



REPUBLIC OF TURKIYE
MINISTRY OF NATIONAL EDUCATION
The General Directorate
of Technical and Vocational Education

15th INTERNATIONAL MoNE ROBOT CONTEST

UNDERWATER VEHICLE RULES



RULES

1. PURPOSE

The aim of the MEB Underwater Robots Competition is to enable our young people to design an unmanned vehicle that can fulfil the tasks given under water using today's technologies. In addition, it is to pioneer the dissemination of technological studies and research and development processes that can fulfil the underwater tasks of unmanned vehicles, which are seen as the technology of the future, at the high school education level. In this context, our students are expected to access and use information, analyse possible problems, produce solutions and reach new information.

2. COMPETITION THEME

Nowadays, when we are very close to celebrating the 100th anniversary of our Republic, the increase in the number of unmanned smart vehicles with high added value added to our technological infrastructure in every field has attracted attention and the importance of disseminating the studies in this field has increased day by day. The MEB Underwater Robots Competition, which will be held for the first time this year within the scope of these dissemination activities, will be a competition that will bring you together with the first step of designing and producing technological products that can meet the needs of sustainable, nature-friendly, people and the underwater world by bringing together the knowledge and equipment of our developing technological infrastructure with you, our esteemed students.

3. COMPETITION SPECIALITIES

In the MEB Underwater Robots Competition, competing teams are expected to design an unmanned underwater vehicle that has the ability to move on the track to be prepared under water and can fulfil dragging tasks.

3.1 Scoring, Evaluation, Competition Tracks and Task Objects

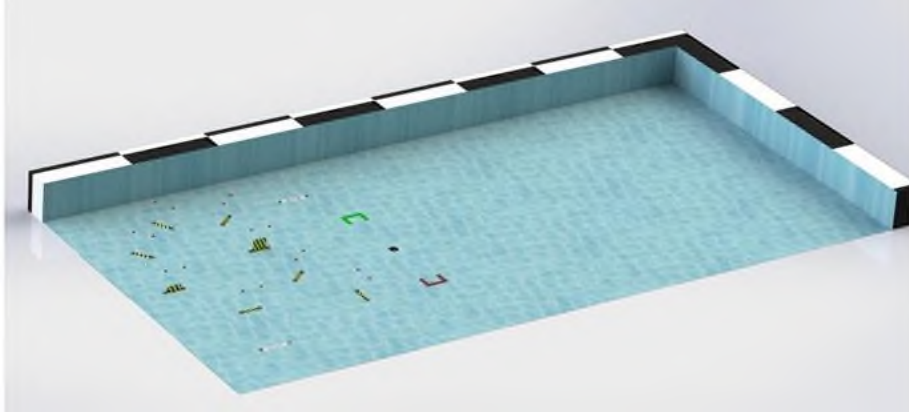


Figure-1: 15th MEB Robot Competition Underwater Robots Competition Pool Drawing

The competition will be held in a pool with a depth of 140cm, a width of 1250cm and a length of 2500cm. A platform will be built in the pool to determine the starting and finishing areas. The competition track area where the tasks will be performed will be placed by the referees before the competition. After each team is positioned at the starting point, they will start the competition by passing through the starting point when the referee starts the competition.

The underwater vehicles of the competing teams are expected to perform two different tasks. These tasks have **no** order of priority **and** each task is subject to a scoring within itself. One of these tasks is the task of passing between two buoys attached to a total of 10 buoys at 3 different heights from the

pool floor, while the other task is the task of taking two red and green balls in the form of cylinders between two castles placed opposite each other into two red and green castles in accordance with their own colour. The cylindrical balls will be pre- positioned on a black coloured platform between the two castles. The underwater vehicle will carry these balls into the castle of its own colour **by dragging them**. The cylindrical balls **will not be carried** by the grab and carry method. Figure-2 shows a picture of the competition course.

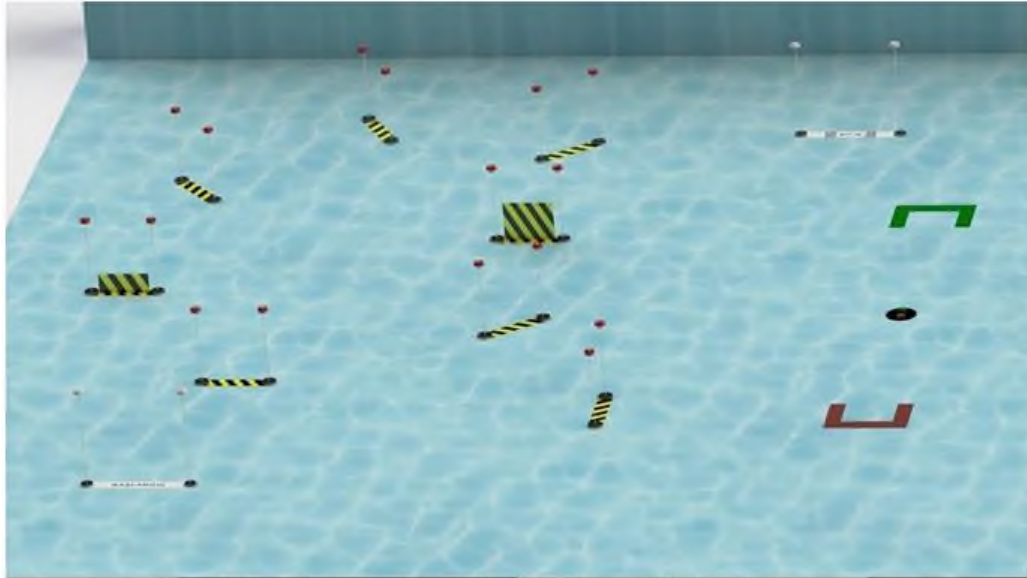


Figure-2: Underwater Systems Competition Course

3.1.1. Passing Between Buoys

In this task, the competitor vehicles are expected to complete the course by passing through 8 platforms prepared with two buoys in the pool. These platforms are prepared in three types and the competitor vehicle passing through each buoy platform will **add 10 points** to the team score. Failure of the vehicles to pass through any platform will only cause them to be deprived of that platform score and will **not prevent** them from reaching the finish platform at the end of the track.

The first of these platforms will consist of a plate placed between the two buoy columns shown in Figure-3. This platform will be named as "*Barrier-Free Buoy Platform*".



Figure-3: Unobstructed Buoy Platform



The height of the buoys on the unobstructed buoy platform in Figure-2 from the pool floor will be 100cm and the distance between the two buoy centres will be 80cm.

Another platform placed in the course is made of a 20cm high plate placed perpendicularly on the plate sitting on the ground between two buoy columns. The picture of this platform is shown in Figure-4. This platform will be referred to as "20cm Disabled Buoy Platform". If the vehicle of the competing team has difficulty in performing the task of passing through the 20cm obstacle buoy platform, it has the right to pass by this platform to perform other buoy tasks or the task of dribbling into the goal. Vehicles that can pass through this platform without knocking it over or dislodging it will have 10 points added to their team score. Vehicles that knock over or dislodge the platform while passing through this platform will have 5 points deducted from their team score.



Figure-4: 20cm Obstacle Buoy Platform

The height of the buoys on the 20cm disabled buoy platform in Figure-4 will be 100cm from the pool floor and the distance between the two buoy centres will be 80cm.

The last of the platforms placed in the course was formed by a 40cm high plate placed perpendicularly on the plate sitting on the ground between the two buoy columns. The picture of this platform is shown in Figure-5. This platform will be referred to as "40cm Disabled Buoy Platform". If the vehicle of the competing team has difficulty in performing the task of passing through the 40cm obstacle buoy platform, it has the right to pass by this platform to perform other buoy tasks or dribbling into the goal. Vehicles that can pass through this platform without knocking it over or dislodging it will have 10 points added to their team score. Vehicles that knock over or dislodge the platform while passing through this platform will have 5 points deducted from their team score.



Figure-5: 40 cm Obstacle Buoy Platform



The height of the buoys on the 40cm disabled buoy platform in Figure-5 will be 100cm from the pool floor and the distance between the two buoy centres will be 80cm.

On the track consisting of buoy platforms; 6 unobstructed buoy platforms, 1 20cm disabled buoy platform and 1 40cm disabled buoy platform will be placed by the referees as shown in figure-2 and all team vehicles will compete according to this layout. Before the start of the competition, the referees have the right to change the placement as deemed appropriate by the referees, provided that the integrity is not disturbed. It will be ensured by the referees that all teams compete on the same course from the start to the end of the competition. Team vehicles that perform all buoy tasks in the competition will earn 10 points for each task. A total of 80 points will be added to the team points. No 10 points will be added to the teams of the vehicles that do not pass through the buoy courses.

The team car driver has the right not to pass the buoy platform of his/her choice.

After the teams' preparation time, the vehicle will be deemed to have entered the competition course by passing through the "Starting Buoy Platform" at the start of the competition. Within the preparation time given to the teams, the vehicle is expected to be in front of the starting buoy ready to start the competition. After the referee starts the competition, the competing vehicles are expected to pass the "Finish Buoy Platform" after completing the tasks within the competition time. Figure-6 shows the start buoy platform and Figure-7 shows the finish buoy platform.



Fig.6: Starting Buoy Platform

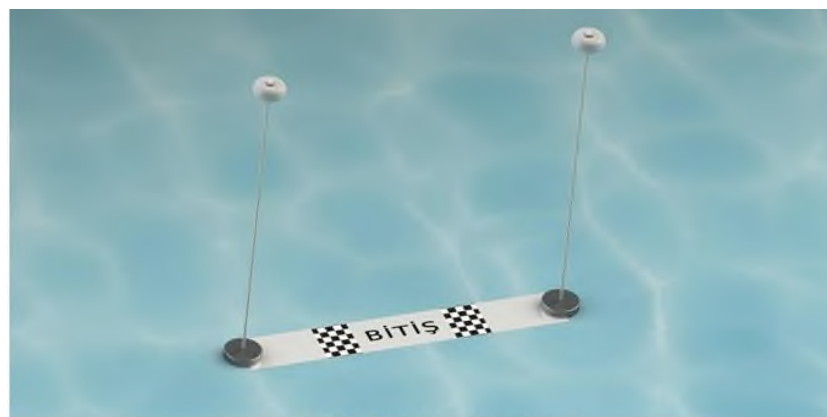


Fig.7: End Buoy Platform

The height of the buoys on the buoy platforms in Figure-6 and Figure-7 will be 100cm from the pool floor and the distance between the two buoy centres will be 100cm.

While no points will be added to the vehicles passing through the starting buoy platform, 10 points will be added to the teams' points of the vehicles passing through the finishing buoy platform.

3.1.2. Dribbling Task



Figure-8: Dribbling Task Track Layout

In this task, there are two castles, the dimensions of which are shown in Figure-9, sitting on the red and green coloured pool floor, which are opposite each other inside the track and 400cm (+- 20cm) distance from outside to outside.

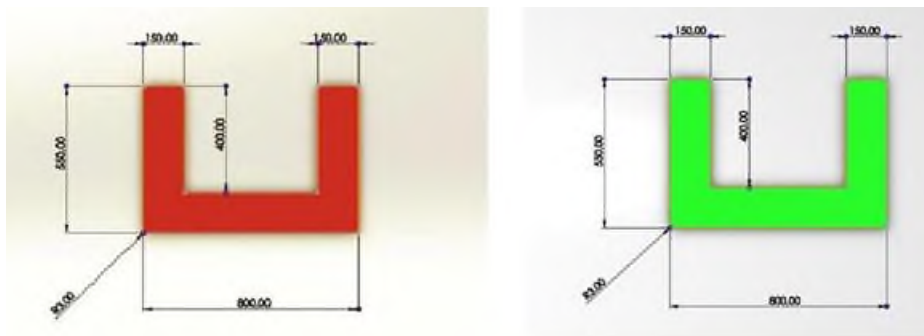


Figure-9: Castle Dimensions for Dribbling (in millimetres)

Two cylindrical balls with a diameter of 10cm and a thickness of 5cm, having the same colours as the goal colours, shall be placed by the referees on the black coloured platform with a diameter of 50cm placed on the pool floor at equal distance to these two goals, facing the goal and in accordance with the colours.



Figure-10: Cylinder Platform and Balls



The vehicles of the competing teams are expected to **drag** these two cylinders from the black platform to the castle of the appropriate colour. If each cylinder is placed in the castle of its own colour, **10 points will be added to the team score**. A total of 20 points will be added to the team score if both cylinders are dragged and dropped into the castle of the appropriate colour. Teams that move the castle will have **5 points deducted** from their team score. The picture of the dribbling task of the track is shown in Figure-10. The track will be placed by the referee before the competition and all teams will compete according to this placement.

3.2 Rules

- The competition time is 9 minutes in total. At the end of this time, teams must remove their vehicles from the pool.
- Each team is given 5 minutes for preparation. After 5 minutes, the competition time is started. For the team captains who are ready before the preparation time and declare to the referee that they are ready, the competition is started with the start command given by the referee.
- Competitor teams may withdraw from the competition at any time. The decision to withdraw must be notified to the poolside referee by the driver. Tasks performed after the decision to withdraw are not added to the team score and tasks accomplished before the decision are added to the team score.
- The expected task completion time for all teams is 7 minutes.
- Teams that reach the finish line before the expected task completion time (7 min.) will not be awarded points.
- Teams crossing the finish line after the expected task completion time (7 minutes) will have 2 points deducted from their team score for every 10 seconds they exceed the competition time from the moment they cross the finish line. Times under 10 seconds are not included in the score calculation. Any team may decide to withdraw after the expected task completion time (7 minutes) has expired. The decision to withdraw must be notified to the referee by the driver. Tasks accomplished before the withdrawal request are added to the team score. Under all circumstances, the vehicle must be removed from the pool at the end of 9 minutes. For example, if the competitor team crossed the finish line in 8 minutes 24 seconds, 16 points for 1 minute 24 seconds (for 84 seconds (4 seconds are not taken into account) $8 \times 2 = 16$ points) will be deleted from the team score.
- It is 20 points to reach the finish line.
- Each team has the right to call one technical time-out. Technical time-out duration is 5 minutes. At the end of this time, 15 points are deducted from the team that requests a second technical time-out and the second technical time-out is given. Maximum two technical time-outs can be requested during the competition.
- The competition period of the vehicles controlled from outside the pool with the cable is stopped and the robot is removed from the pool and 50 points are deleted from the team score. Task points before that moment when the team is excluded from the competition are added to the team score. The points scored for the tasks after that moment by the team, which is determined from the camera footage that the cable was interfered with, are deleted and 50 points are deleted from the team score.



- Teams that design and use an original vehicle control card will have 10 points added to their team score.
- Teams that design and use an original power distribution board will have 10 points added to their team score.
- Teams that design and use an original balance control system will have 10 points added to their team score.
- The competing teams will be ranked from high to low according to the team score they earned at the end of the competition. The places of the teams with the same score in the ranking will be determined by the teams' time to cross the finish line. The team with the least time to finish the competition will be placed higher in the ranking. In addition, if one of the two teams with the same team score decides to withdraw, the team that decided to withdraw will be placed at the bottom of the ranking. If the teams with equal team points have also decided to withdraw, the ranking of the teams will be determined according to the vehicle weights. The lighter vehicle will be placed at the top of the ranking.
- The team captain has the right to request a technical time-out for vehicles that get stuck on any track element in the pool or whose cable is entangled.
- A maximum of two people can be present at the poolside with the team captain and team member.

3.3. Scoring Table

Tasks	Competition Score
Passing through the Barrier-Free Buoy Platform	10 Points
6 Passing Through Unobstructed Buoy Platform	6 x 10 Points
Passing through 20cm Obstacle Buoy Platform	10 Points
Passing through 40cm Obstacle Buoy Platform	10 Points
Dribbling Cylinder Dribbling Green Cylinder into Green Castle Placement	10 Points
Cylinder Dribbler Drives the Red Cylinder into the Red Castle Placement	10 Points
Passing through the Finish Buoy Platform	10 Points
Original vehicle control card design	10 Points
Original power distribution board design	10 Points
Original stability control system design	10 Points
Maximum Mission Points	150 Points

Penalty points

1. The maximum penalty point to be deducted from the team score of the teams that do not complete the competition task within the completion time (7 minutes) and use the entire competition total time (9 minutes) will be **12 points**. (120 seconds extra time/10 seconds) x 2 points = 12 points)
2. Teams that move the goal will have **5 points** deducted from the team score.
3. **5 points will be deducted** from the team score of the vehicles that overturn or displace the



platform while passing through the 20cm or 40cm disabled buoy platform.

Total team points = Mission Points - Penalty Points

3.4. Expectations from Teams Applying for the Originality Points Award

The Originality Points Award will be given to teams with vehicle control system, vehicle stability system and power distribution unit system developed, designed and manufactured by the team member students of the underwater vehicle. Our students will prepare a report on the development, design and production processes and present this report to the Originality Evaluation Board. In this context, teams are expected to present all the processes of the design (circuit design diagram, PCB design diagram, software, production processes, 3D drawings, etc.) as a presentation (digitally or as a file) to the competition committee and explain the originality of the design in order to receive originality points. The documents of the report shared by the team members during the interview will remain with the Originality Evaluation Committee. Originality Award Points will not be given to teams that do not submit documents.

Teams that come to the lottery registration for the competition must inform the registration commission that they will apply for the originality point award before the competition starts, in which area they will give an originality presentation in the competition area. The interview times of the teams applying for the originality point award, whose order of competition is determined by drawing lots, will be notified to the teams, and when the interview time comes, the evaluation commission will be notified with the relevant documents are expected to arrive on time. The application of the teams without documents or 20 minutes after the interview time notified to the team will not be taken into consideration.

4. DETAILS OF THE COMPETITION AREA AND WORKING AREAS

The pool where the vehicles will compete will be semi-olympic. 220 VAC energy will be supplied in the area. In addition, there will be a control desk at the edge of the competition pool where the team whose turn it is to compete will control the underwater vehicle. 220 VAC voltage will be supplied to the teams here. The highest DC voltage level that can be used will be 50 V DC (no current and capacity limit).

5. TECHNICAL SPECIFICATIONS, SAFETY AND LIMITATIONS OF THE UNDERWATER VEHICLE

- The largest separation of the underwater vehicle shall not exceed **50 cm**.
- It is important that the length of the cable to be used by the underwater vehicles to provide energy, data and control transmission is at least 20 metres in order to perform the tasks without difficulty on the competition course.
- Underwater vehicles must be water resistant to a depth of 2 metres.
- Cables used in underwater vehicles must be insulated by the teams against tearing and electrical leakage.
- In order to prevent the cable used in underwater vehicles from entangling with the task objects, it will be appropriate to be equipped with buoyancy (buoy, foam, etc.) equipment at certain intervals.
- Before the competition, the safety suitability of the underwater vehicles will be checked by the referees. If deemed appropriate, the team will be able to participate in the competition.



- 220 V AC will not be allowed to be transmitted to the vehicle and/or pool for safety reasons.
- Vehicles will be checked by the referees before being taken to the track, and vehicles that do not comply with the rules will not be allowed to enter the pool.
- Before the competition, the vehicles will be subjected to a water tightness test by the referees with the power off. Teams found to have taken water during the competition or within the preparation time allocated to the teams will be excluded from the competition.
- Vehicles will be energised after the necessary checks are made.
- Battery-powered vehicles **must** have an easy-to-access emergency stop button. This button must cut off all power of the vehicle and stop the engines. There is no restriction on the creation of a magnetic dial, push button, etc. stop device.
- The operating voltage of battery-powered vehicles must be maximum 50V DC and **must not exceed** this limit.
- Any battery can be used. There is no current and capacity limit.
- Batteries should be transported in a fireproof protection bag. If the battery is embedded in the vehicle and cannot be removed, the vehicle must be powered off and transported.
- The vehicles that will receive the operating voltage from outside will be supplied with a maximum of 50 VDC.
- This supply will be provided by the AC/DC converter provided by the tools themselves.
- 220V will definitely **not** be allowed to be supplied to the vehicle and / or pool.
- Externally fuelled vehicles **must have** an emergency stop button.
- The cables of vehicles to be supplied with external energy must be isolated from water and the external environment. There must not be any exposed cables. There must be a fuse according to the voltage and current determined on the power supply or cable.
- The engines of the underwater vehicle must be isolated against water and must be able to operate under water.
- There must not be any sharp parts and spikes on the body engine propeller parts of the vehicle, unsuitable parts must be blunted or rounded off.
- Motor propellers **must not be** exposed. The propellers must be **insulated** with a protective outer shell.
- Cables connected to the vehicle should not be tense and should be resistant to sudden movements.
- High-voltage overwater devices and underwater system feeds must be independent.
- **It is forbidden** to use any oil in the hydraulic systems and in the vehicle reservoir, as it may adversely affect the continuation of the competition in case of leakage.
- Chemicals **should not be** allowed to mix into the pool in any way. Vehicles **should be designed** with this situation in mind.



6. CODE OF ETHICS

- Rude and unkind words and behaviour should be avoided.
- Insults, threats and bad words should be avoided.
- Direct targeting and insulting through social media tools such as e-mail, facebook, skype, messenger, whatsapp, twitter etc. should be avoided.
- In your petitions and objections, attention should be paid to spelling rules and style.
- In the competition area, behaviours such as situations, actions, words, etc. that will affect the functioning and motivation of other teams should not be exhibited.