



marine technology
SOCIETY

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Aligarh Muslim University
IEEE STUDENT BRANCH

MTS AUV-ZHCET presents

AMU ROV CHALLENGE

Organised by MTS AUV-ZHCET and IEEE.



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1. Objective

AMUROV is a national-level student competition established to generate, cultivate, and enhance a community of innovators capable of making substantive contributions to the remotely operated Underwater Vehicles (ROVs) domain.

Participants tackle fundamental challenges in the design of ocean systems capable of changing the world — while getting hands-on experience by designing, building and testing a remotely operated underwater vehicle. By providing a venue and mechanism to share knowledge and innovate, students are primed for jobs in developing, testing and managing state-of-the-art systems.

2. AMUROV Information and Updates

2.1. AMUROV Forum

All technical questions, comments, and suggestions should be posted on the 2021 **AMUROV** Forum. Teams are encouraged to actively participate in the online community and monitor it for the latest news and updates regarding all things.

2.2. Points of Contact

- ORGANISERS – 1. MTS AUV-ZHCET, AMU :
aувzһcet@zhcet.ac.in
2. IEEE, AMU :
ieeestudentbranch@zhcet.ac.in

3. Schedule

AMUROV 2022 will be hosted offline. All venue, tasks, vehicle guidelines and descriptions included in this document are meant to guide competition submissions and will be executed in 2022.

4. Official AMUROV Competition Website

The official competition website is <https://amurov.co.in/>. The documents posted at [AMUROV](#) are the official documents for this competition. All documents referenced here and in other **AMUROV** documents are available at the official competition website. These documents are updated regularly. It is the teams' responsibility to check the website for the most recent revisions.

5. Registration Information

To participate in the competition, all teams must register through the official **AMUROV** 2022 website.

This registration collects team contact information, an optional team bio and logo and the required registration fee (for UG Students).

6. Competition Categories

There are two broad categories of the competition namely:

- 1) School level: The school level competition will be virtually conducted and no physical presence will be required for the successful completion of the **poster making** competition. *Refer to 7.2*
- 2) Undergraduate(UG) level: The undergraduate level competition will require the physical presence of the team including the prototype or the culminating hardware solution that the team has created.

7. Team Deliverables (Design Documentation)

7.1. Structure of the Team

7.1.1. School Level (9th - 12th)

- Maximum 2 students can participate in a team.
- Students can be across schools.

7.1.2. Undergraduate Level

- Maximum 5 students can participate (including team head).
- A team mentor (who needs to be a faculty advisor/master's student).
- Students must be of the same school/college.

7.2. For School Level

- A4 size paper for poster making
- Submit ID proof(school ID) along with submission

7.2.1. Themes for posters

- THE VERY COMMON PROBLEM OF PLASTIC POLLUTION IN OCEANS
- THE CATASTROPHIC IMPACT OF CLIMATE CHANGE ON CORAL REEFS
- MAINTAINING HEALTHY WATERWAYS

7.3. For Undergraduate Level (UG)

7.3.1. Video Submission

The maximum length of the video should not be more than 1 minute, in which the team should show at least 30 seconds of maneuvering inside a pool, demonstrated by one of their team members.

7.3.2. Technical Design Report (TDR)

The report should start by an introductory page containing the structure of the team and relevant information. Other important areas to mention but not limited to:

1. Specifications of the ROV including: weight, dimensions etc.

2. Technical details including: Battery and power consumption, buoyancy etc.
3. Design CADs/ 3D drawings/ CFD Simulations/ MATLAB Simulink Simulations/ Circuit diagrams/ Pictures etc.
4. Details of the sensors and software used.
5. Procurement Report: It should contain the details of manufacturing cost, providing a clear overview of the budget plan.
6. The report should be submitted in both pdf and word file format.

8. Competition Overview (UG level)

8.1. Venue

Aligarh Muslim University, Aligarh.

8.2. Registration Fees

Rs. 1000 - UG Students (team).

Free for School Students.

8.3. Specifications of ROVs

8.3.1. Weight and size constraints

Competition officials will use the following chart to award points for size and weight:

L=Length

B=Breadth

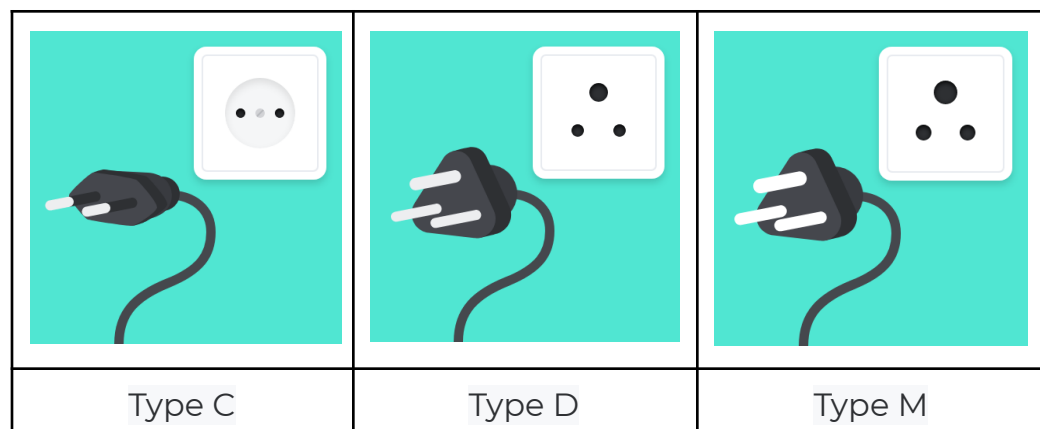
H=Height

SIZE (cm)		Weight (In Air)	
L<75, B<65.01, H<60.01	+ 10 points	< 20 kg	+10 points
75<L<100, 65.01<B<75.01, H<69.9	+5 points	20.01 kg to 28 kg	+ 5 points
L>100.01, B>75.01, H>69.9	NOT ALLOWED	28.01 kg to 35 kg	+0 points

Vehicles greater than 35 kg in weight, will not be allowed.

8.3.2. Power

India operates on **230V supply voltage** and **50Hz frequency**. In India there are three associated plug types, types C, D and M. Plug type C is the plug which has two round pins, plug type D is the plug which has three round pins in a triangular pattern and plug type M is the plug which also has three round pins



All the peripherals of the vehicles should be working on the official voltage supply of **48 Volts** provided at the Centre. This voltage may go upto 56 Volts so the vehicles

should take appropriate measures to clip it and work under the given range. There would be no stepping down of the voltage in any condition, the teams should work under this fixed supply only. There should not be any converters or moderators at the receiving point of the ROV, the stepping down and other measures should be done on the ROV system bus, i.e., the motherboard of the vehicle.

There should also be proper use of **fuses** in the vehicle concerning the safety standards. In addition to it, there should also be an external **kill switch** to stop the working of the vehicle completely.

Length of tether should be decided by the teams themselves after going through the dimensions of the pool and the different task descriptions.

8.3.3. Safety

- ROVs must be designed and manufactured as to pose no danger of any kind to anyone or anything at the venue.
- ROVs must not leak and pollute the pool.
- Pressure of any compressed gas used must not exceed 6 bars.
- The use of explosives, fire or hazardous chemicals is prohibited. Certified lithium batteries are allowed.
- If lasers are used, they must be of class 2 or lower. Care must be taken to protect all persons at the venue from harm. Beams must be oriented in such a fashion that they cannot shine into the eyes of the spectators.

8.4. Balloons

Balloons of radius 10cm will be used in Task-2

9. Competition Requisites (Applicable for UG Level only)

All the participating teams are imperatively required to bring their own tether cables for the completion of the appropriate tasks.

10. Competition Rules (UG level)

Rule 1 : The official source for all information concerning rules, interpretations, and information updates for AMUROV is at :

<https://amurov.co.in/>

Rule 2: Only the registered students of each team are eligible for the cash awards.

Rule 3 : Participants must be enrolled at their colleges/schools as a full-time student during winter and spring to be considered “students.”

Rule 4: One student cannot be a part of multiple teams.

11. Competition Tasks

11.1. Task 1 : Maneuvering

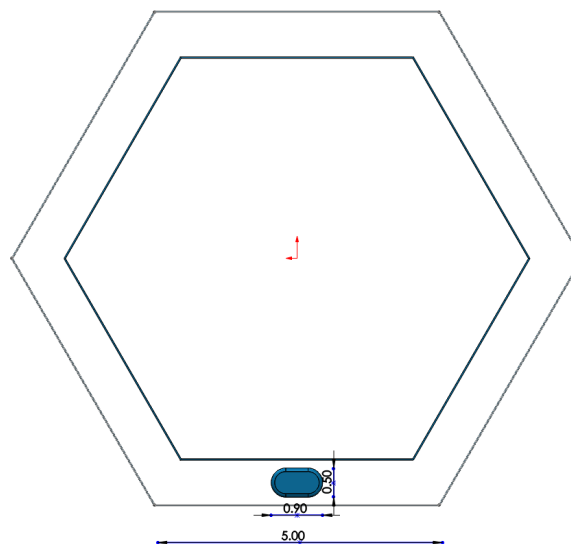


Fig. 1 : Top View

The aim of this task is to check the maneuvering of the vehicle. The task is to move to the Hexagon-shaped arena placed at the surface of the pool, as shown in Fig. 1. The vehicle has to move along the Hexagon-shaped path which is 80 cm wide (path-width is tentative, final width will be decided after the submission of technical design reports). The ROV must swim at the

surface level along the path without touching it. And If the vehicle touches the boundaries, then the points will be deducted.

11.1.1. Points

1. The total points to be awarded to a team for this task is: 100.
2. If the team completes the maneuvering round, it will be granted the whole of the 100 points.
3. However, 5 points will be deducted every time the ROV touches the hexagon periphery.

11.1.2. Props Specifications

ROV has to maneuver inside a hexagon with an 80 cm gap between the outer and inner boundaries. The hexagon is made up of Poly Vinyl Chloride(PVC) Pipes.

11.2. Task 2 : Vision and Control

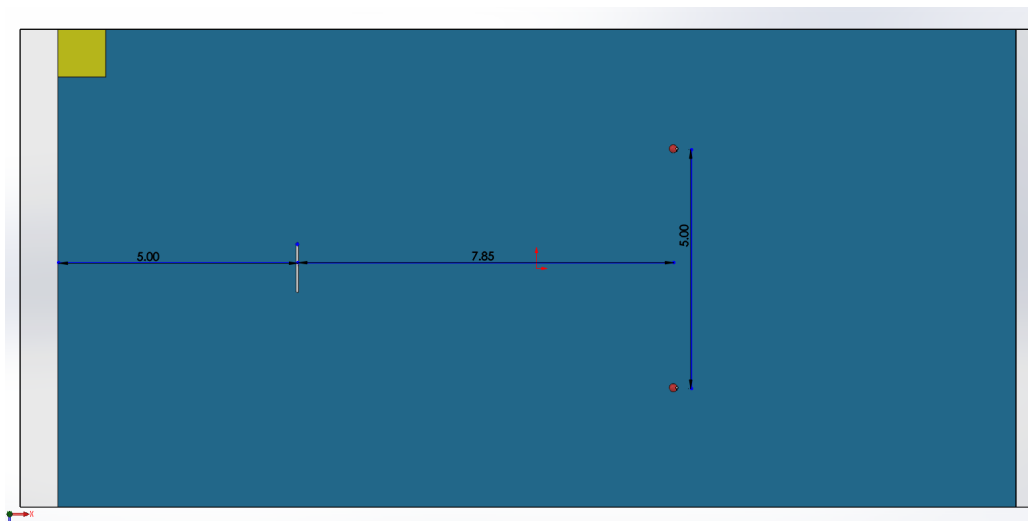


Fig. 2-i : Top View

The goal of the challenge is to find and capture a target amid two balloons at the pool's bottom, each with a different shape.

A target zone is established by two balloons with two forms on each of the balloons, namely rectangle and triangle, and two flags placed on the top section of the balloons. Fig. 2 depicts the position of the balloons in relation to the arena.

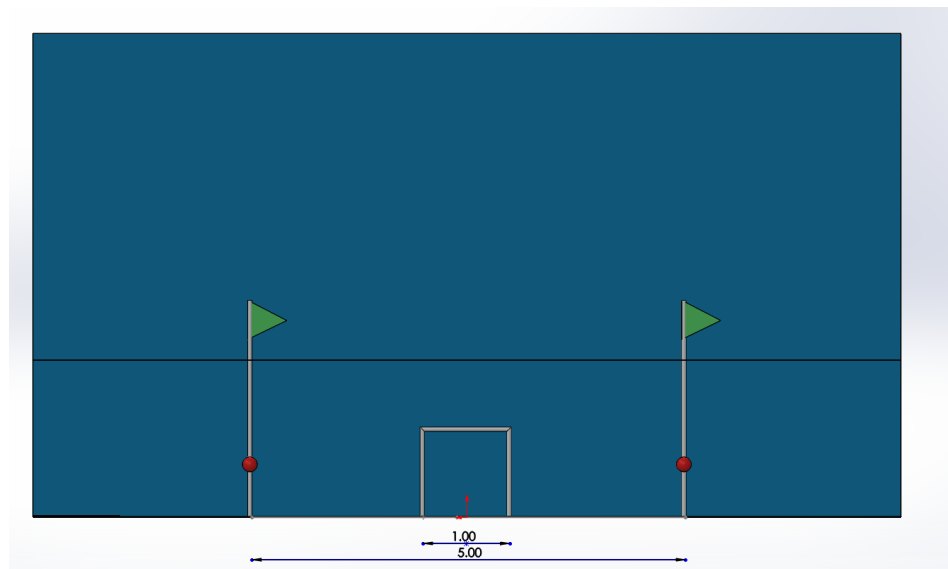


Fig 2-ii : Front View

In the arena, there are two balloons. They're all submerged in the target zone. On the top of both balloons, will be two flags. Each team is given a specific shape representing a specific balloon. The ROV must begin at the starting position and then pass through the underwater gate, which is located around 5 m to 10 m from the starting point and has an inverted U form of height 1 m. When the ROV uses vision to locate the corresponding balloons with the specified shape of triangle or rectangle, points will be granted.

If the ROV only wanders around the balloons with the prescribed shape, it will receive some points; however, if the ROV bursts/touches the balloon with the respective/assigned shape, it will receive additional points.

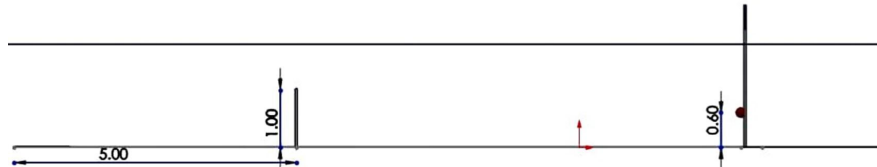


Fig 2-iii : Side View

11.2.1. Points

1. The total points to be awarded to a team for this task is 100.
2. 30 points will be given if the ROV passes through the gate.
3. 70 points will be given when the specific balloon bursts.
4. 30 points will be given if the ROV wanders around the balloon with the prescribed shape.
5. If the team bursts the wrong balloon, then ZERO points will be marked for the team instead of 70.

11.2.2. Props Specifications

2 balloons with separate specific sticker marks will be tied to respective identical flags. The teams have to burst a clear sticker-marked balloon, whereas the other balloon should remain untouched.

11.3. Task 3 : Depth Control

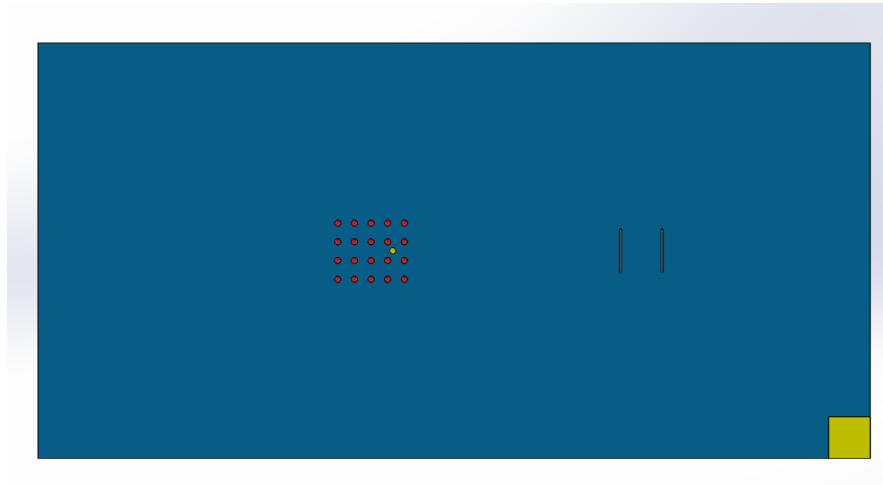


Fig. 3-i : Top View

The goal of the task is to find and acquire a succession of balls in the target zone. The target zone is created by placing 20 balls at the surface of the arena, and a golden ball at the bottom. Fig. 3 depicts the target zone's placement in relation to the arena.

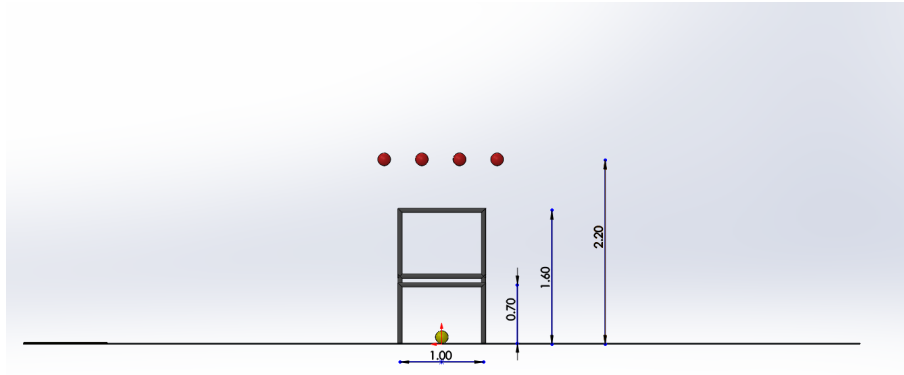


Fig 3-ii : Front View

There will be 20 balls in the arena floating on the surface, plus one extra golden ball submerged in water near the aim zone. The ROV should begin at the starting position and proceed to gate 1, which is 500 cm away from the starting point and is 70 cm tall and 100 cm wide.

After passing through gate 1, the ROV should proceed to the second gate, which has a height of 160 cm and a width of 100 cm and is placed roughly 100 cm away from gate 1. Lower half area is blocked, thus ROV has to pass through the upper half area (80cm x 100cm) of gate 2.

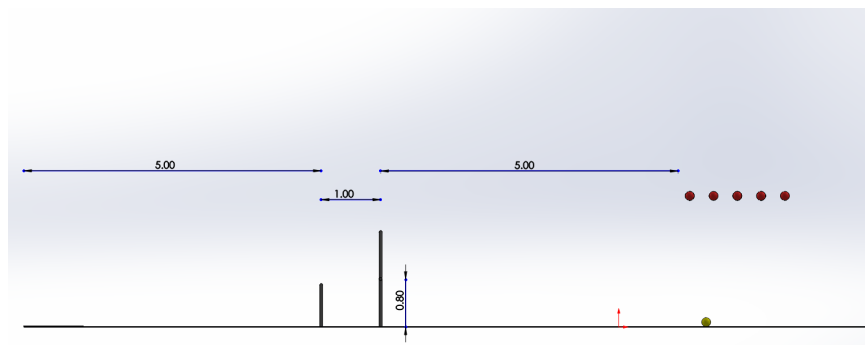


Fig 3-iii : Side View

The ROV should aim to gather as many floating balls as possible before returning to the destination point.

The ROV can also pick the submerged golden ball in order to gain some bonus points.

Note:

- This task is time bound and will be evaluated accordingly for a total of 12 minutes for each team.
- It is not necessary for ROV to have a gripper for Task 3.

11.3.1. Points

1. If the ROV passes through the gates, then 20 points will be awarded for passing through each of them. Hence a total of 40 points will be awarded for passing through the gates without touching it.
2. If the ROV touches the gate, 5 points will be deducted for each encounter.
3. The balls on the surface each carry 5 points on their collection.
4. The golden ball at the bottom has 15 points for its collection.

11.3.2. Props Specifications

2 different sized gates are made of Poly Vinyl Chloride(PVC) Pipes. Colored plastic balls on the surface and a specific golden ball at the bottom. Diameter of all the balls including the golden ball is between 2.5 inch to 3 inch.

12. General Restriction

- Team members are not allowed inside the swimming pool at any point during the game.
- Team members may not disturb the water surface once the game starts.

- Members of other teams are not allowed in the game area.
- Nobody is allowed to wear any footwear near the pool area.
- The Judges may suspend the challenge if the weather turns unfavorable.
- The pool area must be evacuated in case of lightning.

13. Prizes

13.1. UG Category

- The first three winners will be awarded prizes, total cash pool of worth: Rs.50,000.
- Certificates will be awarded to all participants.
- Prize distribution ceremony will be held at OCEANS 2022 Chennai.

13.2. School Category

- The following prizes will be awarded for the following positions:
 - 1st - ₹1000
 - 2nd - ₹700
 - 3rd - ₹500
- All the winners will have a chance to visit the AMUROV challenge-UG category at the venue.

14. Disqualification

Teams may be disqualified if :

- Oil or lubrication leaks causing the pollution of the pool.
- Battery leak causing the pollution of the pool.

- The ROV damages or tries to damage the arena, facilities or equipment.
- The team performs any acts that are not in the spirit of fair play.
- The team fails to obey instructions or warnings issued by the Judges.
- If the team does not abide by the general restrictions.

15. Others

- The legitimacy of any actions not provided in this rulebook will be subject to discretion of the Judges.
- The dimensions, weights, etc. of the field, facilities and equipment stated in this rulebook have a margin of error of $\pm 5\%$ unless otherwise stated. However the dimensions and weights of the ROVs as stated in the rule book are the maximum and cannot be deviated.
- The Judges may demand additional explanations on safety issues when the safety of a vehicle is deemed to be in question.