



UNMANNED UNDERWATER SYSTEMS COMPETITION SPECIFICATION

2024

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VERSIONS		
Version	History	Description
V1.1	16.12.2023	TEKNOFEST 2024 First Version
V2. 1	20.02.2024	Competition Calendar

1 PURPOSE

Today, underwater research is carried out for various purposes such as protection and investigation of natural resources in civil and military applications and ensuring national security. A significant portion of recent academic and industrial research has focused on the use of unmanned vehicles in order not to put human life at risk and to reduce costs in underwater or marine studies.

In line with this need, our aim is to pioneer the development of indigenous vehicles by spreading the issue of the production and development of underwater vehicles capable of performing remote-controlled and/or autonomous missions that will successfully perform the missions related to the scenarios given to the teams to a wider base throughout the country.

2 GENERAL INFORMATION ABOUT THE COMPETITION

2.1 Conditions of Participation

- The competition should be organised by the gathering of secondary education (secondary school, high school) or higher education (associate, undergraduate and graduate) students studying in Türkiye and abroad.
- It is compulsory to participate in the competition as a team.
- Teams must consist of at least 3 and at most 15 people. Apart from this, teams can only take 1 person as a counsellor.
- The number of teams in the final will be announced later.
- Teams can be formed from a single school or as a mixed team by bringing together one or more secondary/higher education students. The competition category in which the team can participate will be determined according to the highest education level of the team members.
- The finalist teams are required to upload their approved student documents, and for the counsellors, they are required to upload the approved document showing that they are lecturer/assistant, research assistant or teacher to the area to be opened on the CMS platform.
- The competition consists of two categories: Basic Category and Advanced Category.
- Participants at secondary level can only enrol in one of the Basic or Advanced Categories.
- Participants at higher education level can only register for the Advanced Category.
- Secondary level teams must have a teacher from their school as a counsellor.
- Higher education level teams can take a lecturer/member or research assistant as an advisor.
- Teams will be disqualified if they participate with the same, similar or copy of any project report.

- In case of quoting from the reports published on www.teknofest.org, the source must be indicated. You can find the format of citing the source in the specification.
- During the competition process, all information to be provided by the TEKNOFEST competitions committee will be made to the person designated by the team as the communication officer. For this reason, each team must designate a communication officer.
- The follow-up of the processes (Application, Report Upload Deadline, Form to be filled in, etc.) is the duty of the communication officer and TEKNOFEST competitions committee is not responsible for delays and / or disruptions caused by the communication officer.
- Applications are made online via the application system www.t3kys.com until **29 February 2024**.
- Between the application dates, the team captain/advisor registers through the system, makes the registration of the advisor and/or team captain/team members, if any, in the system correctly and completely, and sends an invitation to the e-mails of the advisor and members, if any. The member to whom the invitation is sent logs into the application system and accepts the invitation from the "My team information" section and the registration is completed. Otherwise, the registration is not completed.
- Competitors who have completed the team formation process must apply to the competition suitable for their project.
- Members of the eliminated or disqualified team(s) will not be eligible to participate in any other team.
- Each person can be a member of at most 1 team.
- All necessary processes within the scope of the competition (Application, Report Receipt, Report Results, Financial Support Application, Appeal Processes, Member addition / removal processes, etc.) are carried out through the CMS system. Teams are required to follow their processes through the CMS system.
- Member additions/removals are made until the Critical Design Report Delivery date.
- Throughout the competition process, making applications, uploading reports and filling out forms via CMS are within the authority of the team captain and/or advisor and the competition processes are managed through these persons.
- A maximum of 20 teams can be finalists for the Basic Category.
- A maximum of 20 teams can be finalists for the Advanced Category.
- **If more than 20 teams are successful in the video stage for both categories, the teams will be requested to make an online presentation as a result of the decision of the Advisory Board and the Referee Committee.**
- TEKNOFEST Competitions Committee has the authority to limit the number of members in the festival area. In case of limitation, the committee will be informed by the committee.
- During the competition process, your level of education at the time of your application will be taken into account. You should pay attention to this when choosing a category.
- Applications will be made through the TEKNOFEST Aviation, Space and Technology Festival Technology Competitions official website (www.teknofest.org).

2.2 Competition Calendar

History	Description
29.02.2024	Competition Application Deadline
18.03.2024 – 22:00	Technical Qualification Form Deadline
01.04.2024	Announcement of Technical Qualification Form Results
13.05.2024	Critical Design Report Deadline
31.05.2024	Announcement of Critical Design Report Results
01.07.2024	Deadline for Submission of Sealing and Mobility of Underwater Vehicles Videos
16.07.2024	Announcement of Finalist Teams
AUGUST 2024	Competition Date

2.3 Contact and Question & Answer

2.3.1 Contact

The communication channel for technical questions about the competition is the e-mail group whose link (**UNMANNED UNDERWATER COMPETITION GROUP**) is given in the introduction section of the Unmanned Underwater Systems Competition on the website (www.teknofest.org). It is the responsibility of the competing team to actively follow this group and to follow the announcements and questions & answers in this group as a member of at least 1 person from each team. The referee and jury committees are not responsible for the inability of the teams to access the current information that may arise as a result of not following the specified mail group.

Questions regarding the organisational aspects of the competition should be sent to iletisim@teknofest.org.

It is important to send your technical and organisational questions through the correct channels above in order to respond quickly to the questions asked.

2.3.2 Question & Answer

The details of the competition are explained in this specification. In order for the competition to be carried out in a healthy process, the specification must be read carefully. In cases where the relevant rule and/or phrase in the specification is not clear/understandable or is thought to be insufficient, it is necessary to ask a question about the relevant subject.

Question & Answer is not a source for the following items:

- Strategic or uncertain situations planned by the competitive team for the future
- Questioning the rule changes made by the referee committee in the past during the competition
- To have the vehicle design/design approved by the referee and/or jury committees

Questions that are weak, not referenced in the specification, open-ended, unclear, unclearly understood and already answered in the specification will not be answered. The following items can be given as examples of questions that will not be answered:

- Is the part/vehicle we designed suitable for the competition?
- Questions that are not clear or not understood due to lack of references
- Repetitive questions
- Subjects specified in the specification

2.4 Competition Process

Evaluations will be made according to the following stages.

2.4.1 Technical Qualification Form

Teams are obliged to submit the Technical Qualification Form on the date specified in 2.2 Competition Calendar. In the Technical Qualification Form; mechanical, electronic, algorithm and software design of underwater vehicles should be specified. A pre-qualification will be carried out according to the results of the Technical Qualification Form. As a result of the Technical Qualification Form evaluations, the teams that pass to the Critical Design Report (CDR) stage will be announced on the date specified in 2.2 Competition Calendar. The Technical Qualification Form template will be announced after the end of the application period.

The Technical Qualification Form template will be shared later on the competition page on www.teknofest.org.

2.4.2 Critical Design Report

Teams that have passed to the Critical Design Report (CDR) stage are obliged to submit their Critical Design Reports by the date specified in 2.2 Competition Calendar. The template for the Critical Design Report will be announced after the application deadline.

The critical design report shall be maximum 30 pages (including cover, contents and references sections). Reports that do not comply with the page limit will not be evaluated.

Teams above the barrage score to be determined according to the results of the Critical Design Report will continue the competition and financial support will be given to the number of teams determined by the Competition Advisory Board and the Referee

Committee. Other teams above the barrage score will continue the process without financial support.

The Critical Design Report template will be shared later on the competition page on www.teknofest.org

2.4.3 Sealing, Mobility and Mission Demonstration Video

The sealing, mobility and task demonstration video is a continuous video in which it is shown that the underwater vehicle to be participated in the competition has a sealed structure, can remain balanced, can move voluntarily and in a balanced manner in the desired direction and can perform at least 1 task. Teams that can pass this stage will be eligible to compete in the final stage.

2.4.3.1 Expectations in Sealing Demonstration:

In order to demonstrate the underwater sealing feature, it should be shown in the video that no air bubbles rise to the water surface after the underwater vehicle is completely submerged in the water.

2.4.3.2 Expectations in the demonstration of mobility

Following the demonstration of sealing, it must be shown that the underwater vehicle can move from one point to another point under water in a voluntary and balanced manner. The following items can be given as examples of unacceptable movements.

- Involuntary rotation/driving in the axes of movement in water and independent of the direction of movement
- For wired vehicles (basic category) routing the vehicle by interfering with the cable
- External control (external to autonomous software) for autonomous vehicles (advanced category)
- Videos where the image and movement of the vehicle is not clear

2.4.3.3 Expectations from Task Demonstration:

- The basic category teams are expected to demonstrate that they have successfully launched **at least one torpedo** manually to any of the **targets specified in the theme.**
- Advanced category teams are expected to demonstrate that they have successfully launched **at least one torpedo** autonomously to any of the **targets specified in the theme.**

2.4.3.4 General Considerations in Video

- It is expected to show that the emergency stop button to be found in battery-powered vehicles is working. When the button is pressed (Magnetic or rotary

emergency buttons are also accepted), it should be shown that all motors stop and the system switches off.

- The resolution of the video must be at least 720p and the total duration must be at least 1 minute and at most 5 minutes.
- In order to participate in the competition, the sealing and mobility video must be submitted by the date specified in 2.2 Competition Calendar.
- The vehicles in the videos of the teams that will compete in the advanced category will also be battery powered and wireless.
- Videos will be uploaded to Youtube. Videos uploaded to other platforms will not be accepted.

2.4.4 Final Evaluation Stage

After the pool stage, the teams will make their final evaluations and present a detailed presentation/report to the referees, including their feedback on the competition process. In the Final Evaluation Stage, the referees will evaluate the teams in different branches (electronics, software, mechanics, etc.) in accordance with the final version of their vehicles (taking into account the changes after the Critical Design Report). The content of the Final Evaluation Presentation should include information such as how the designs and plans realised before the competition can be compared with real applications, information about the problems, if any, and solutions. The Final Evaluation Presentation will be held during the time period to be determined by the referees together with the pool stage.

3 REFEREE INFORMATION

Before the start of the competition, there will be a referee briefing where general issues about the competition will be explained to the competitors.

The referee committee will call the teams in the relevant category around the pool before each course and ensure that the competing teams see the course closely.

The referees will read the technical reports of the teams before the competition and will have information about the teams. After the vehicle is lowered into the water, the referee at the poolside will check the external interventions that may affect the movement of the vehicle (such as steering the vehicle with a cable) and will stop the competition in case of any negativity. The referees will be responsible for the application of the rules during the competition.

For any safety concerns or issues that may arise during the competition, the referees are authorised to stop the competition and cut the power to the underwater vehicle.

After the competition stages, the referee committee will evaluate the final evaluation report/presentation of the teams by interviewing each team. It is expected that the

competitor team producing the underwater vehicle will be able to answer technical questions about the vehicle. Consultants will not be able to attend the interview.

4 GENERAL CONSIDERATIONS FOR COMPETITORS:

4.1 Technical Considerations:

- The largest edge of the underwater vehicle (Width-Length-Height excluding the manipulator arm) shall not exceed 90 cm.
- Underwater vehicles must be water resistant to a depth of 3 metres.
- Cables used in underwater vehicles must be insulated by the teams against tearing and electrical leakage.
- 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 VAC will not be allowed to be transmitted to the vehicle and/or pool for safety reasons. As a result of polluting the pool area, 20 penalty points will be deducted from the total points of the relevant team.

4.2 Safety Considerations:

- Mission objects are not placed too close to the pool walls to ensure the safety of the vehicles.
- Each underwater vehicle participating in the competition will be inspected for compliance with the safety aspects defined in the rules. Underwater vehicles that are not deemed safe as a result of the controls will not be allowed to enter the pool.
- Teams may energise their vehicles only after they have complied with the necessary safety rules.
- The electrical insulation of all cables on the vehicles must be complete and appropriate. There shall be no exposed cables, electrical connections, etc. in any way.
- Before the competition, the whole vehicle will be tested by the judges by immersing the whole vehicle in water (without electrical connection).
- The electric motors on the vehicle must be insulated against water.
- In the motor / propeller systems that provide the movement of the vehicle, there will be no open sharp ends in the middle, all ends will be blunted and located in the nozzle.
- There shall be no sharp points on the main body of the vehicle and it shall be rounded.
- The electricity of the devices operating with 220V AC above water shall be completely separate from the electricity of the underwater vehicle.
- The use of hydraulic systems is not suitable within the scope of this competition as it will cause pollution in case of leakage.

- There shall be no loose parts (camera, etc.) on the underwater vehicle.
- Vehicles that do not meet all safety requirements and do not receive the appropriate approval from the referees will not be allowed to enter the pool and compete.

4.3 Other Considerations:

- The pool where the vehicles will compete will be Olympic or semi-Olympic. The competition will be held in an area separate from the pool, where there will be a table for each participating competitor team to use. 220 VAC energy will be supplied in the area.
- No one other than the team member and his/her counsellor will be allowed in the competition area and in the area where the team tables are located
- No external information and guidance will be received regarding the movements of the underwater vehicle and its position in the pool. In case of any external information and guidance, the competing team may be excluded from the competition with the decision of the referee.
- The teams will be monitored by the cameras to be placed in the pool and the referees on the competition course, on issues such as information transfer to the control desk, external intervention to the vehicle with cable, whether the stages are completed or not.
- The camera system will be activated in case of any objection by the teams and to prevent possible cheating. In addition, the performance of the teams during the competition will be recorded and can be used as promotional material.
- For special situations that may arise during the competition, the referees will meet and decide on the case.

4.4 General Scoring for Basic Category and Advanced Category:

The scores given in the tables below are valid for both categories. Only the course scoring will be carried out differently for the Basic and Advanced Category.

4.4.1 Reports, Originality and Indigenouness Scoring

Report	Scoring
Technical Qualification Form	0 points
Critical Design Report	50 points
Final Evaluation Presentation	30 points
Authenticity	40 points
Indigenouness	40 points

4.4.2 Size Rating

Dimensions (The longest dimension among width, length, height will be taken as basis)	Scoring
Vehicle \leq 50 cm	40 Points
50cm < Vehicle \leq 60 cm	20 Points
60 cm < Vehicle \leq 75 cm	10 Points
75cm < Vehicle < 90 cm	0 Points

Note: The robot arm that does not move in at least one of the x,y,z axes or does not have the ability to hold moving will be included in the vehicle dimensions. Movements must be provided by any actuator.

4.4.3 Weight Rating

Vehicle Weight	Scoring
Vehicle weight \leq 8kg	40 Points
8 kg < Vehicle weight \leq 10 kg	20 Points
10 kg < Vehicle weight \leq 12 kg	10 Points
12 kg < Vehicle weight	0 Points

Note 1: All robot arms will be in the weight calculation.

Note 2: Teams can change equipment on their under-water vehicles between tasks and/or during the task construction phase (In this case, if there is a maintenance period, if not, the competition period will run. If teams will make equipment changes on their vehicles in any part of the competition process, they must bring their vehicles to the size and mass measurement with the largest and / or heaviest configuration).

5 COMPETITION DETAILS

TEKNOFEST 2024 Unmanned Underwater Systems Competition will include 3 mission themes. These themes will be the same for Basic and Advanced Category teams, and the autonomy levels will differ for the two categories.

- **Theme 1: Torpedo Launch**

With this task, the competing teams will have the opportunity to demonstrate the precise positioning and aiming capabilities of their under-water vehicles. Another skill expected from the teams is to demonstrate the capabilities of the launching mechanisms they have designed by shooting accurately towards the specified targets.

This task evaluates the technical and engineering skills of the competing teams by combining underwater mobility and shooting accuracy.

- **Theme 2: Underwater Cable Tracking and Anomaly Detection**

Thanks to underwater cables, transfers of important elements such as electrical energy and communication lines can be realised. For this reason, it is critical to keep these lines under regular surveillance.

Tracking and anomaly detection systems, increasing the sustainability of subsea infrastructures and modelling the solution of technical problems by detecting them in advance have been created with this task. This competition encourages young engineers to contribute to future subsea exploration and maintenance technologies and supports innovation in this field.

- **Theme 3: Colour Detection and Passing Through The Door**

Competitor teams will demonstrate their ability to accurately detect the colour of an underwater door by using colour detection systems integrated on the unmanned underwater vehicles they design, and to pass through the door when it meets the specified colour criteria. In this technical task, participants are expected to adapt to the changing light conditions and colour variations of the water that may be encountered underwater. While colour detection requires maximising underwater visual perception capabilities, the gate passing phase requires precise control and manoeuvrability of the underwater vehicle.

This mission aims to emphasise the advances in underwater reconnaissance and navigation technologies and to highlight the technical capabilities of the participants that can be used in precision operations underwater.

6 BASIC CATEGORY

The main category themes are open to the participation of students at secondary education level, which includes tracks at **3 different autonomy levels**. Autonomy levels are as follows:

- Stage One
 - Manuel
 - Semi-Autonomous
- Stage Two
 - Autonomous

The points that the teams competing in the basic category should apply and pay attention to are as follows.

- Basic category competitors can use their vehicles either wired or wirelessly.
- For wired vehicles:
 - **The length of the cable** to be used by underwater vehicles to provide energy, data and control transmission must be **at least 25 metres**.

- For wired vehicles, it **is mandatory to have an emergency stop button** on the control desk.
- **The operating voltage of the AC/DC (self-provided) converter to be located on land for power supply to the vehicle shall not exceed 50VDC (no current and capacity limit).**
- At the desk side of the cables carrying electrical power between the vehicles and the control desk, there must be **a fuse appropriately selected according to the power and current requirement.** If there is a fuse on the power supply, **no additional fuse is required.**
- Electrical connections to the vehicle and control unit should not be tense and should be able to provide **flexibility in sudden movements.**
- Each basic category team that will supply wired power will make AC/DC conversion at the control desk with the converter to be provided by themselves.
- For battery-powered vehicles:
 - **It is mandatory to have an emergency stop button (push, rotating, magnetic, etc.) in an easily accessible** position.
 - The operating voltage shall not exceed 50 VDC (no current and capacity limit).
- The competitor team will compete **as two separate teams** during their race time. **There will be a maximum of 2 team members at the control desk** and these team members will not be able to see the pool and the underwater vehicle during the competition. **The team members who leave the underwater vehicle in the pool will also be maximum 2 people** and these people will not be able to go to the control table. The counsellor and other team members will not be allowed to be around the control desk or the pool.
- Competitor teams have a preparation time of **5 minutes each for the first and second stages.** The competition will start as soon as the underwater vehicle is dropped into the pool within this period. At the end of 5 minutes, the competition will start **regardless of whether the underwater vehicle is left in the pool.**
- When a situation requiring maintenance or change occurs after the start of the competition time for the basic category, the vehicle may be taken out of the pool upon the **request of the team leader.** In this case, the time is stopped and **a maintenance period of 5 minutes** is given **2 times in total, 1 time in Stage 1 (manual and semi-autonomous) and 1 time in Stage 2 (autonomous).** If the support of other team members is needed, the relevant team members can come to the area where the vehicle is located. **At the end of the 5 minute period, the** competition time continues to run in **any case.**
- In cases requiring changes on the vehicle during the competition outside the maintenance period (cable entanglement, etc.), the vehicle can be taken out of the water with the approval of the referee and the change / correction can be made and the vehicle can be released back into the water. However, the **competition period will continue** even if the vehicle is out of the water.
- At the end of the maintenance period taken during the mission, the underwater vehicle will start from the starting point **determined by the referee committee.**

Information about the competition themes to be included in the basic category is given below.

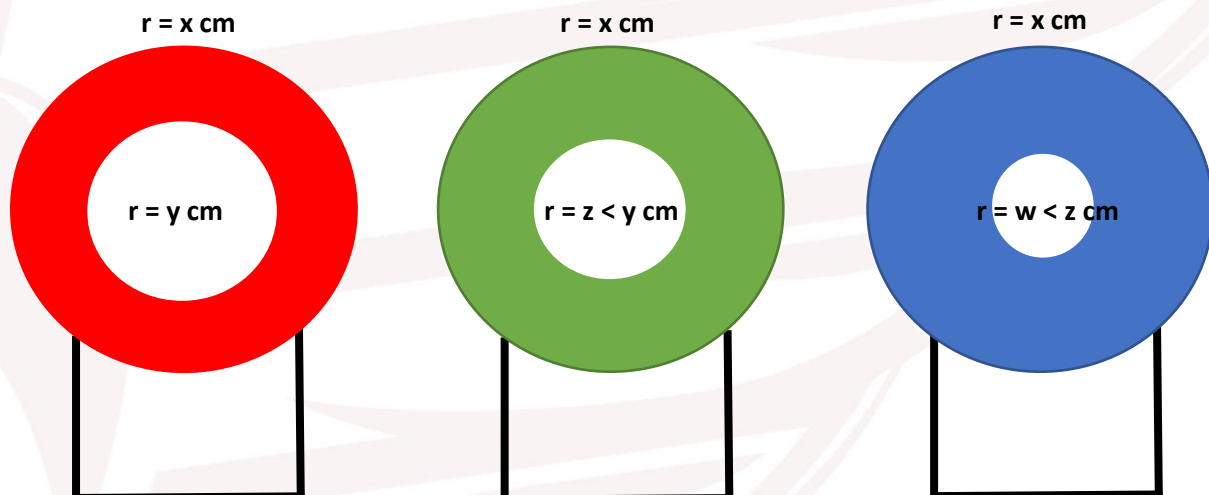
6.1 Torpedo Launch (Manual):

Basic category teams are expected to carry out the torpedo launch theme manually.

Teams are expected to produce their **torpedo models, which** 3D drawings will be **shared** with them later, in a **minimum of 5 pieces** before arriving at the competition area, in a way that they will be **completely filled (100% infill) with 3D printing method**. **It is the teams' own responsibility to bring their torpedo models ready for the competition area!**

During the competition, teams are expected to **launch a total of 5 torpedoes at 3 different sized targets placed anywhere in the pool**, which are shown below in 2D drawings. The restrictions to be followed by the teams during the shooting are as follows:

Important Note: The information given about the theme objects is preliminary and representative. Details such as final technical drawing and colour codes will be shared with the teams in the following process.



- Teams will be allowed to carry **a maximum of 3 torpedoes** on the underwater vehicle. After completing the launching of the torpedoes they carry, **they are free to** come to the poolside and **reload to** complete the total number of torpedoes to five (5).
- Competitor teams will be able to launch maximum of **5 torpedoes in total**.
- Teams are **not allowed to launch by touching the targets**. They can launch from anywhere they want without touching the targets.
- **It is forbidden for teams to drop torpedoes into the target with an apparatus such as a gripper**. It is obligatory to launch to the target by means of a moving mechanism to be produced by themselves.
- Teams are **prohibited from using explosive (pyro, etc.), pneumatic and hydraulic systems** in their launch mechanisms. They are expected to perform

the launch with a mechanical and/or electromechanical system (spring system, etc.) that they will design themselves.

- **There shall be no point difference** between contact and non-contact passage of torpedoes through targets.
- **The maximum time** set for this theme **is 5 minutes.**
- This theme **includes mission time points.** Mission time points will **only be** awarded to teams that launch **all 5 torpedoes at the smallest diameter target before the deadline.**

The scoring for the torpedo launch theme is as shown in the table below:

Torpedo Launch Theme	Scoring
Each successful torpedo launched at the smallest sized target	20 Points
Each successful torpedo launched at a median-sized target	10 Points
Each successful torpedo launched at the largest sized target	5 Points
Maximum Theme Score	100 Points

Mission Points (GP) = Successful launch of torpedoes at the target

Time Score (SP) = GP × (Time (Seconds)/300)

Track Score = Mission Score + Time Score

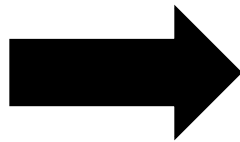
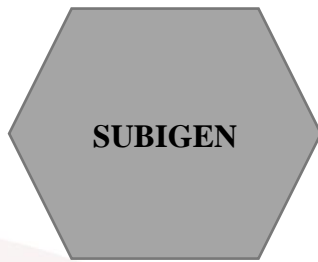
6.2 Underwater Cable Tracking and Anomaly Detection (Semi-Autonomous):

Basic category teams are expected to fulfil the theme of underwater cable tracking and anomaly detection semi-autonomously.

The training set consisting of 10 different shapes in total will be shared with the teams **along with the names of these shapes.** **Any 5 of** the shared shapes will be placed **anywhere** on the representative underwater cable. These shapes placed on the cable will represent anomalies. **While manually following** the underwater cable, the competing teams are expected **to automatically recognise the shapes placed on the** cable with **image processing, artificial intelligence, etc. methods through the** cameras on their vehicles.

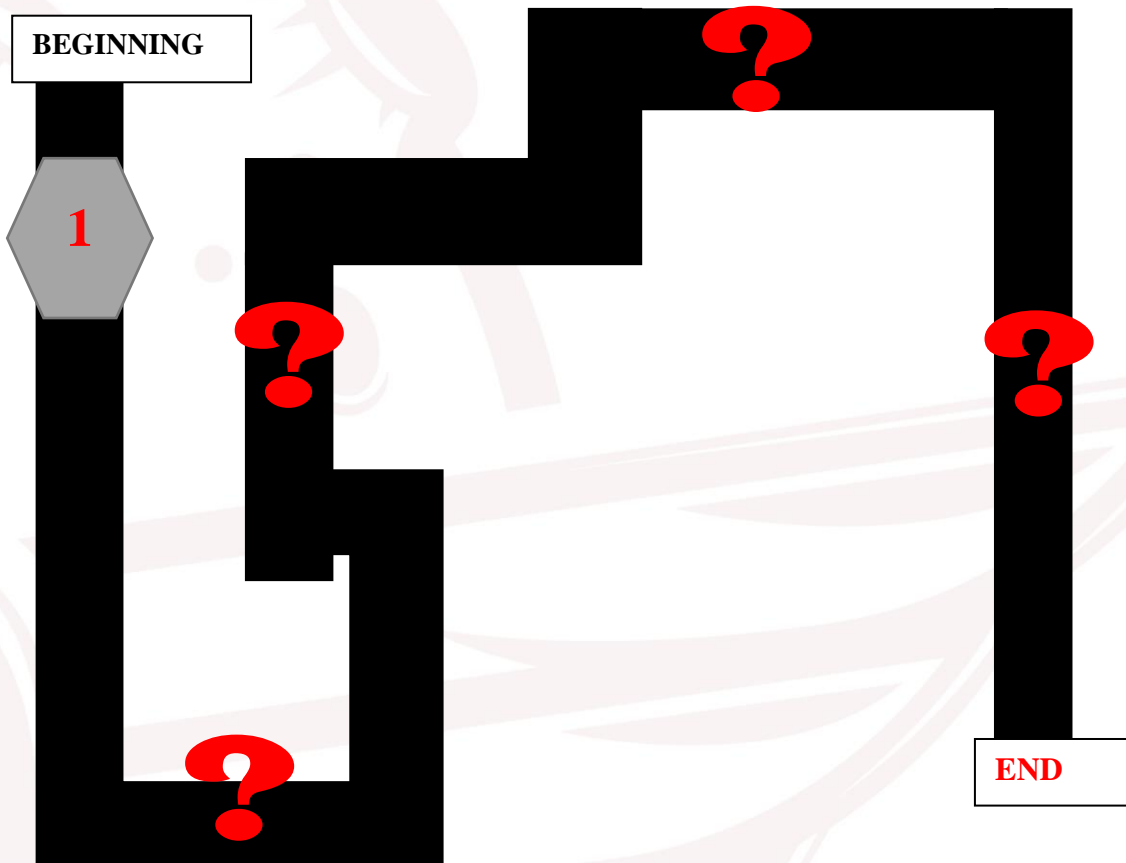
During the duration of this theme, at least 1 person from the referee committee will be present at the operator's desk. The referees will check the trueness of the detection when the competing teams automatically recognise the shapes representing the anomalies and display the shape names on the screen. With the approval of the referee for each correct detection, the competing teams will earn their points.

Important Note: The information given about the theme objects is preliminary and representative. Details such as final technical drawing and colour codes will be shared with the teams in the following process.



It is sufficient for the competitor team to show the "SIXIGEN" text on the screen after the detection.

The representative track that teams must complete in this theme is as follows:



The points to be considered by the competing teams during this theme are as follows:

- The competing teams **cannot directly head towards the shapes representing the anomalies.** They must **follow the cable line and** find and detect the anomalies respectively.
- The competing teams **can manually monitor the cable line with operator control,** but they must **automatically recognise anomalies.**
- **The maximum time** set for this theme **is 5 minutes.**
- In this theme, **there are mission time points.** Mission time points will **only be** awarded to teams **that detect all 5 anomalies by following the cable line before the deadline.**

The scoring to be applied for the theme of underwater cable tracking and anomaly detection is as in the table below:

Underwater Cables Tracking and Anomaly Detection Theme	Scoring
Detection of each anomaly	20 Points
N anomalies detected	N x 20 Points
Maximum Theme Score	100 Points

Task Score (GP) = Successful detection of anomalies

Time Score (SP) = GP × (Time (Seconds)/300)

Track Score = Mission Score + Time Score

6.3 Colour Detection and Door Passing (Autonomous):

Basic category teams are expected to autonomously perform the colour detection and gate passing theme.

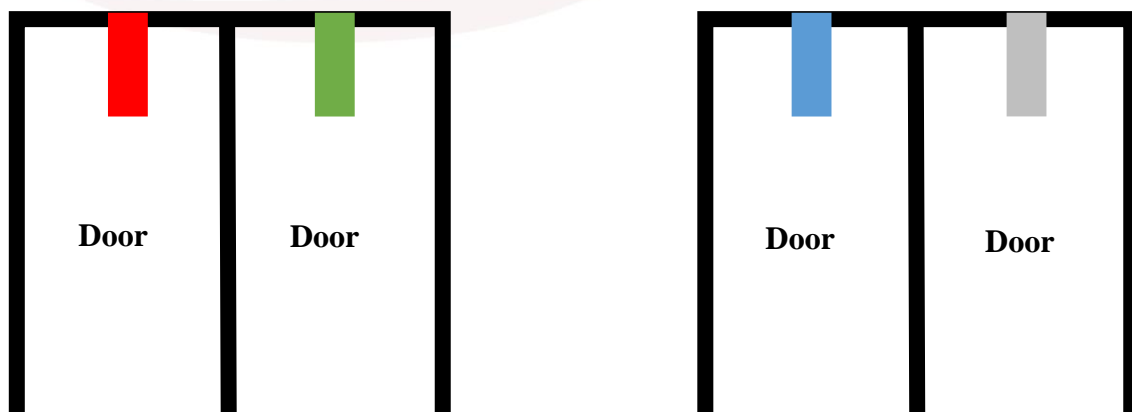
There will be **a total of 4 gates** in this theme, **doubly combined**. These gates can be placed anywhere in the pool. **A total of 4 target colour cards** belonging to each gate will be hanging on the gates. **RAL codes of these 4 different colours** will be shared **with the teams before the competition**.

Any one of the 4 different colours specified to the competing teams before the competition will be shared with the team **at the beginning of the preparation period as a target**. This target colour may **vary for each team**.

Underwater vehicles are expected to pass **through the gate carrying the target colour card** specified to the competing team.

Important Note: The information given about the theme objects is preliminary and representative. Details such as final technical drawing and colour codes will be shared with the teams in the following process.

The representative track that the teams will face in this theme is as follows:



The points to be considered by the competing teams during this theme are as follows:

- **RAL codes** of 4 flags will be shared **with the competing teams before the competition.**
- Only **at the beginning of the preparation period of** this theme, **the flag colour hanging on the target gate** will be shared with the competing team. The target colour will not be announced before that.
- **The target colour may vary for each team,** so competing teams are advised to come prepared to **complete the software updates within the preparation time.**
- **There will be no point difference between contact and non-contact passage** through the target gate **and both of them will be called successful passage.**
- **The maximum time** set for this theme **is 5 minutes.**
- In this theme, **there are mission time points.** Mission time points will be awarded to teams **that pass through the target door, with or without contact, before the time is up.**

The scoring to be applied for colour detection and the theme of passing through the door is as in the table below:

Colour Detection and Pass Through Door Contact	Scoring
Successful passage through the target gate	100 Points
Passage through non-target door	0 Points
Maximum Theme Score	100 Points

Mission Points (GP) = Successful passage through the target door

Time Score (SP) = GP × (Time (Seconds)/300)

Track Score = Mission Score + Time Score

6.4 Basic Category Total Points Calculation (Excluding Time Points)

No	Description	Score
1	Critical Design Report, Presentation, Originality and Indigenousness Scoring	160
2	Size Rating	40
3	Weight Rating	40

4	Task Scoring	-
4.1	Stage 1 Tasks Scoring	
4.1.1	<i>Torpedo Launch</i>	100
4.1.2	<i>Underwater Cable Tracking and Anomaly Detection Task</i>	100
4.2	Stage 2 Tasks Scoring	
4.2.1	<i>Colour Detection and Door Passing Task</i>	100
Total		560

7 ADVANCED CATEGORY

The advanced category is a **fully autonomous** competition that includes **3** different tracks and is open to the participation of students at all levels of education.

The points that the teams competing in the advanced category should apply and pay attention in the followings.

- Advanced category competitors can **only** use their vehicles wirelessly.
- **It is mandatory to have an emergency stop button (push, rotating, magnetic, etc.) in an easily accessible location on the vehicles.**
- The operating voltage of the batteries shall not exceed 50 VDC (no current and capacity limit).
- In the advanced category, the competitor team will compete **as a single team.** There will be **maximum 4 team members** in the competition area.
- Competitor teams in the Advanced Category have **3 minutes of preparation time for each task.** The competition will start as soon as the underwater vehicle is left in the pool within this time. At the end of the 3-minute period, the competition will start **regardless of whether the underwater vehicle is left in the pool.**
- In case of a situation requiring maintenance or change after the start of the competition time for the advanced category, the vehicle may be taken out of the pool upon the **request of the team leader.** In this case, the time is stopped and **a maintenance period of 5 minutes** is given for **a total of 3 times, 1 time for each autonomous task.** If the support of other team members is needed, the relevant team members can come to the area where the vehicle is located. At the end of the 5-minute maintenance periods, the **competition time continues to run in** any case.
- In cases requiring changes on the vehicle during the competition outside the maintenance period (cable entanglement, etc.), the vehicle can be taken out of the water with the approval of the referee and the change / correction can be

made and the vehicle can be released back into the water. However, the **competition period will continue** even if the vehicle is out of the water.

- At the end of the maintenance period taken during the mission, the underwater vehicle will start from the starting point **determined by the referee committee**.

Information about the competition themes to be included in the advanced category is given below:

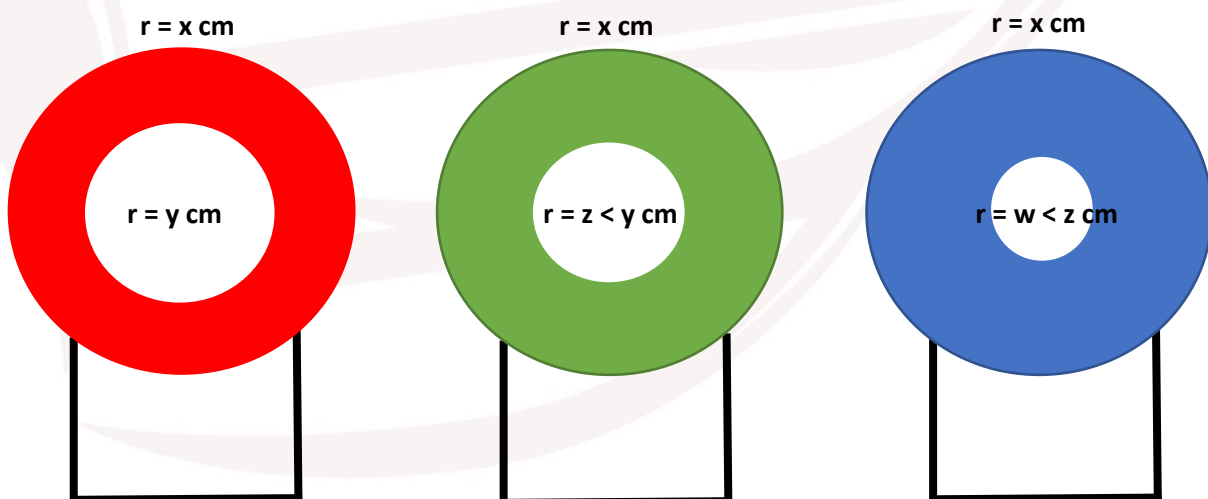
7.1 Torpedo Launch (Autonomous):

Advanced category teams are expected to fulfil the torpedo launch theme autonomously.

Teams are expected to produce their **torpedo models, which** 3D drawings will be **shared** with them later, in a **minimum of 5 pieces** before arriving at the competition area, in a **way that they will be completely filled (100% infill) with 3D printing method**. **It is the teams' own responsibility to bring their torpedo models ready for the competition area!**

During the competition, teams are expected to **launch a total of 5 torpedoes at 3 different sized targets placed anywhere in the pool**, which are shown below in 2D drawings. The restrictions to be followed by the teams during the shooting are as follows:

Important Note: The information given about the theme objects is preliminary and representative. Details such as final technical drawing and colour codes will be shared with the teams in the following process.



- Teams will be allowed to carry **a maximum of 5 torpedoes** on the underwater vehicle at **the same time**. In the case of carrying less than five (5) torpedoes, teams **are free to** come to the edge of the pool after completing the launching of the torpedoes on the vehicle and **reload to** complete the total number of torpedoes to five (5).
- Competitor teams will be able to launch a maximum of **5 torpedoes in total**.

- Teams are **not allowed to launch by touching the targets**. They can launch from anywhere they want without touching the targets.
- **It is forbidden for teams to drop torpedoes into the target with an apparatus such as a gripper**. It is obligatory to launch to the target by means of a moving mechanism to be produced by themselves.
- Teams are **prohibited from using explosive (pyro, etc.), pneumatic and hydraulic systems** in their launch mechanisms. They are expected to perform the launch with a mechanical and/or electromechanical system (spring system, etc.) that they will design themselves.
- **There shall be no point difference** between contact and non-contact passage of torpedoes through targets.
- **The maximum time** set for this theme **is 5 minutes**.
- This theme **includes mission time points**. Mission time points will **only be** awarded to teams that launch **all 5 torpedoes at the smallest diameter target before the deadline**.

The scoring for the torpedo launch theme is as shown in the table below:

Torpedo Launch Theme	Scoring
Each successful torpedo launched at the smallest sized target	20 Points
Each successful torpedo launched at a median-sized target	10 Points
Each successful torpedo launched at the largest sized target	5 Points
Maximum Theme Score	100 Points

Mission Points (GP) = Successful launch of torpedoes at the target

Time Score (SP) = GP × (Time (Seconds)/300)

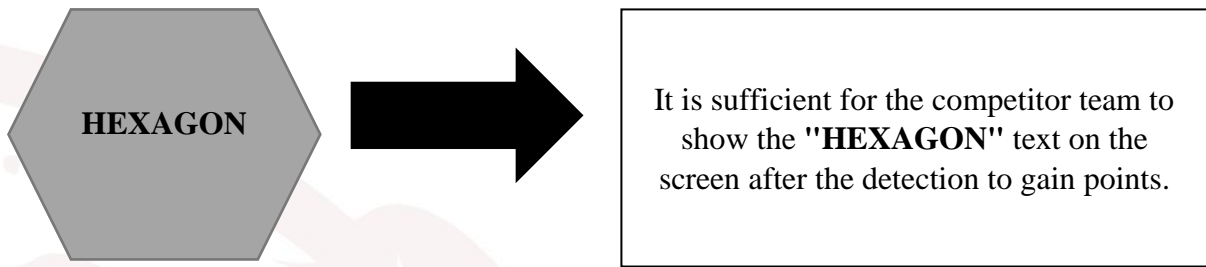
Track Score = Mission Score + Time Score

7.2 Underwater Cable Line Tracking and Anomaly Detection (Autonomous):

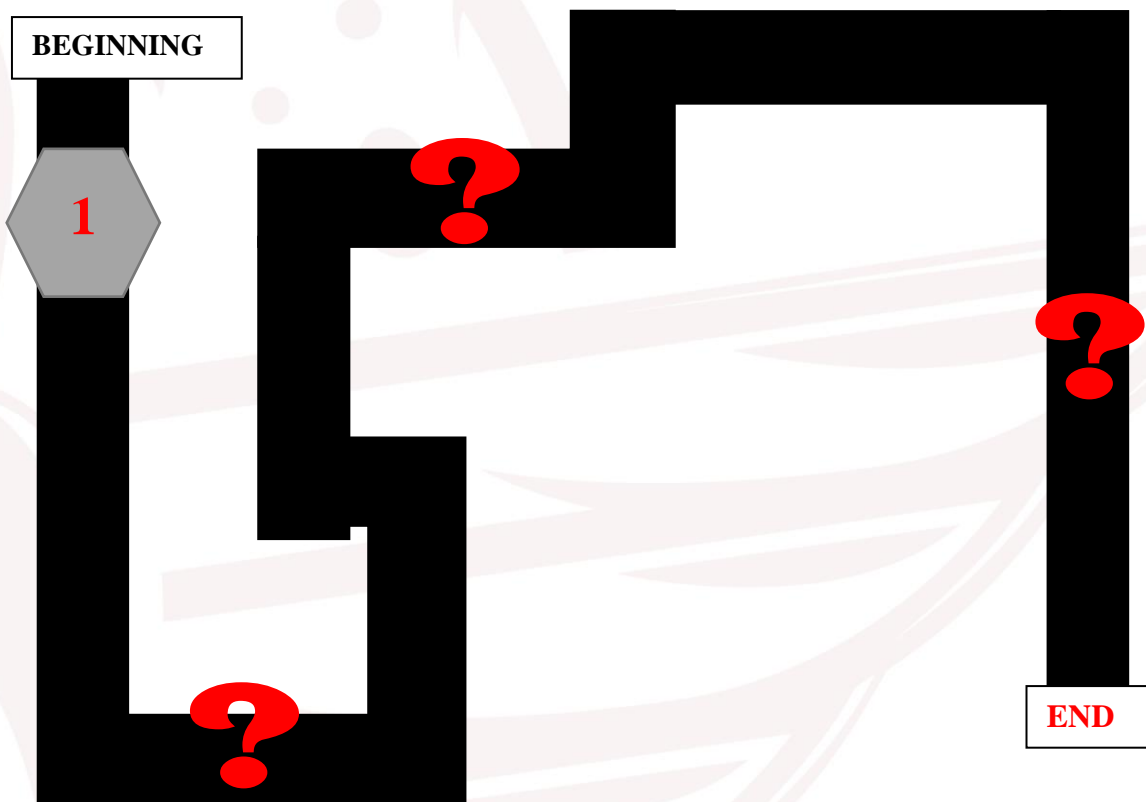
Advanced category teams are expected to autonomously fulfil the theme of underwater cable tracking and anomaly detection.

The training set consisting of 10 different shapes in total will be shared with the teams **along with the names of these shapes**. **Any 4 of** the shared shapes will be placed **anywhere** on the representative underwater cable. These shapes placed on the cable will represent anomalies. **While autonomously following** the underwater cable, the competing teams are expected **to automatically recognise the shapes placed on the** cable with **image processing, artificial intelligence, etc. methods through the** cameras on their vehicles.

After completing its mission, the underwater vehicles will be taken ashore and will show the record files of the anomaly detections recorded in its memory to the referee committee.



The representative track that teams must complete in this theme is as follows:



The points to be considered by the competing teams during this theme are as follows:

- The competing teams **cannot directly head towards the shapes representing the anomalies.** They must find and detect the anomalies in order **by following the cable line.**
- The competitor team is expected to show **the anomaly names they have identified** with the team in the water, **matched with the photograph they have taken.** Only anomaly names presented without photographs **will not be accepted.**
- **The maximum time** set for this theme **is 5 minutes.**

- In this theme, **there are mission time points.** Task time points will **only be awarded to teams that detect all 4 anomalies by following the cable line before the deadline.**

The scoring to be applied for the theme of underwater cable tracking and anomaly detection is as in the table below:

Underwater Cables Tracking and Anomaly Detection Theme	Scoring
Detection of each anomaly	25 Points
N anomalies detected	N x 25 Points
Maximum Theme Score	100 Points

Task Score (GP) = Successful detection of anomalies

Time Score (SP) = GP × (Time (Seconds)/300)

Track Score = Mission Score + Time Score

7.3 Colour Detection and Door Passing (Autonomous):

Advanced category teams are expected to carry out the colour detection and gate crossing theme autonomously.

There will be **a total of 4 gates** in this theme, **doubly**. These gates can be placed anywhere in the pool. **A total of 4 target colour cards** belonging to each gate will be hanging on the gates. **RAL codes of these 4 different colours** will be shared **with the teams before the competition.**

Any of the 4 different colours specified to the competing teams before the competition will be shared with the team **at the beginning of the preparation period as a target.** This target colour may **vary for each team.**

Underwater vehicles are expected to pass **through the gate carrying the target colour card** specified to the competing team.

Important Note: The information given about the theme objects is preliminary and representative. Details such as final technical drawing and colour codes will be shared with the teams in the following process.

The representative track that the teams will face in this theme is as follows:



The points to be considered by the competing teams during this theme are as follows:

- **RAL codes** of 4 flags will be shared **with the competing teams before the competition.**
- Only **at the beginning of the preparation period of** this theme, **the flag colour hanging on the target gate will be** shared with the competing team. The target colour will not be announced before that.
- **The target colour may vary for each team,** so competing teams are advised to come prepared to **complete the software updates within the preparation time.**
- **There will be no point difference between contact and non-contact passage** through the target gate **and both will be called successful passage.**
- **The maximum time** set for this theme **is 5 minutes.**
- In this theme, **there are mission time points.** Mission time points will be awarded to teams **that pass through the target door, with or without contact, before the time is up.**

The scoring to be applied for colour detection and the theme of passing through the door is as in the table below:

Colour Detection and Pass Through Door Contact	Scoring
Successful passage through the target gate	100 Points
Passage through non-target door	0 Points
Maximum Theme Score	100 Points

Mission Points (GP) = Successful passage through the target door

Time Score (SP) = GP × (Time (Seconds)/300)

Track Score = Mission Score + Time Score

7.4 Advanced Category Total Points Calculation (Excluding Time Points)

No	Description	Score
1	Critical Design Report, Presentation, Originality and Indigenousness Scoring	160
2	Size Rating	40
3	Weight Rating	40
4	Task Scoring	-
4.1	<i>Torpedo Launch</i>	100
4.2	<i>Underwater Cable Tracking and Anomaly Detection Task</i>	100
4.3	<i>Colour Detection and Door Passing Task</i>	100
Total		560

8 AWARD

Among the teams ranked in the award ranking, the teams ranking in their categories, basic and advanced, will be awarded the cash prizes specified in the table below. The prizes specified in this table show the total amount to be given to the teams that are entitled to receive awards, individual awards will not be made. The first, second and third prizes will be divided equally according to the total number of Team Members and will be deposited into the bank account specified by each individual.

	Basic Category	Advanced Category	Counsellor
First	150.000 ₪	200.000 ₪	6000 ₪
Second	120.000 ₪	150.000 ₪	6000 ₪
Third	100.000 ₪	120.000 ₪	6000 ₪

8.1 Minimum success criteria for Award ranking in the Basic Category

In order to qualify for the award in the basic category, it is necessary to score at least 50 points from the task scoring.

8.2 Minimum success criteria for Award ranking in the Advanced Category

In order to be ranked in the advanced category, it is necessary to score at least 50 points from the task scoring.

9. GENERAL RULES

[Click here](#) to access the General Rules booklet which is valid within the scope of the competition.

10. ETHICAL RULES

[Click here](#) to access the General Rules booklet which is valid within the scope of the competition.

Statement of Responsibility

T3 Foundation and TEKNOFEST are in no way responsible for any product delivered by the competitors or for any injury or damage caused by the competitor. T3 Foundation and the organisation authorities are not responsible for any damages caused by the competitors to third parties. T3 Foundation and TEKNOFEST are not responsible for ensuring that the teams prepare and implement their systems within the framework of the laws of the Republic of Türkiye.

Technology Team Foundation of Türkiye reserves the right to make any changes in this specification.



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