

Techno-Ocean 2023
underwater robot competition
AUV Division
Competitive Rules

Reiwa 5 March 30 first edition

Date and Time: October 7th, 2005 (Saturday)

Place: Kobe City Port Island Sports Center

Techno-Ocean 2023

Underwater Robot Competition Executive Committee

competition rules

1. INTRODUCTION 1.1

COMPETITION STRUCTURE OF THE AUV DIVISION

- In the AUV category, underwater robots with a weight of 50 kg or less will be evaluated based on the following two items.

(1) Introduction video

(2) Water tank competition

- The overall score will be 1000 points in total for the introductory video (400 points) and the water tank competition (600 points). synthesis

The team with the highest score wins. *Participation with only the introductory video is also possible.

1.2 Competition Overview

Each team should create and submit an introduction video in advance. For details on the introductory video, see "2.

About the introductory video". In the aquarium competition, underwater robots

Earn points by clearing the stages. In addition, depending on the number of participating teams, league matches

and adjust the content of tournament battles.

The competition will be held in a heated pool with a maximum depth of 1.1 meters as shown in Figure 1. Therefore, please participate with an underwater robot that can operate at a depth of 1.1 meters without any problems. in need

If necessary, carry out a water tightness test.



Figure 1: Competition Venue

Notes

Each team designs and assembles so that there will be no breakage of the pressure vessel, oil leakage, or falling of sharp parts.

Please consider from the stage of Please note that if there is a problem with entering the pool, you will be disqualified.

Also, make sure that the underwater robot can be safely held by divers.

2. About introduction video

The judges watched the introductory videos submitted by each team, and evaluated the structure, clarity, and appeal of the videos. We will comprehensively evaluate and score the media and technical content. In addition, there is a possibility that an introductory video will be broadcast at the competition venue and published on the Internet.

*Please submit the introductory video via Net Storage. Information on where to submit the introductory video will be provided later on the official website (or by email from the organizer).

Please include the following in your video: Items (a) to (c) are required items.

- (a) Team affiliation, team composition (self-introduction is optional) (b) Strategies and ingenuity in aquatic competition, technical challenges (c) Appeal of underwater robot concept and technology (d) Appearance design and safety sexual appeal

However, we will not disclose personal information without consent, slander, or violate public order and morals. Content is prohibited. The length of the video should be 3 to 8 minutes.

3. About water tank competition

3.1 Introduction

One team from each course will compete in order within the specified time. of each team

The competition time is scheduled to be 15 minutes (5 minutes for preparation + 10 minutes for water tank competition), but depending on the number of participating teams, change. The starting order will be announced on the day of the competition. For smooth progress, each team should be ready to start by the scheduled start time.

3.2 About the competition pool

The competition pool is a 25m heated pool. The water temperature is set higher than a normal pool
I'm here. Also, be careful when operating the robot so as not to damage the equipment.

3.3 Aircraft inspection

If necessary, a watertightness test is carried out. If the need for testing arises, submerge the underwater robot to a depth of 1.1m to confirm that there are no problems. Submerge for about 10 minutes to check the watertight performance. A weight is attached to the underwater robot to calm it down. At the same time, check for oil leaks and dropped parts. Please declare containers containing oil in advance.

3.4 Operating the underwater robot

It is also possible to operate it manually in the course of the water tank competition. wireless or
Please design the underwater robot so that it can be operated manually by wire. *You can manually operate all tank competitions (participate in ROV), but you can eventually earn

score will be lower. The score distribution is such that the AUV has a high score. *It is also permitted to enable wired communication in the aquarium competition. When using a wired connection, use a cable of 25m or longer. However, even if the underwater robot is operated by autopilot, if the competition score or overall score is tied, the team with the more autonomous aircraft will be given preferential treatment as wired connection aircraft < wireless connection aircraft.

* During the competition, when switching the underwater robot from manual operation to automatic operation, the operator must

Take a posture or state in which you cannot operate it, such as letting go of the end.

* During the manual operation in the competition, it is prohibited to convey information that the pilot does not know by instructions from a third party (e.g.

"more right", etc.).

3.5 About the competition course

Figure 2 shows the competition course. Allocate half of the water tank from the center in the longitudinal direction to the competition course

I am During the competition, two courses will be used at the same time to compete for points.

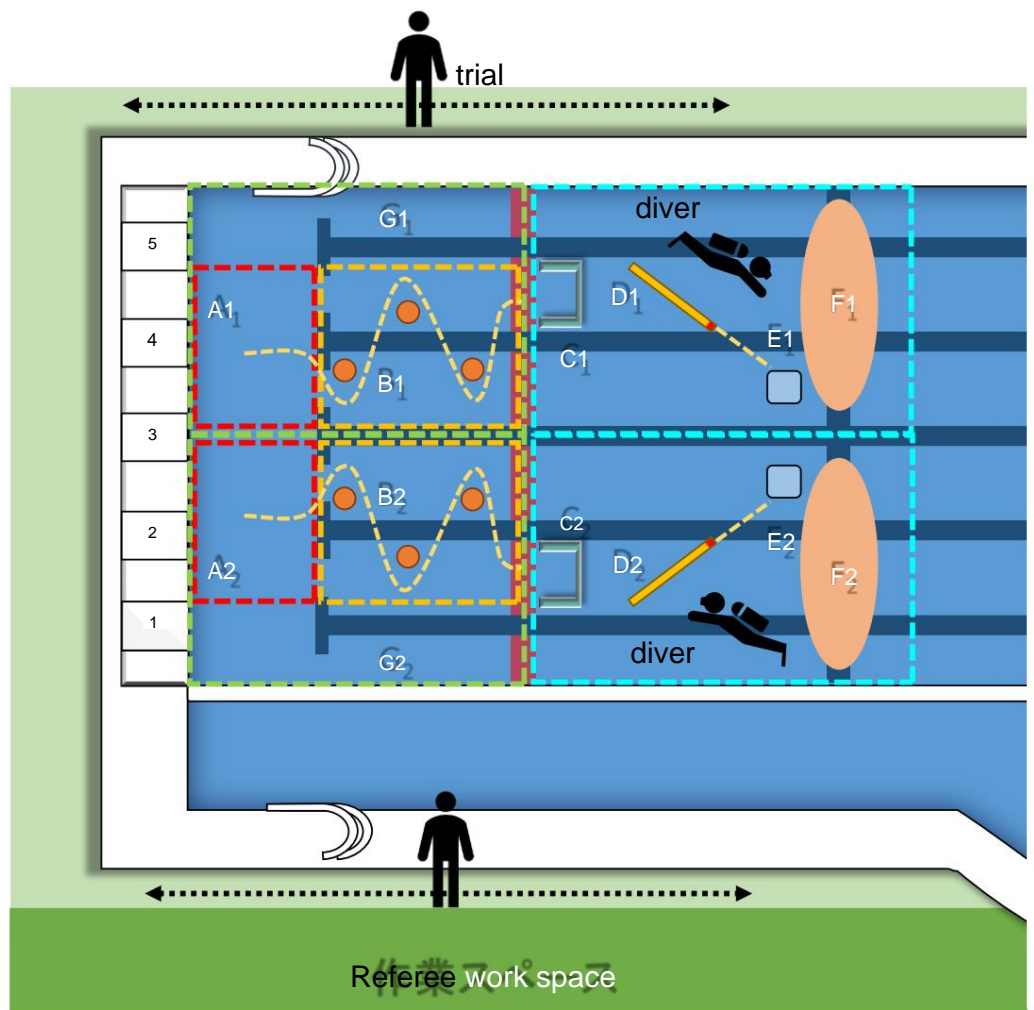


Figure 2: Competition course

The competition course is divided into areas. Corresponding to Ax to Gx ($x=1, 2$) in the figure, navigation
There are conditions, installations and scoring missions. Each area is described below.

[Description of competition area]

• Ax : Indicates the start area. The underwater robot is within the range of the red dotted line in this Figure 2.

please put in

• Bx : Indicates the slalom area. Make the underwater robot slalom between the buoys within the range of the

yellow dotted line in Figure 2. Autonomous driving or manual operation

please. You can move on or under water.

Scoring: By navigating alternately outside the buoys as shown in Figure 3, 40 points are added for each buoy,
with a maximum of 120 points. However, 40 points are added for each buoy in the case of autonomous
operation, and 10 points are added for each buoy in the case of manual operation. Install the buoy as shown in Fig. 4.

increase. *Maximum points will be awarded only if the buoys are passed alternately from the front. For example, 2

If you ignore the first buoy and pass straight outside the first and third buoys,

Only the first buoy is worth points. *Even if only

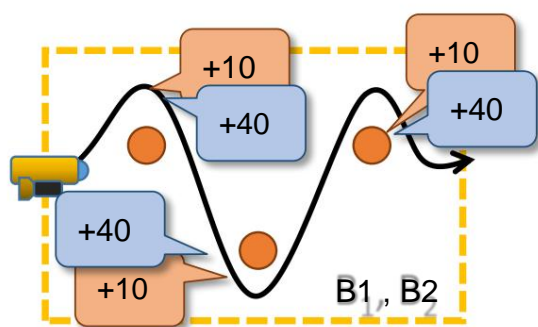
the second buoy fails, the underwater robot will perform a slalom operation.

If the referee judges that the buoy was on the ground, the points for the first and third buoys will be added.

*If only one of the three buoys is successful, one additional point will be given regardless of the order of
passage. *Even

if the first buoy fails, if the second and third buoys succeed, two

There is an additional point for each minute.



• Slalom navigation (water / underwater)

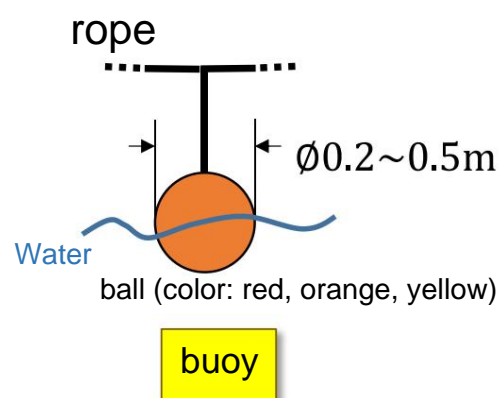


Figure 4: Installations in the slalom area

Figure 3: Slalom area

Ÿ Cx : Represents the gate area. Make the underwater robot dive at the boundary between the yellow dotted line and the light blue dotted line in Fig. 2 and pass through the gate as shown in Fig. 5. through the gate

After that, keep the underwater robot underwater at all times. Scoring: A maximum of 30 points are awarded for successfully diving through the gate. However, 30 points for autonomous operation and 10 points for manual operation.

increase. The gate will be installed as shown in Figure 6. Underwater robot completely underwater

It is judged that the dive is completed when it dives.

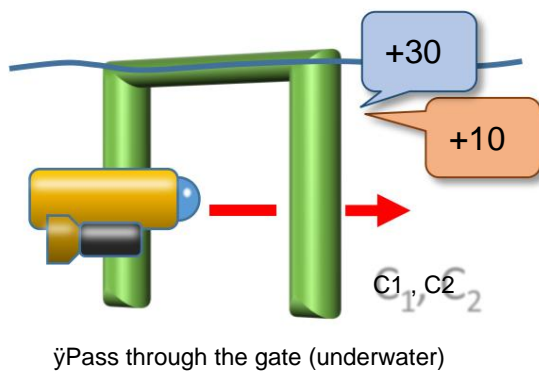


Figure 5: Gate area

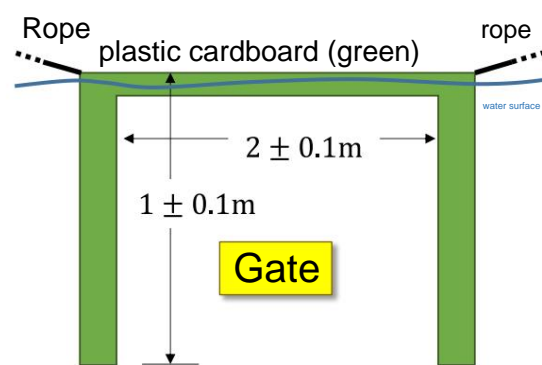


Figure 6: Installations in the gate area

Ÿ Dx : Represents the panel search area. Go straight ahead facing the gate and you will see a yellow

Guidance by the guide plate is installed. The orientation of this guide plate is a hint for the Ex panel position shown later . Underwater robots in this area

It must be kept submerged at all times.

Score: No score is set in the panel search area. The guide plate

The installation will be as shown in Figure 7.

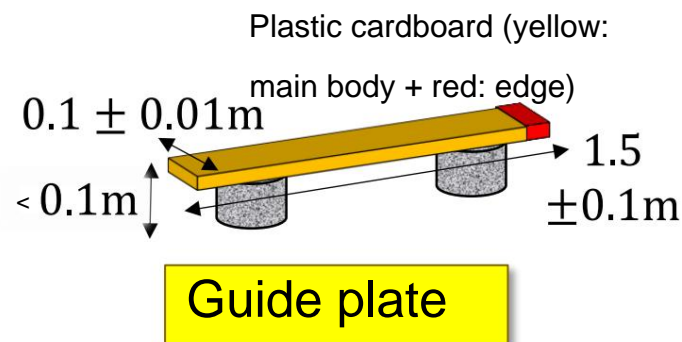


Figure 7: Installations in the panel search area

\ddot{y} Ex : Indicates the underwater measurement area. Longitudinal extension of the guide plate as shown in FIG.

Panels are installed along the line. This panel must be measured underwater by an underwater robot. Obtain video data that allows you to understand what is written on the panel. Underwater robots must always be submerged in this area.

I don't. A QR code is drawn on the front of the panel. Score: A maximum of 80 points will be added if the video data of the panel is successfully acquired. However, 80 points for autonomous operation and 10 points for manual operation. The panel will be installed as shown in Figure 9. *For video data, it is necessary to have the referee check the video or still image after the competition. Within 5 minutes after the end of the competition

Please complete the verification within.

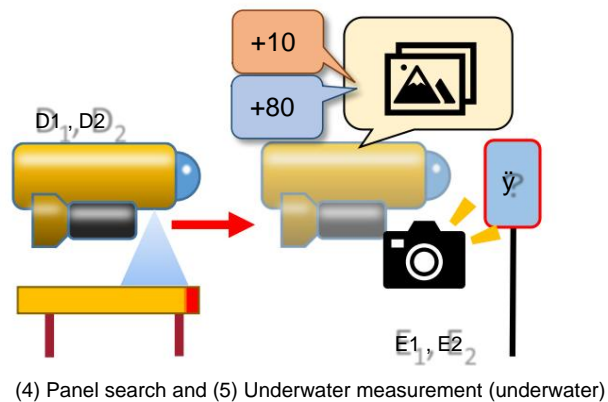


Figure 8: Panel search area and underwater measurement area

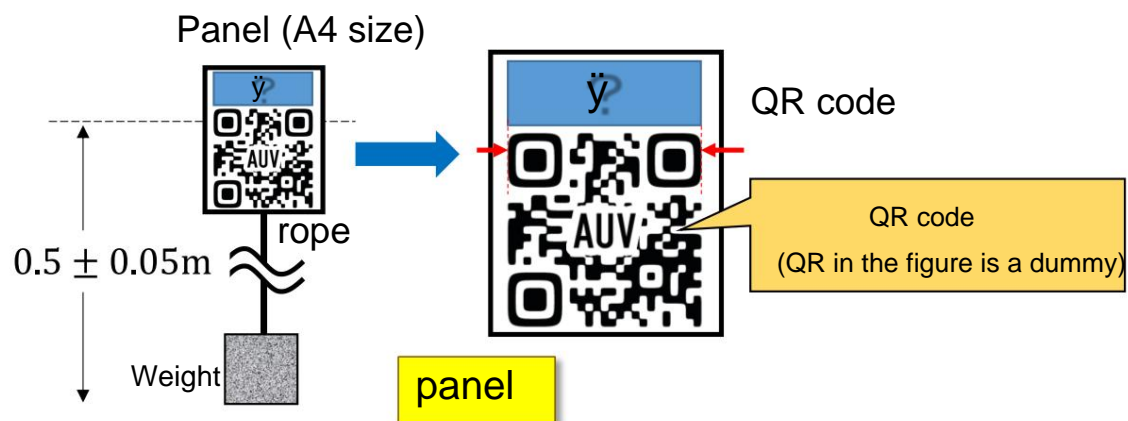
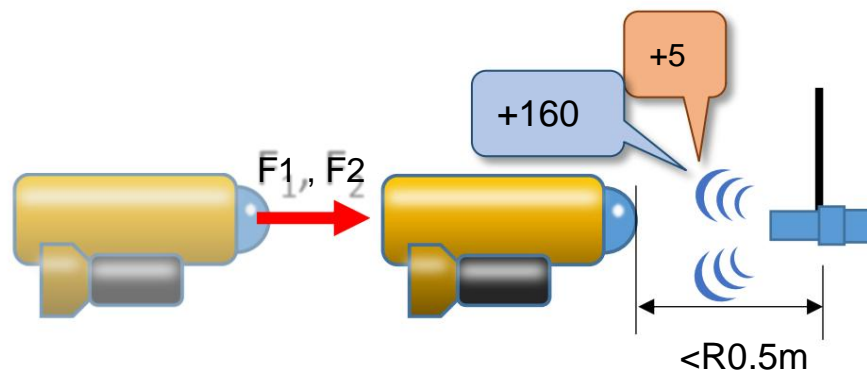


Figure 9: Installations in the underwater measurement area

Ƴ Fx : Represents the acoustic lighthouse search area. The location of the acoustic lighthouse is not specified. Underwater robots need to rely on the sound emitted by the acoustic lighthouse to explore. Underwater robots must remain submerged in this area at all times.

Score: Score points by approaching within a 0.5m radius of the acoustic lighthouse. A maximum of 160 points can be obtained. However, points will only be added if you successfully pass through the gate. 5 points are awarded for failing to pass the gate or for manual action. The transmission frequencies of the acoustic lighthouse (pinger) will be 21.164kHz and 27.211kHz.

*When changing the frequency, it will be in the range of 10kHz to 30kHz.



Ƴ Exploring the acoustic lighthouse (underwater)

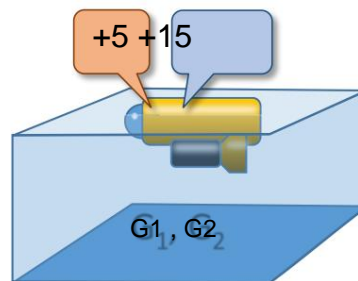
Figure 10: Acoustic lighthouse search area

Ƴ Gx : Represents the levitation area. Inside the green dotted line in Fig. 2, the underwater robot is raised to the surface.

please give me. The approximate range should be visible at the location of the pylons.

Scoring: A maximum of 15 points can be obtained for a successful ascent within the specified range. However, 15 points are added for autonomous operation and 5 points for manual operation. judgment of levitation

The constant is when a part of the underwater robot appears on the surface of the water. See Figure 11 when.



Ƴfloating (in water Ƴ above water)

Figure 11: Floating area

Table 1 shows a summary of the aquarium competition.

Table 1: List of aquatic competitions

Area	Area name	score	sailing conditions	Setup
Ax	start area	none	water surface	none
Bx	slalom area	40 points per autonomous buoy 10 points per manual buoy	Surface or underwater	buoy
Cx	gate area	Self-discipline 30 points Manual 10 points	Surface & Underwater	Gate
Dx	panel search area	None	in the water	Guide plate
Ex	underwater measurement area	Self-discipline 80 points Manual 10 points	in the water	panel
Fx	Acoustic Lighthouse Search Area	Self-discipline 160 points Manual 5 points	in the water	acoustic lighthouse
Gx	floating area	Self-discipline 15 points Manual 5 points	water & water surface	

3.6 Flow of water tank competition

During the competition, please act according to the following flow.

<1: Preparation> Each team will set up the underwater robot and operation equipment five minutes before the competition start time.

Place it in the assigned location for each team. <2: Commencement of competition> Complete the preparation of the underwater robot and operation equipment, and make it ready for the underwater robot to enter. <3: Landing on the water> Start area for underwater robots of each team after confirming safety

AX

Please be careful not to touch the robot when they are safely held by the underwater robot. Also, please request them to stop the underwater robot. After starting, the underwater robot will start the competition. <4: Water Tank Competition> From the start of the competition, the boat must be navigated manually. In the event of trouble, it is possible to pull it up even during the competition. After the gate area, you must return submerged. In principle, if the underwater robot surfaced due to emergency surfacing, etc., it will be restarted. The restart will be at the discretion of the referee or

performed at the request of <5: Pick-up> After confirming safety, the underwater robot will be picked up according to the pick-up method of each team. ancestor

Be sure to stop the underwater robot when <6: Completion of competition> We will promptly withdraw the underwater robot and operation equipment. <7: Video data confirmation> Please have the referee check the video data of the

panel taken in the underwater measurement area within minutes after the competition. <8: Team Interview> Each team may be interviewed during preparation for the competition, during the competition, or after the competition. At that time, please emphasize the technical highlights of the competition.

3.7 Point Allocation in Aquarium Competitions

Points will be allocated according to the ranking as follows. Reflect the allotted points after the ranking is confirmed in the overall score increase. Please note that the points earned during the competition are only used to determine victory or defeat, and do not directly affect the overall score. Also, depending on the number of participating teams, a qualifying league will be held. The implementation method of the qualifying league will be notified at the team leader meeting on the day before and on the day.

Table 2: Competition Ranking Scoring Table

Rank	Points
1st place	600 points
2nd place	500 points
3rd place	400 points
4th place	300 points
Others	100 points

Q&A

Q1) Is the use of tethers allowed? Or is it permissible to use a string without a communication function?

mosquito?

A) Yes. However, even if there is no communication function, it is judged as a wired connection machine. Also, autonomy
When sailing, please do not touch the operation terminal (cannot operate).

Q2) If the aircraft becomes uncontrollable, is it possible to have a diver pick it up (diver help) and restart? Are there any penalties?

A) Restart is possible. However, if the score is higher than the score obtained before the restart, _____
will be the final score. No points will be deducted, but the points will be reset from zero when restarting.
Become.

Q3) If it is possible to restart, at what point should we start over? Start
Is it acceptable to send commands to the aircraft in the rear in some way?

A) Please process for restart from the start area. if the start area
Wired or wireless operation is possible.

Q4) What kind of judgment will be made if the points for the aquatic competition are tied?

A) Please follow the judgment of the management side. Preferential treatment will be given depending on whether it is a wired connection machine or a wireless connection machine.

In addition, there is a possibility that the winner will be decided based on the score of the introductory video, rock-paper-scissors, etc.

Q5) Are lights installed in the pool?

A) We are not currently considering installing lights in the pool.

Since the pool has a high degree of transparency, we believe that it is possible to see the installed objects sufficiently with indoor lighting.

If necessary, install a light on the underwater robot side.

Q6) Please tell me the distance from the yellow line to the panel.

A) Since the panel search is one of the competitions, there are no plans to disclose the installation distance. Venue on the day
So, it is okay for each team to measure the distance in their own way, such as during practice.

Q7) If I go straight after going through the green gate, will I reach the tip of the yellow line?
reaches the halfway point of the yellow line?

A) If you pass through the center of the green gate and go straight, you will reach the center of the yellow line
Install. Accurate installation in the pool is difficult, so installation errors are likely to occur
I think.

