The 3rd Marine Robotics Competition in Okinawa

1.　Schedule of Competition

11/11(Sat): Team Practice, Poster Session, Social Event
11/12(sun): Competition Rounds, Awards Ceremony

１．１　schedule in details
●1st day of the competition：11/11(Sat)
　Venue
　　・Registration, Opening Ceremony, Poster Session, Space for Robotics Maintenance: Ginowan Marine Support Center
　　・Team Practice: Ginowan New Fishing Harbor (see Figure 1-1-1.)
　　・Social Event: Ginowan Yui-Marche

Time Table

9:00	Registration
10:00	Opening Ceremony, Orientation Session
10:15	Poster Session
11:15	Briefing on ROV rounds
	Briefing on AUV rounds
	Briefing on the Performance of Free-Style Vehicles
12:00	Safety Inspection, Team Practice
17:00	finish Team Practice
17:30	begin Social Event
19:00	finish Social Event
20:30	Space for Robotics Maintenance will be closed.

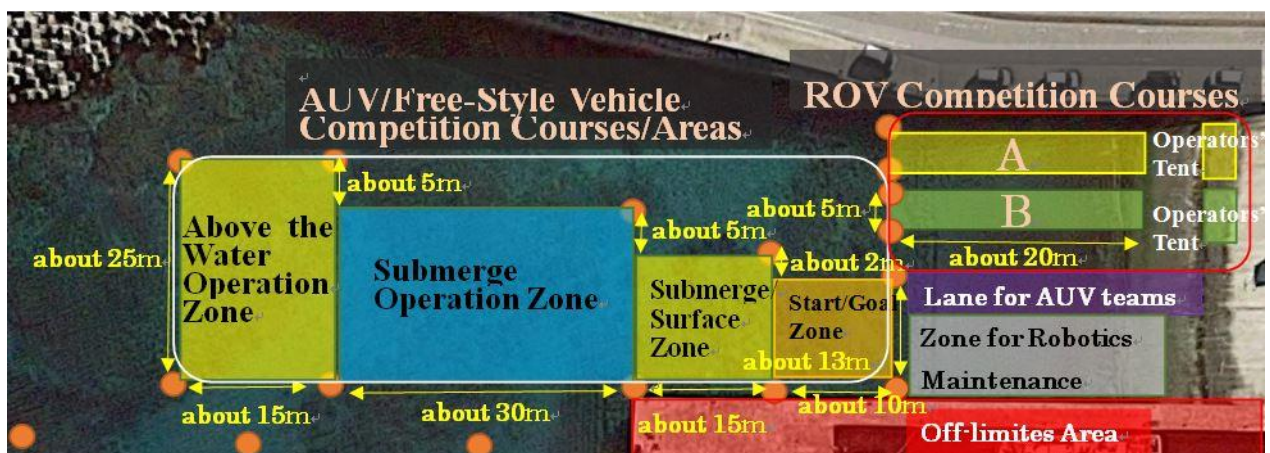
Figure 1-1-1　Competition Areas (Ginowan New Fishing Harbor)

● 2nd day of the competition：11/12(Sun)

Venue
・Competition Areas: Ginowan New Fishing Harbor
・Meet-up area, Awards Ceremony: Ginowan Marine Support Center

Time Table

9:00　Meeting Up

9:30　Draw for rounds/demonstrations

10:00　begin the 1st Qualifying Rounds of ROV

Roll Call for Teams (15 minutes before rounds), Team Swap: 5minutes,

Match Time: 5minutes, Withdrawal: 5minutes

（Two teams starts the round simultaneously.） *Number of teams：10 (subject to change)

〔ROV〕Competition Courses : Team Name		Roll Call	Preparation	Round	finish Withdrawal
A-course: Team A	B-course: Team B	9:45	9:55	10:00 - 10:05	10:10
〃　：Team C	〃　：Team D	10:00	10:10	10:15 - 10:20	10:25
〃　：Team E	〃　：Team F	10:15	10:25	10:30 - 10:35	10:40
〃　：Team G	〃　：Team H	10:30	10:40	10:45 - 10:50	10:55
〃　：Team I	〃　：Team J	10:45	10:55	11:00 - 11:05	11:10

begin the 1st Qualifying Rounds of AUV

Roll Call for Teams: 15 minutes before rounds, Team Swap: 5minutes,

Match Time: 5minutes, Withdrawal: 5minutes

*Number of teams：5 (subject to change)

〔AUV〕Team Name	Roll Call	Preparation	Round	finish Withdrawal
Team A	9:50	10:00	10:05 -10:15	10:20
Team B	10:05	10:15	10:20 -10:30	10:35
Team C	10:20	10:30	10:35 -10:45	10:50
Team D	10:35	10:45	10:50 -11:00	11:05
Team E	10:50	11:00	11:05 -11:15	11:20

11: 20　begin the 1st demonstration of Free-Style Vehicles

*Number of teams: 2 (subject to change)

〔FREE〕Team Name	Roll Call	Preparation	Demonstration	finish Withdrawal
Team A	11:10	11:15	11:20-11:25	11:30
Team B	11:15	11:25	11:30-11:35	11:40

11:35　finish the 1st demonstration of Free-Style Vehicles

11:40　Lunch Break

12:30   begin the 2nd Qualifying Rounds of ROV

Roll Call for Teams: 15 minutes before rounds, Team Swap: 5minutes,

Match Time: 5minutes, Withdrawal: 5minutes

（Two teams starts the round simultaneously.）*Number of teams：10 (subject to change)

〔ROV〕Competition Courses : Team Name		Roll Call	Preparation	Round	finish Withdrawal
A-course: Team B	B-course: Team A	12:15	12:25	12:30 -12:35	12:40
〃 : Team D	〃 : Team C	12:30	12:40	12:45 -12:50	12:55
〃 : Team F	〃 : Team E	12:45	12:55	13:00 -13:05	13:10
〃 : Team H	〃 : Team G	13:00	13:10	13:15 -13:20	13:25
〃 : Team J	〃 : Team I	13:15	13:25	13:30 -13:35	13:40

12:35   begin the 2nd Qualifying Rounds of AUV

Roll Call for Teams: 15 minutes before rounds, Team Swap: 5minutes,

Match Time: 5minutes, Withdrawal: 5minutes

*Number of teams: 5 (subject to change)

〔AUV〕Team Name	Roll Call	Preparation	Round	finish Withdrawal
Team A	12:20	12:30	12:35 -12:45	12:50
Team B	12:35	12:45	12:50 -13:00	13:05
Team C	12:50	13:00	13:05 -13:15	13:20
Team D	13:05	13:15	13:20 -13:30	13:35
Team E	13:20	13:30	13:35 -13:45	13:50

13:40   finish the Qualifying Rounds of AUV

13:45   begin the 2nd demonstration of Free-Style Vehicles

*Number of teams: 2 (subject to change)

〔FREE〕Team Name	Roll Call	Preparation	Demonstration	finish Withdrawal
チーム A	13:30	13:40	13:45 -13:50	13:55
チーム B	13:40	13:50	13:55 - 14:00	14:05

14:00   finish the demonstrations of Free-Style Vehicles

14:00   begin the1st Final Rounds of ROV

Roll Call for Teams: 15 minutes before rounds, Team Swap: 5minutes,

Match Time: 5minutes, Withdrawal: 5minutes

（Two teams starts the round simultaneously.）

〔ROV〕Competition Courses : Team Name		Roll Call	Preparation	Round	finish Withdrawal
A-course: 1st team of QR	B-course: 2nd team of QR	13:45	13:55	14:00	14:10

14:05　　begin the Final Rounds of AUV

Roll Call for Teams: 15 minutes before rounds, Team Swap: 5minutes

Match Time: 5minutes, Withdrawal: 5minutes

〔AUV〕 Team Name	Roll Call	Preparation	Round	finish Withdrawal
2nd team of Qualifying Rounds	13:50	14:00	14:05-14:15	14:20
1st team of Qualifying Rounds	14:05	14:15	14:20-14:30	14:35

14:30　　begin the 2nd Final Rounds of ROV

Roll Call for Teams: 15 minutes before rounds, Team Swap: 5minutes

Match Time: 5minutes, Withdrawal: 5minutes

（Two teams starts the rounds simultaneously.）

〔ROV〕 Competition Courses : Team Name		Roll Call	Preparation	Round	finish Withdrawal
A-course: 2nd team of QR	B-course: 1st team of QR	14:20	14:25	14:30-14:35	14:40

15:00　　begin Awards Ceremony

15:30　　finish Awards Ceremony

2．Scoring

1) Every team will be ranked according to the total scores among other teams participated in the same types of competition [AUV/ROV/ Free-Style Vehicle], and teams placed higher in rankings will be given highest award and outstanding performance award respectively.

2) Both of AUV and ROV's scoring consist of two criteria: scores of Poster Session and competition scores, which go up to 100 points in total. The allocation of marks mentioned above is shown in Table 2-1.

Table 2-1. Allocation of Marks [AUV/ROV]

Scoring Element Types of Competition	Poster Session Scores	Competition Scores*	Max Possible
AUV/ROV	30	70	100

*Competition Scores will be given to teams based on the team's place in the rankings which is decided by the task-complete points. (see Table 4-2-2. Scoring Summary)

3) Scoring of Free-Style Vehicle consists of two criteria: scores of Poster Session and performance scores, which go up to 100 points in total. The allocation of marks mentioned above is shown in Table 2-2.

Table 2-2. Allocation of Marks [Free-Style Vehicle]

Scoring Element Types of Competition	Poster Session Scores	Performance Scores	Max Possible
Free-Style Vehicle	50	50	100

2.1 Scores of Poster Session [AUV/ROV/Free-Style Vehicle]

Scores of Poster Session (teams are encouraged to display their marine robotics at their booth along with their posters.) will be graded based on the quality of posters, manner, understandability, Q&A session, and technical contents of robotics etc.

2.2 Competition Scores [AUV/ROV] and Performance Scores [Free-Style Vehicle]

1) [AUV/ROV]

Teams which participate in AUV/ROV will be ranked according to the average scores of 2 Qualifying Rounds, and top 2 teams will move into Final Round.
If all teams get 0 points in the Qualifying Rounds, final round will be canceled. And in this case, none of the teams will be given highest award and outstanding performance award.

To qualify to move into final, AUV teams must complete the task no.2 or no.4 in Figure 4-2-1. (Robotics must submerge into the ocean in required points in their competition courses. This requirement is to make team's robotics closer to AUVs in a real-world.)

In the Final Round, teams will be ranked according to the scores of the Final Round only. Result of Qualifying Rounds will not be taken into consideration as a general rule.

Listed below is a scoring summery of Competition, which is based on teams' ranking. If teams break a rule, Judges will decide how to deal with the team concerned including disqualification of the team. (see Table 2-2.)

Table 2-2. Scoring Summery of Competition [AUV/ROV]

Rankings of Teams	Competition Scores
1st	70 points
2nd	50 points
3rd	40 points
4th	35 points
5th and under	30 points
Not to fulfill tasks at all.	0 points

*Way to rank tied score rounds

 [AUV]
Qualifying Rounds
If top 2 teams cannot be determined based on teams' average scores of 2 Qualifying Rounds, teams' record time of completing the tasks of no.2 or no.4 in Table 4-2-1 will be used to decide the finalists. The teams with faster record time will be placed higher in the rankings of Qualifying Rounds (see scoring summary of AUV in 4.2.1. AUV Competition)

Final round
If round ends with the score tied, the team which is placed higher in the rankings of Qualifying Rounds will be a winner.

[ROV]
Qualifying Rounds
1. If top 2 teams cannot be determined based on teams' average scores of 2 Qualifying Rounds, the team which have higher scores on the 1st Qualifying Round will be placed higher in the rankings of Qualifying Rounds.

2. If top 2 teams still cannot be determined in a way above in [ROV] Qualifying Rounds 1., either of the Qualifying Rounds (1st round or 2nd round) which teams earned more points will be used to rank two teams.

Teams which read the 1st QR code before the opponent will be placed higher in the rankings of Qualifying Rounds. If both teams have the same record time of reading the 1st QR cord, then the 2nd QR code, the 3rd QR code, and the 4th QR code counterpart will be used to rank two teams in the same way. (Competition Officials will use the time recorded on the app in the tablet PC as teams' record times.)

*If both teams get full score in both 2 Qualifying Rounds, Competition Officials will use the sum of the record time of reading the 1st QR code in 2 Qualifying Rounds, then the 2nd QR code, the 3rd QR code, and the 4th QR code counterpart in the same way.

Final Round
1. If round ends with the score tied, the same way as in Qualifying Rounds will be applied to rank finalists. In that case, the record time in the Final Rounds will be used.
2. If both 2 teams earn no points in the Final Round, the team placed higher in the rankings of Qualifying Rounds will be a winner of the Final Round.

2) [Free-Style Vehicle]
   The 2nd demonstrations in the afternoon on the day of competition will be scored.
   Scoring of Free-Style Vehicle consists of two criteria as follows:

   ・**Technical Capability**: 20 points (Whether teams could realize the concept of robotics which they had presented in Poster Session.)

   ・**Realization Capability**: 30 points (Whether robotics could give/achieve the performance which respective teams had presented in poster session.)

3. Poster Session [AUV/ROV/Free-Style Vehicle]

・Each team is required to conduct a Poster Session. During the period of the Poster Session, Judges will visit booths. Teams are encouraged to display their marine robotics at their booth along with their posters.

・Scores of Poster Session will be graded based on the quality of posters, manner, understandability, Q&A session, and technical contents etc.

1) Make sure to appeal technical contents and originality of team's robotics with one page of A4 handout (single-sided).

2) Teams can use an outlet (power point) at their booths so that they can use a laptop for the Poster Session if necessary.

4. Competition and Performance in details

4.1 Robotics Requirement

[AUV/ROV/Free-Style Vehicle]
1) All robotics except for commercially available finished products are allowed.

2) **Control System Requirements:**
[AUV] Robotics must be switched to autonomous control mode during rounds. However, it is allowed to use remote control mode in order to transfer robotics to its start point before the rounds.
[ROV] Robotics must be operated with remote control.

3) **Radio:**
If teams use commercial radio control transmitter, teams should use the only radio frequency allotted to land type RC (radio-controlled boats, radio-controlled cars etc.) Using the radio frequency for radio-controlled airplane is not allowed.
A list of available wavelength and frequency will be posted on this website later.

4) **Weight:** Robotics must be less than 45kg.

5) **Size:** Robotics' maximum limit of size is shown in Figure 2-1-1.

6) **Battery:**
All Teams which use secondary batteries must take safety measures in case of a short circuit (setting fuses or circuit breakers etc).Teams which use lithium-ion batteries should pay enough attention when retrieving team's disabled marine robotics and opening its pressure resistant vessel. Should robotics have an unusual odor, please stop opening the pressure vessel and ask Competition Officials for instruction.

7) **Charge of Batteries:**
Teams must not charge secondary batteries in tightly sealed condition. Teams must pay special attention to lithium batteries because of its high risk nature.

8) **Prevention of Marine Pollution**
Competition Officials may not allow robotics' launching which may cause marine pollution such as oil leak. Robotics which uses normal O-rings is allowed be launched, however, please consult with Executive Committee in advance if you feel anxiety.

Teams which use silicone liquids and the like for their robotics are required to get rid of them as much as possible before launching the robotics.

9) **Launching and Lifting**
Robotics must be launched into and lifted from the ocean by divers without using a crane. Competition Officials may not allow launching of robotics for safety considerations. If you feel anxiety, please consult with Executive Committee beforehand.

10) **Electric Leakage Prevention:**
Robotics must have been taken electric leakage measures.
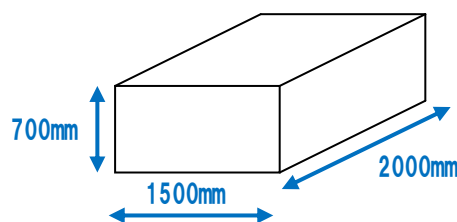

Figure 2-1-1. Robotics' Maximum Limit of Size

[AUV]

1) **Equipment of a Safety Cord**

It is mandatory for all robotics runs in AUV competition to have a Safety Cord, for fishing boats will come and go through near the competition area on the day of rounds. In order to prevent accidents, robotics must have Safety Cords so that Competition Officials can observe their location by simply watching the ocean surface and that divers can capture robotics safely by grasping the cords when robotics go off the course. Image of safety cords are shown in Figure 2-1-2.

*Safety Cords must been made up from two parts: cord and a buoy. The buoy must be more than 40mm in diameter. And the cord must be strong enough for a diver's tug, and must be the length which keeps at least 500mm intervals between robotics and a buoy.

2) **Equipment of GPS, Wi-Fi**

The teams which equip GPS device or Wi-Fi with robotics must equip them where they submerge in water with the main part of robotics during operations. It is not allowed to equip GPS device or Wi-Fi with a buoy, which always floats on water.

3) **Taping Up as a Reference Position of Robotics**

When teams complete the Safety Inspection, Competition Officials will hand the teams yellow tape. It is required for teams to put the yellow tape on the part of robotics where they wish to be regarded as a respective reference position by Judges.
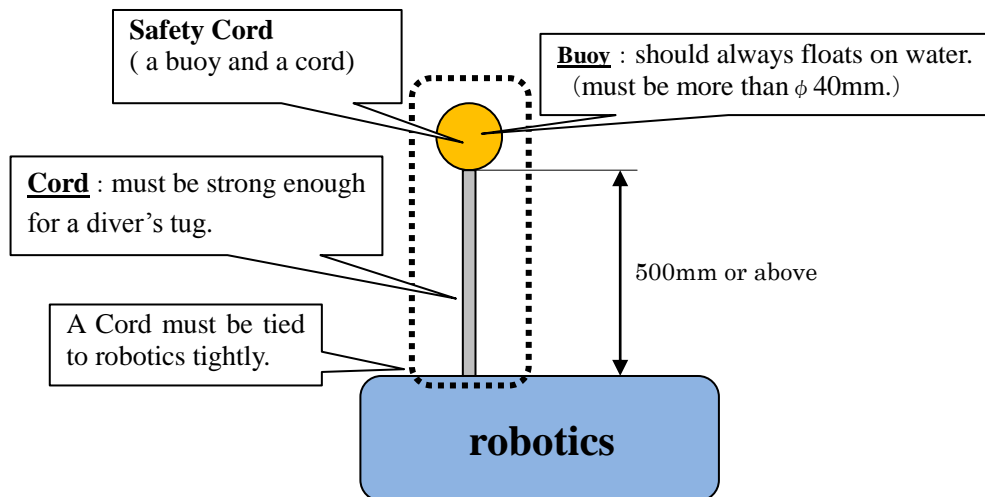

Figure 2-1-2. Safety Cord

[ROV]

1) **Output of Images**

Teams are required to display images on WIDE 21.5 inch LCD (1920×1080 resolution) which will be set up in each operators' tent via HDML terminal or VGA terminal during the operation.

2) **Electrical Power Supply**

Competition Officials will provide teams with 100-volt AC power source by power generator if necessary. The teams which hope to use the AC power source (teams which plan to supply robotics power through underwater cables etc) need to apply maximum power consumption on the application for this competition.

3) **Underwater Cables**

Teams must decide the length of underwater cables suitable for the tasks of competition. (30m or more are recommended.)

4.2   Rules of AUV/ROV Competitions, Free-Style Vehicle Performances

[AUV/ROV/Free-Style Vehicle]
1) Each team must be in a state for start before the scheduled start time of each round.

2) It is not allowed to change teams' turns right before the rounds/demonstrations due to the robotics problem etc.

3) Match time/ allotted time for demonstration are 5 minutes.

4) Teams can restart the run/performance by the aid of divers if robotics becomes unable to continue its run/performance due to the robotics failure. However, teams must restart robotics from the start point in that case. Robotics which failed to pass the Safety Inspection based on [4.1 Robotics Requirement] will not be allowed to operate in competition courses.

[Precautions]
5) All robotics are required to undergo Safety Inspection on the 1st day of the competition, prior to the Team Practice.

6) The maximum depth of competition courses are about 3.5m.

7) If robotics moves buoys as boundary markers, Rule Personnel may forcibly brought back the robotics to its start point with the aid of divers and instruct the team to restart. Swinging buoys will be permitted. However, moving buoy weight will not be permitted.

8) Conditions of the competition courses will constantly change under the influence of natural environment such as waves and winds.

9) Figure 4-2-1 and Table 4-2-2 are the just the image. It is team's responsibility to grasp the accurate course layout on the day of the competition.

10) Breaking a rule may result in the team's disqualification. Rule Personnel will decide how to deal with the offending teams in such cases.

11) Teams are required to take measures to protect their PC against water preparing for rainy weather.

4.2.1   AUV Competitions

1) AUV Competition Overview
Robotics must start near the center of Start/Goal Zone, submerge in the ocean while robotics runs in the middle of the Submerge/Surface Zone, then continue to run in submerging state until arriving the Above the Water Zone. After crossing into the Above the Water Zone, robotics is required to surface and to keep running above the water. Then robotics must submerge again when entering the Submerge Zone and keep running underwater until it enters Submerge/Surface Zone. After that, robotics must surface and return to the Start/Goal Zone with running above the water.

Teams compete with others for scores by completing each task below.

(2) Criteria for AUV Competition Scores

1) The contents of tasks which teams can earn points by completing them are shown in Figure4-2-1.
*1 "Submerge Operation" in task no.2 is defined as robotics' moving from above the water to underwater. It is also required that the most upper parts of robotics do not come out from the water surface in this definition.

*2 "Surfacing" in task no.3 is defined as robotics' moving from underwater to above the water. The most upper parts of robotics need to come up to the water surface in this definition.

2) When Judge makes decisions on whether robotics crossed the finish line and the like, the yellow tape which is on robotics will be used as a reference position.
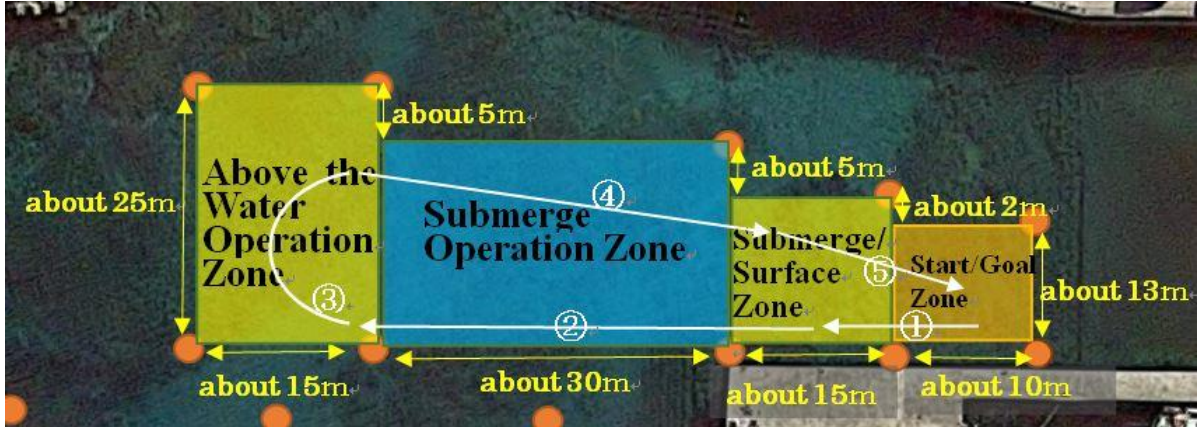

Figure 4-2-1.   AUV Competition Course

Table 4-2-2. Scoring Summary of AUV

Task no.	Elements of Tasks	Scores
1	Operating above water from Start/Goal Zone to Submerge/Surface Zone in ①	15 points
2	Submerge Operation in ②. (The time robotics submerge will be timed)	25 points
3	Surfacing within the Above the Water Operation Zone in ③	20 points
4	Submerge Operation in ④. (The time robotics submerge will be timed)	25 points
5	Operating above water from Submerge/Surface Zone to Start/Goal Zone in ⑤	15 points

(3) Requirement in playing in AUV rounds

1) It is the necessary condition to complete tasks that robotics have kept autonomously controlled since its start.

2) Each team is allowed to use whichever mode, autonomous control mode or remote control mode to transfer team's robotics to its start point.

3) Start point of robotics will be near the center of Start/Goal Zone. It is required to submerge when robotics cross into the Submerge Operation Zone.

4) Teams must have buoys of the safety cords floated on the ocean surface throughout rounds.
   *This condition is also required while robotics operates in Submerge Operation Zone.

5) Robotics must operate above the ocean surface when it is in Start/Goal Zone, Submerge/Surface Zone, and Above the Water Zone. (Robotics must operate in underwater in other Zones.)

6) It is required that robotics operate in underwater when it enters Submerge Operation Zone from Above the Water Operation Zone.

7) Surfacing within the Submerge Operation Zone is allowed only once. However, robotics must not continue the state (operating above the water) in that case. More than 2 times surfacing within the Submerge Operation Zone or operating above the water after the first time of surfacing within Submerge Operation Zone will not earn points of the task.

8) When robotics goes off its course, the robotics may be forcibly placed beck into its start point by divers in Rule Personnel's judgment. However, the previous scores of the teams concerned will be hold.

9) Judges will time each team in task no.2 and task no.4 in Table 4-2-1. (Those times will be used to rank teams when they are tied with competition score. For the way of handling with tie game, please see **2.2**. 1).

4.2.2   **ROV Competition**

(1) ROV Competition Overview
   There will be 4 targets (Figure 4-2-5) located in competition courses. Teams competes the number of the QR codes which robotics read.

1) Each team will play games both in A-course and B-course once (2 rounds in total) in both Qualifying Rounds and Final Rounds.

2) All teams will go Qualifying Rounds, and top 2 teams will move into final.

3) Each team will be divided into A-course and B-course one at a time, and two teams will start the mission simultaneously. (If number of teams is odd-number, the last team will carry out the mission with no opponent.)

4) Start Point will be designated near the edge of water. Each team must operate robotics above the water to transfer it to the Start Point.

5) Each course is about 5m×20m (see Figure 4-2-2). 4 targets shown in Figure 4-2-5 will be located within A- course and B-course respectively, and points will be awarded for reading QR-codes on the targets.

6) QR codes on each target will be prepared as many as the number of rounds on each target in the competition courses. Teams are required to read the QR code indicated. The image of a target is shown in Figure 4-2-5.

7) Teams must write down the information which teams read from QR codes on the report sheets. The report sheet must be submitted to Judges in headquarters tent.

8) In both Qualifying Rounds and Final Rounds, Competition Officials will specify targets (Ex. Target①, Target ②, Target ③, Target④) and QR code numbers (Ex. QR1, QR2, QR3, QR4) for each team when rounds begin. The course layout and images of a target are shown in Figure 4-2-4, 4-2-5a, 4-2-5b.
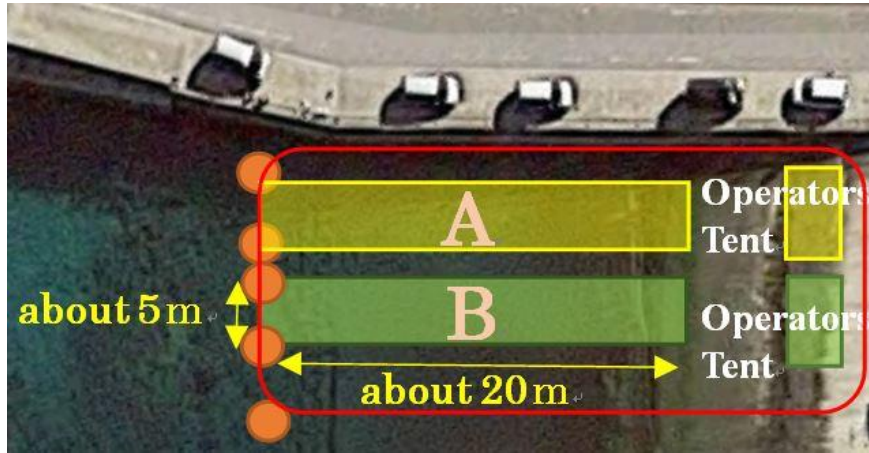   *sample instruction: QR1 on target①.

Figure 4-2-2. ROV Competition Course

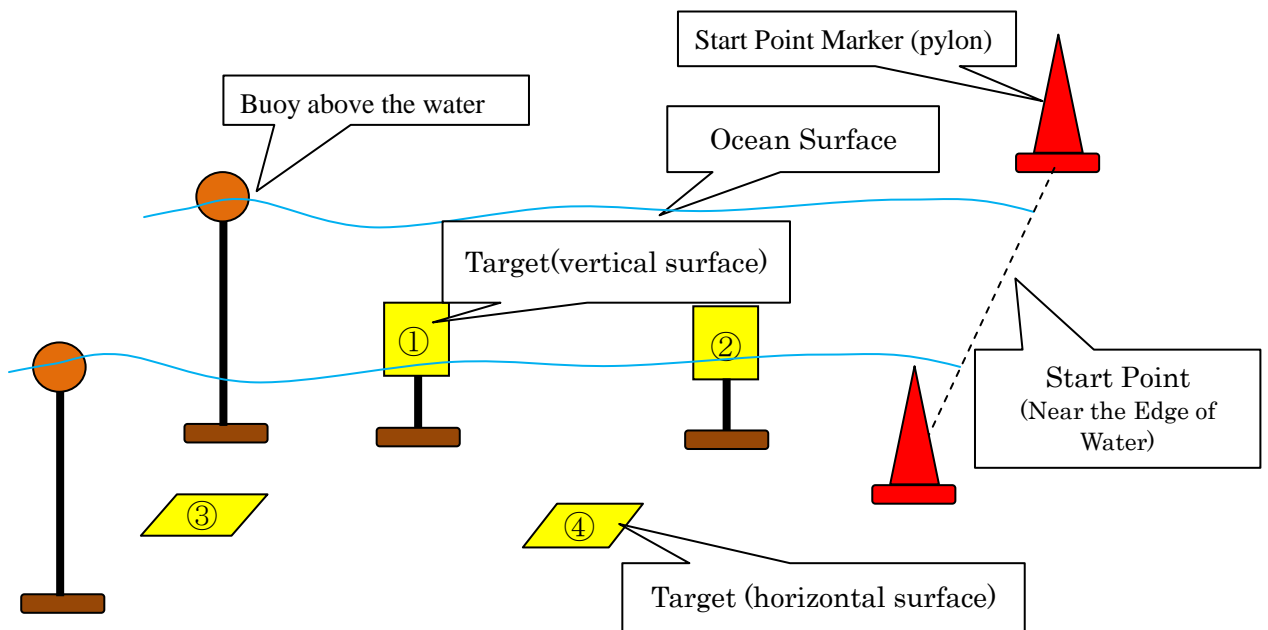Figure 4-2-3. Image of Operators' Tent

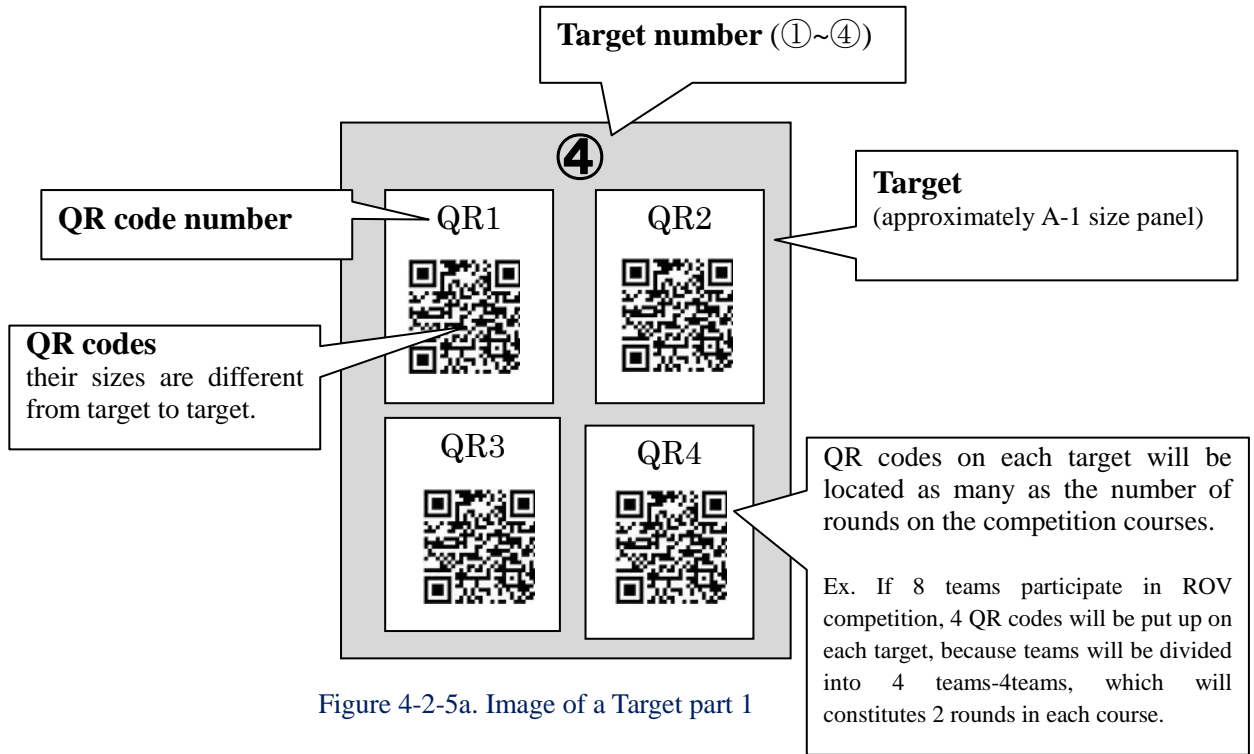
Figure 4-2-4. ROV Competition Course Layout

Figure 4-2-5a. Image of a Target part 1

Figure 4-2-5b Image of a Target part 2

Figure 4-2-6. Image of the Way to Read QR codes

(2) Criteria for ROV Competition Scores

Teams can earn points by reading QR codes. The scoring of tasks is listed in table 4-2-3.

Table 4-2-3. Scoring Summery of ROV

Target no.	Scores
①	25 points
②	25 points
③	25 points
④	25 points

(3) Requirements in playing in ROV rounds

    1) Staffs will transfer team's robotics from top of the slope to the edge of water. After that, teams must operate robotics to transfer it to its Start Point. Start Point is an extension of pylon as a start point marker.

    2) Teams must complete tasks in serial order of the target number (①→②→③→④).

    3) If robotics moves in on other team's courses and interfere with other teams, the errant robotics will be forcibly placed beck into its Start Point by divers in Rule Personnel's judgment.

    4) Up to 3 members from each team are allowed to enter the Operators' Tent. Changing the members in Operator's Tent is not allowed during a round.

    5) Each team can designate one member as a Cable Adjustor. Cable adjustors will not be allowed to enter Operators' Tent during a round.

    6) Members in Operators' Tent must operate robotics using only images transmitted from robotics in operation and must not operating robotics with the eye on competition course. (See Figure 4-2-3.) However, Cable Adjustors are allowed to give hints of robotics' location to their members in Operators' Tent.

    7) Teams must read QR codes on a screen (see 8) for details) by using the tablet PC with built-in camera which Competition Officials will provide for teams. The image of tablet PC above is shown in Figure 4-2-6. Teams must use the designated app, "QR code reader" (Seller: @Honestly App).

    8) Listed below are the screens which teams are allow to output images of QR codes to read.

    ・WIDE 21.5 inch LCD (1920×1080 resolution) placed in each Operators' Tent
    ・Teams' own display   (Bringing own display in Operators' Tent is allowed.)
    ・Screen on robotics controller

4.2.3   Free-Style Vehicle competition

1) Free-Style Vehicle Competition Overview

    ・There will be two opportunities for each team to perform a demonstration during this competition. Only the 2nd demonstration in the afternoon will be scored. Please take the 1st allotted time for a demonstration in the forenoon as an opportunity to practice.

    ・Teams must perform demonstrations in the AUV Competition Course. The demonstration must starts from the Start/Goal Zone of the course.

    ・It is required to perform demonstrations within allotted time, 5 minutes for each team.

    ・Teams are required to start demonstrations in Start/Goal Zone.

    ・Teams must explain on teams' robotics and on its performance to Judges during demonstrations. In addition, teams must explain to Judges the performance of robotics they plans during the Poster Session prior to their actual demonstrations.