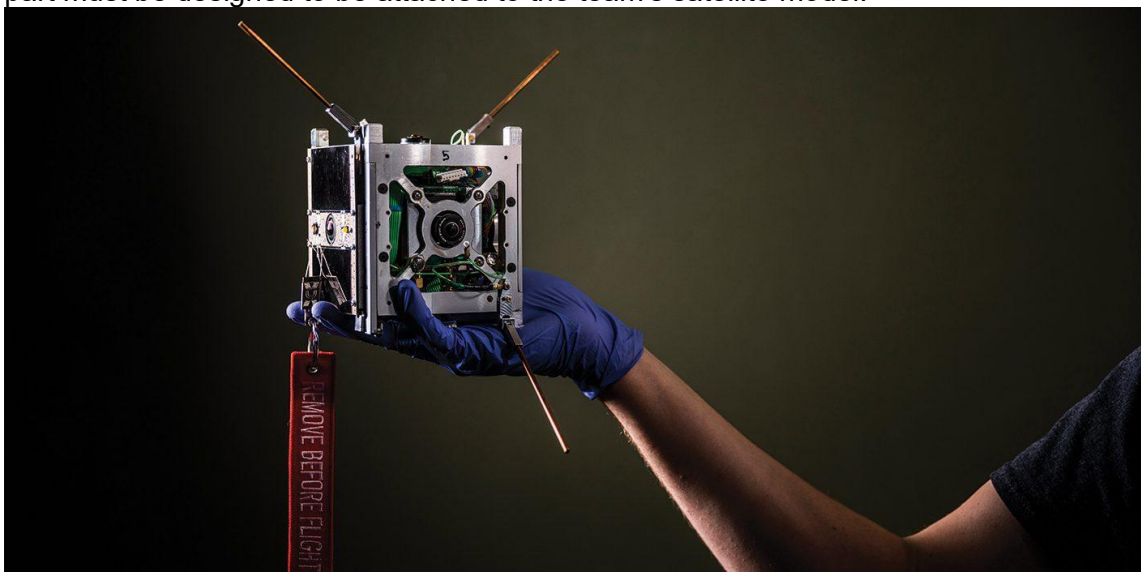
4.Competition structure

- 4.1.** Evaluation during the competition will be conducted by appointed judges .
- 4.2.** The dimensions of the Sat that must be prepared must be 10x10x10cm. Sizes smaller or larger than these dimensions are not allowed in the competition!
- 4.3.** The competition area will be 6x6 meters with tatami flooring.
- 4.4.** We will provide helium balloons for transportation at the competition site.
- 4.5.** Helium balloons will be in 2 parts. One of these parts will be fixed to the body, and the other will be connected to the release mechanism on the Sat.

- 4.6. In the event of technical problems that occur during the race, which are not the responsibility of the team, the race is suspended and the race is resumed after the technical problem is resolved.
- 4.7. In the competition, 2 minutes are given for completing the tasks.
- 4.8. After placing their Sat on the carrier, teams must stand on the edge of the red tape.
- 4.9. Before starting the competition, the team must disconnect from Sat and close the programs they will be using.
- 4.10. The data will be checked against real-world values at the time of viewing.
- 4.11. If any team sends standard values with a ready-made template, that team's attempt will be **canceled** .
- 4.12. Each team's Sat must send data with at least 1 sensor and land on the ground.
- 4.13. If the Sat connection is lost during data transfer, the team may stop the competition, in which case the evaluation will be incomplete and the team's time will be recorded as 2 minutes.
- 4.14. For wireless communication, 433Mhz, IP, WiFi, SMS and Bluetooth connections must be used.

5.Elements required for CubeSat development

- 5.1. **Body** - Can be made from wood and plastic materials using a 3D printer or laser cutting, with edges measuring **10x10x10cm** .
- 5.2. The radius of the helium balloon release hanger will be 25mm and the thickness will be 2mm. The team must design the release mechanism according to these dimensions.
- 5.3. For the international standard of dimensions intended for CubeSat, this link should be used.
https://upload.wikimedia.org/wikipedia/commons/3/33/CubeSat_Design_Specification_rev_12_-_1U_dimensions.png
- 5.4. At least one part of the body must be open so that the interior can be seen. The body part must be designed to be attached to the team's satellite model.



- 5.5. **Weight** - the movement of the prepared Sat with a helium balloon must be taken into account. For this reason, the maximum weight should be **400 grams** .

- 5.6. There is no limit to the applications used for wireless connection. The recommended application is the BLYNK application. <https://blynk.io/home-new>



- 5.7. When sending information via SMS, it must be sent to the address or mobile number that the referee will provide during the competition. **The SIM800** module must be used for SMS communication.



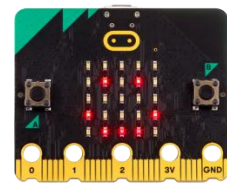
- 5.8. To calculate the operations, **the ESP modules shown in the Arduino nano (or uno) and MicroBit** must be used.



Arduino nano and uno



ESP32 or 8266

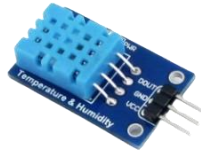


MicroBit

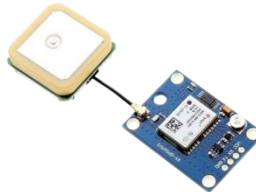
- 5.9. **The ESP32-CAM module must be used** to take or send a photo, which is the main part of the task .



- 5.10. For temperature or humidity values, a DHT11 (or 22) sensor must be used. In addition, it is allowed to use a sensor other than this sensor.



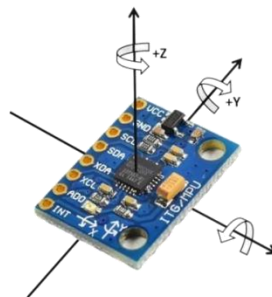
- 5.11.** The most important data information of celestial objects is their coordinates in the air. For this, the NEO-6M GPS module can be used. However, other modules are also allowed. If the competition is held indoors, it will not be necessary to calculate this data.



- 5.12.** At least 1 solar panel must be operational on each Sat.



- 5.13.** A gyroscope should be used to study the position of a free-floating object in the sky relative to the ground. The recommended module here is the MPU6050.



- 5.14.** It is free to use other auxiliary electronic modules and equipment.

6.Task execution and scoring.

- 6.1. **Each team must use medical gloves during the presentation and competition.**
- 6.2. Sat is awarded **10** points when he ascends to the sky. After ascending to the sky, if he establishes contact and can display Sat's (or team's) name on the monitor, he will be awarded **10** points. Here, we will give him a 500-gram lifting effect to lift him to the sky.
- 6.3. After the start whistle, the time the team makes contact with their Sat is recorded and added to the total task completion time.
- 6.4. If the temperature is sent accurately ($\pm 2^{\circ}\text{C}$), **15** points will be awarded. If the temperature is close to reality ($\pm 4^{\circ}\text{C}$), **10** points will be awarded. If any information is sent from the temperature sensor, it will be evaluated with **5** points.
- 6.5. the humidity value of the air is sent ($\pm 2\%$), **15** points will be given. If the humidity value is close to reality ($\pm 5\%$), **10** points will be given. If any information is sent from the humidity sensor, it will be evaluated with **5** points.
- 6.6. If GPS location data is sent , **25** points will be given. If the location data is close to reality (within a 1km radius of the location), **20** points will be given. If any information is sent from the GPS sensor, it will be evaluated with **5** points.
- 6.7. The photo limit is 1 and **20** points are awarded. If the team has taken several photos, they can submit the best one to the judge. During the photo shoot, numbers will be written in the landing zone and those numbers must be reflected in the photo. If there is a video during the takeoff, an additional **10** points are awarded.
- 6.8. **5** points each along the X, Y, and Z axes . If angles along **3 axes** are sent, an **additional 10** points will be given. *The evaluation will look at the changing angles of movement during descent and ascent.*
- 6.9. Each team must send their team name via SMS. **20** points are awarded for the team name. Additionally, **10** points will be awarded for each piece of data sent via SMS.
- 6.10. **5** points will be awarded for the solar panel on the satellite being operational . This process will be carried out after landing.
- 6.11. After sending the data, Sat must release itself from the hanger of the second helium balloon and land freely. Sat is awarded 20 points when it releases itself from the carrier.
- 6.12. The time allotted for the task stops when Sat lands.
- 6.13. the height of the satellite that remains suspended in the air during flight is less than **2** meters, its flight is not accepted and is stopped.
- 6.14. Each team outside the task can send 2 additional data using **2** sensors or 2 different data from the same sensors. In this case, **15** points will be awarded for each functional data.
- 6.15. Data reception with MicroBit is only accepted when presented by a computer program. Values displayed on the MicroBit's LED matrix are not accepted as a receiver.

7.Satellite and CubeSat design evaluation

Evaluation criteria:

- 7.1. The internal electronics of the device, the connection of circuit elements there,

- 7.2.** Inter-board joins
- 7.3.** Circuit element placement structure.
- 7.4.** Preparation and design of the fuselage element, weight and dimensions.
- 7.5.** General appearance, dimensions and innovation of the satellite
- 7.6.** Design of the satellite's wings and antennas