

Techno-Ocean 2016
Underwater Robotics Competition
AUV Class
Competition rule

Version 1.0 (July 1, 2016)
Version 1.1 (July 8, 2016)
Version 1.2 (Sep. 21, 2016)

Date: October 8 Sat., 2016
Venue: KOBE PORT ISLAND SPORTS CENTER

Techno-Ocean2016 Underwater Robot Competition Committee

Competition Rules

© Competition Scoring

- Scoring for Autonomous Underwater Vehicles under 50kg of weight is based on following three criteria

- (1) presentation
- (2) underwater mission
- (3) vehicle handling

- Total of 350 points are distributed: presentation (70), underwater competition (210), vehicle handling (70)

© Presentation

Presentation points are graded based on the quality of slides, understandability, technical content, Q&A session, and timing.

Make sure you appeal technical contents and originality of your robot with one page of A4 handout (single sided) along with your PC presentation. Total of 10 minutes of presentation sessions is held which consists of 5 minutes of verbal presentation and 5 minutes of Q&A. PC for this session will be provided, however, you can bring your own.

© Underwater Mission

One team at a time, a specific period of time will be given. We scheduled each team to finish all tasks by 20 minutes, however, this may change depending the total number of participants. The competition order will be decided and announced after registration. Please make sure your team is ready for the competition as scheduled.

Underwater Mission will be held in a pool width 15m x 25mx 1.1m in length, width and depth. The competition course is shown in Fig. 2.

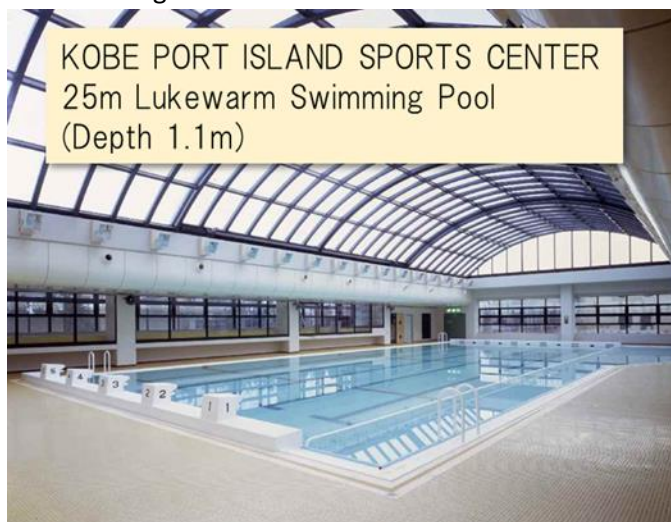


Fig. 1: Competition Venue

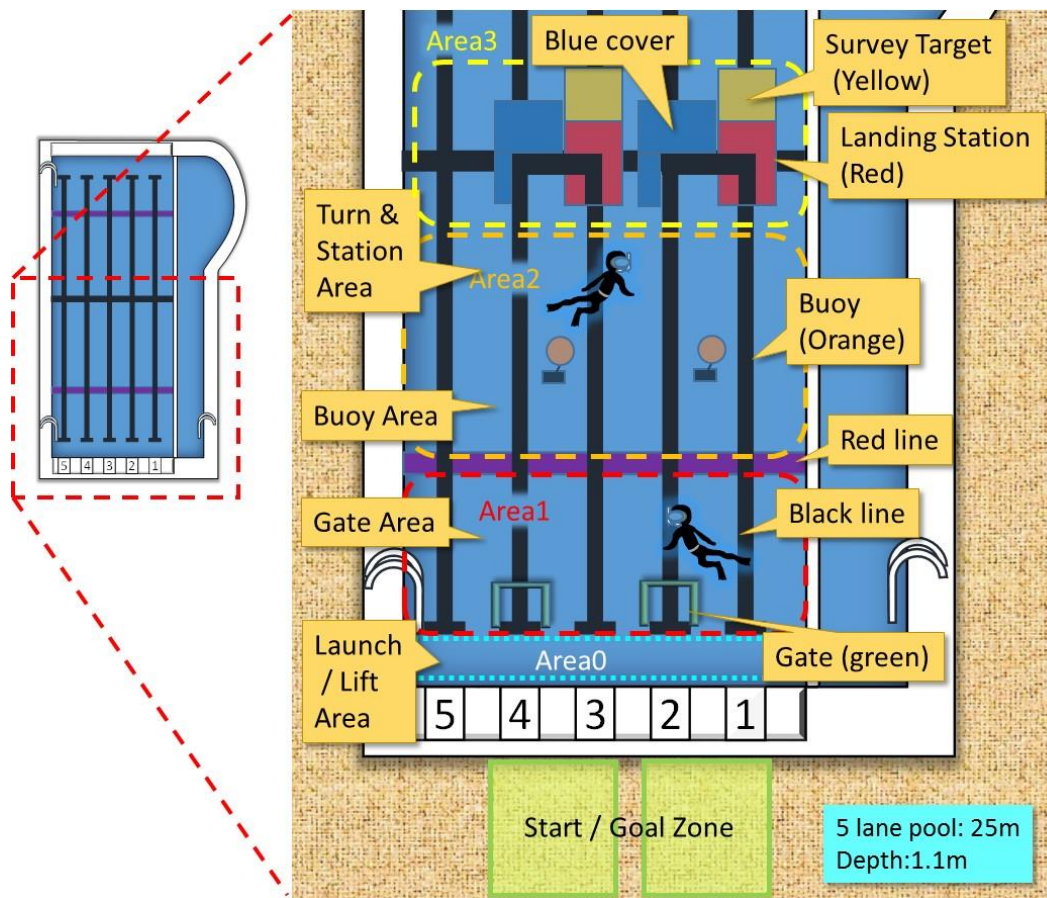


Fig. 2: Competition Course

Competition Overview

- <1: **Preparation**> You must bring your vehicle and equipment on time at Start/Goal Zone shown on Fig. 2.
- <2: **Start Up**> Set up your station and power up your vehicle (or exit standby mode) to start the correct program for mission.
- <3: **Launch**> Make sure your vehicle is safe to start the mission and deploy into the water.
- <4: **Mission Start**> You can start whenever you are ready. You can restart the mission at any point, however, you must return your vehicle back to Area0 for full score. Please refer to "machine handling" for further information.
- <5: **Surfacing**> When you are finished, return your vehicle back to Area0 to surface.
- <6: **Retrieval**> You can retrieve your vehicle at Start/Goal zone after a safety check.
- <7: **Data Confirmation**> Retrieve you data and hand in to the judges.
- <8: **Finish**> Power off your vehicle and withdraw from the area with your equipment.

The competition course consists of total of 6 missions: ①Line Tracking、②Buoy Touch、③Gate Pass、④Landing、⑤Survey、⑥Drop. Fig. 3 shows the dimensions of objects that are used for each mission. Following is the overview of each course. Be sure to check the specific arrangements of the pool on the competition day.

- ① Line Tracking (2 straight, 2 curves : 10 points x 5 = 50 points, 1.2 times for reverse order)
Track the black line, shown in Fig.2, placed on the underwater surface (1.1m in depth). Proceed homeward from the starting point, turn 180 degrees and return outward (Fig.4, left). There are normal and reverse route you can choose from. If your vehicle can successfully perform the reverse route, your team will earn 1.2 times more scores.
- ② Buoy Touch (1 orange buoy: Homeward 10 points + outward 10 points = 20 points, 5 additional points if shootable objects (or droppable objects) are used)
Touch the orange buoy which is placed 0.5m above the underwater surface (additional points for using your own shootable objects). One touch during each homeward and outward maneuver, 10 points per touch is given (Fig. 4, top right)

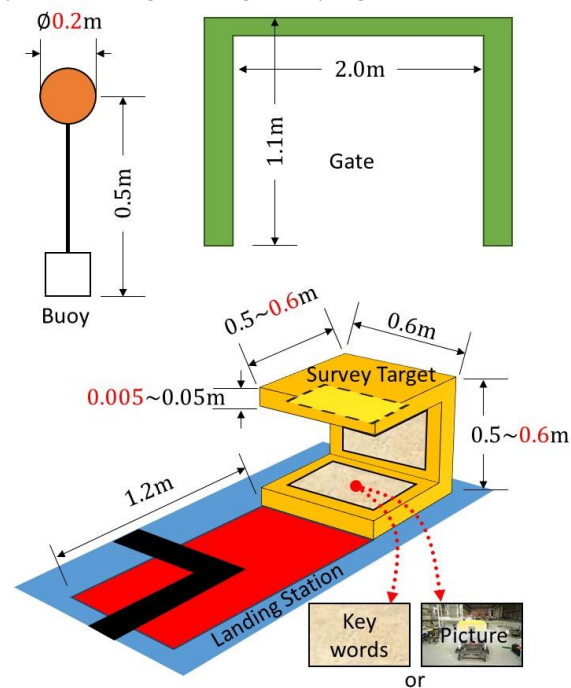


Fig. 3: Dimension of underwater objects

(top left: buoy, top right: gate, bottom: landing pad & survey objects)

- ③ Gate Pas (20 points)
The gate is placed at the end for the normal route and in the beginning for the reverse route. Points are given for passing inside the gate (Fig. 4, bottom right)
- ④ Landing (20 points)
A landing port with 1.2m x 0.6m in dimension is placed on the underwater surface. 20 points is given if the vehicle can land inside the red area.

- ⑤ Survey (bottom panel 10 + front panel 10 + ceiling panel 30 = 50 points)
An object (Fig. 3) is placed at the turning point as shown in Fig. 2. There are panels (on bottom, front and top) on three inner surfaces of the U-shaped object. Each panels have a drawing or a keyword written on it. Your vehicle should be able to record these using a camera. Judges will decide the scores when you hand in the data after retrieval of the vehicle at the end of the mission. (Fig. 5, middle)
- ⑥ Drop (inside 20 + top 20 = 40 points)
Drop your own droppable objects (or shootable objects) inside/on top of the survey object. (Fig. 5, right)

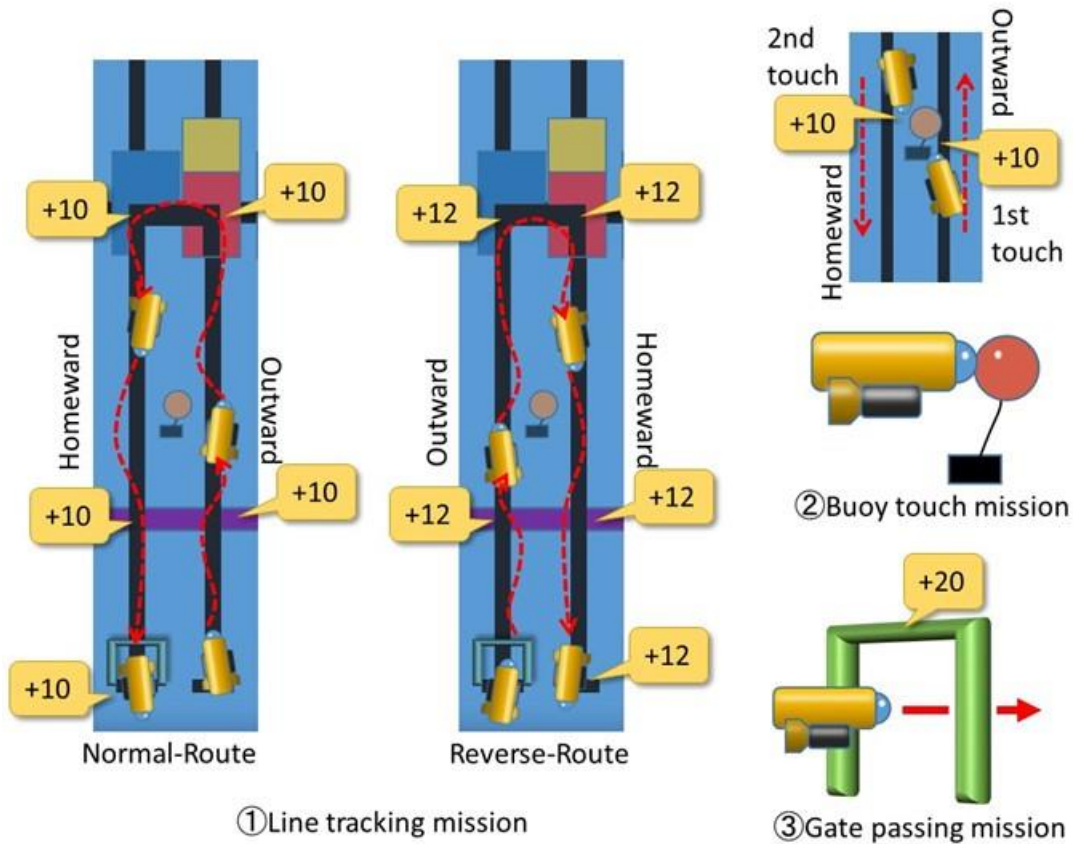


Fig 4: Mission details 1

(Left: : ①Line Tracking, Top Right : ②Buoy Touch, Bottom Right : Gate Pass)

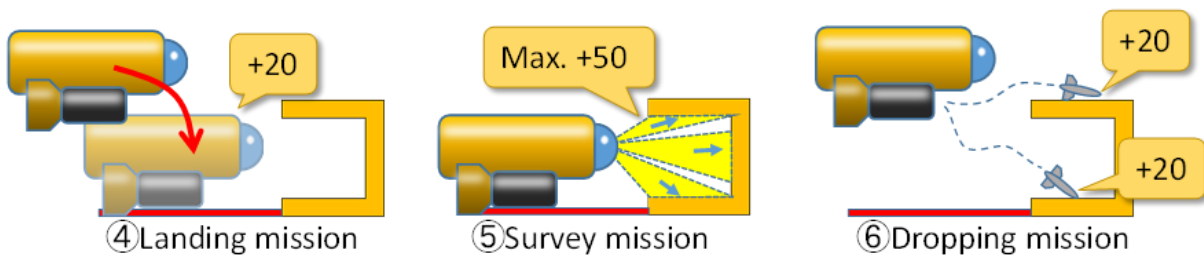


Fig. 5: Mission details 2 (④Landing、 Middle : ⑤Survey, Right : ⑥Drop)

©Vehicle Handling

Your vehicle handling technique is evaluated. Fig. 6 shows the additional points you can achieve. Judges will specifically look for launching and retrieving techniques (handling using lift: 20 points vs manual handling: 2 points), initial vehicle positioning (20 points for autonomous positioning vs 2 points for positioning by diver), and surfacing (10 points for surfacing at the end of entire mission). We highly recommend advanced techniques for launching and lifting for safety reasons. You will lose a large amount of score for damaging the pool or causing possible danger to others (Fig. 7). You will be asked to leave the pool for malicious behavior.

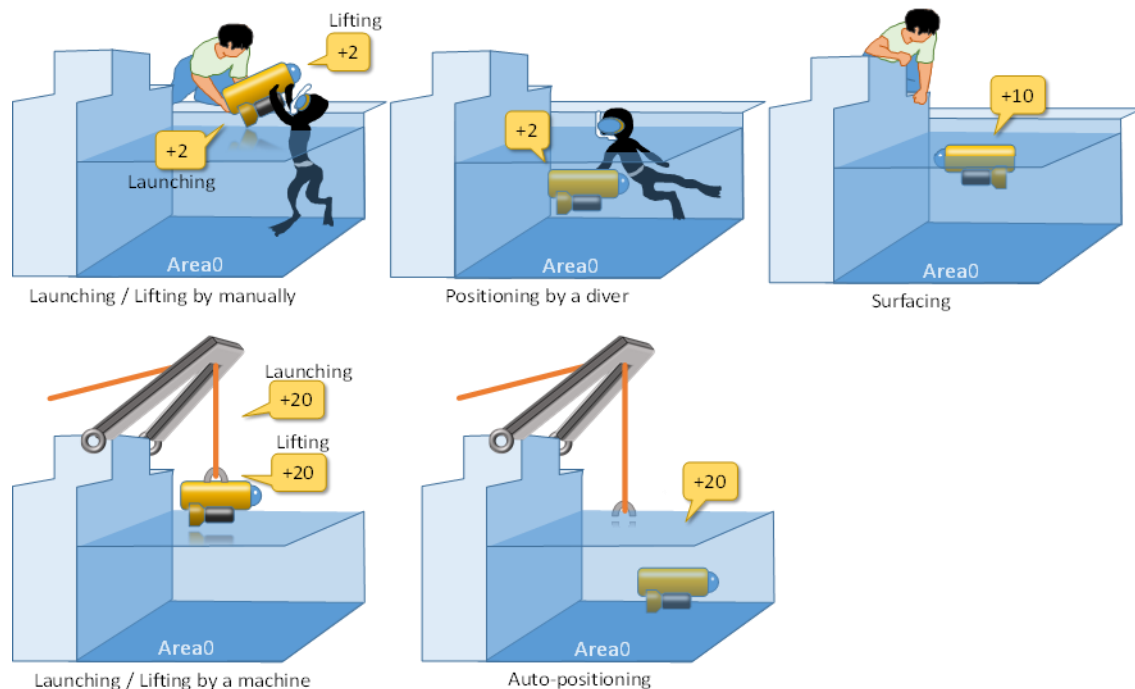


Fig. 6: Vehicle handling points

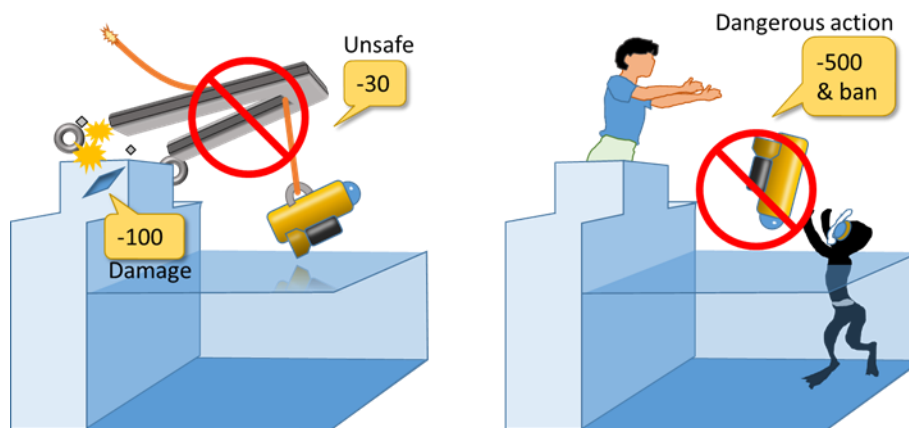


Fig 7: Score deduction for risky handling

[Q&A]

Q1) Will we have a chance to use the pool for practice before the competition? If we can, how long will we have?

A) Yes, you will be given about 2 to 3 hours of time on 7th from 14:30 for testing your vehicles.

Q2) Can we use a cable during the competition. How about a cable that does not function as communication tether line?

A) You can use a type of cable to hold your vehicle while launching or lifting your vehicle, however, the cable must be removed before moving your vehicle to the starting line.

Q3) To start up the vehicle, is a physical switch allowed? Can we also use a none-physical method such as image recognition? How about a remote start?

A) As long as the vehicle is started before moving onto starting line, any method is allowed.

Q4) When our vehicle gets out of control, can we ask divers to retrieve our vehicle and start over? Is there any penalty to do so?

A) You can start over anytime.

For AUVs, we would like to test your vehicles' autonomous function during each tasks. If you decide to start over, all points will be reset except for the points you get during launching/lifting and surveying. However, you will be scored with the highest score you achieved before or after starting over. This means that there is never going to be 0 score for any team.

For example:

Start → 5 points from launching, (challenge for 1st task) 10 points achieved → start over (challenge for 2nd task) 20 points achieved → start over again (challenge for 3rd task) 5 points achieved → 10 points from lifting

Final score:

5 points for launching + 20 for tasks + 10 for lifting = 35 points total (final score marked from second trial)

Q5) When we start over, where should be start again? How are scores marked for sending new signals to our vehicle while it is placed in Area 0. If the vehicle was able to execute autonomous positioning only during the first try, what happens to the score?

A) Any process that is required for start over will be allowed inside the lifting area.

As stated for Q4, all scores except for launching/lifting and surveying gets reset. This means that Even if your vehicle succeeded in autonomous positioning, the score will be reset as soon as you decide to start over. However, if you can get higher score after the start over, that will be marked for your final score.

Q6) What is the length of the black lines placed on the bottom surface of the pool?

A) The black lines are diverted from the original line of pool. In case of standard 25m pool, the lines are 20cm to 30cm width. Although we have not directly measure the thickness of original pool lines, they should be close.

Q7) About the score for vehicle handling, it states that launching/lifting by machine is +20. What are recognized as a 'handling by machine'? What about a man-powered pulleys. Should the vehicle be autonomously attach/detach itself to the lifter?

A) The machine does not have to be automatic or manual. Only if your vehicle is launched/lifted by someone's hand, it will NOT be considered as machine.

A machine must have some type of mechanism for launching/lifting your vehicle. If your vehicle is installed with an equipment that has nothing to do with launching/lifting, it will not count for the scoring.

+20 is the maximum score you can achieve. The judges will decide the score based on novelty and practicality. This score will always be higher than that of manual handling.

Q8) Do we still get surfacing points (10 points) even if we have not finish entire missions? What if our vehicle surfaces in the middle of the pool?

A) You will still get the score for surfacing in the middle of the pool. However, this score will also reset if you start over.

If you decide not to start over, it will be considered as finishing your turn. (even if none of the tasks have been completed)

Q9) Is the time needed to check the survey data included in the 20 minute mission time?

A) We scheduled that time to be included. However, you may be allowed to hand in the data later, depending on the remaining time during the competition.

Change History

2016 September 21, revised

- ① Correction made to mistakes on Fig. 2
- ② Correction made to the dimensions in Fig. 3
- ③ Correction made to the diagram of the line tracking in Fig. 4
- ④ Q&A has been added