RULE BOOK

Go Dive Derby Challenge

GLOBAL ROBOTICS CHALLENGE

2024

Abstract

Small remote-controlled submarine competitions are exciting events that bring together enthusiasts of underwater robotics and engineering. These competitions serve as a platform for participants to showcase their skills in designing and operating miniature submarines in controlled underwater environments. The objective is to navigate the submarines through a series of challenges, including obstacle courses, underwater mazes, and simulated underwater missions.

Participants construct their submarines using lightweight materials and incorporate various propulsion systems, such as thrusters or propellers, to achieve controlled movement and manoeuvrability. The submarines are often equipped with cameras or sensors to provide real-time feedback to the operators.

The competitions feature tasks that test the submarines' agility, speed, and precision. These tasks may involve retrieving objects from the seafloor, navigating through narrow tunnels, or performing intricate maneuvers. Some competitions also simulate scientific research or underwater exploration scenarios.

Judges evaluate the submarines based on performance, design innovation, functionality, and adherence to competition rules. The competitions foster creativity, problem-solving, and teamwork among participants as they optimize their designs and overcome challenges.

These events not only promote technical skills but also inspire a passion for marine robotics and underwater exploration. They encourage participants to

2 Rules and Guidelines

learn about marine ecosystems, sustainability, and the importance of preserving the underwater environment.

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1 Challenge Phase

Go Dive Derby Challenges.

1.1 Discover Category

This category is for primary school students (8-12 years old) with both technical and non-technical backgrounds. They build ROVs to perform simpler simulation tasks, introducing scientific and engineering concepts in an engaging way tailored to their age group. It fosters teamwork and curiosity while promoting STEM learning at an early age.

Note: Registration requires a birth certificate, to verify the participant's age.

1.2 Junior Category

This category welcomes high school students (13-18 years old) of all technical and non-technical levels. Participants are required to build an ROV (remotely operated underwater vehicle) as a team to complete specific simulation tasks that incorporate scientific and engineering concepts.

Note: Registration requires a birth certificate, to verify the participant's age.

1.3 Senior Category

This category is open to undergraduate and postgraduate students, regardless of age or technical/non-technical background. Participants are required to build an ROV (Remotely Operated Underwater Vehicle) as a team and complete specific simulated underwater tasks that incorporate specific scientific and engineering concepts.

6 Rules and Guidelines

2.1 Timeline

1. February 2024: Registration Starts and opening Webinar.
2. April 2024: Registration Closes and Submissions Deadline.
3. June 2024: Regional Finals.
4. September 2024: International finals.

2.2 Registration

Registration will open from February 2024 to April 2024. The team members cannot be less than 3 and not more than 10. Team can register more than 10 with 10$ per exceed person.

All data should be written in English.

Email and phone number for each member must not be duplicated.

3.1 Submission

All the submissions are required from Senior and Junior only. Discover teams shouldn't submit any of the following.

3.1.1 Technical Report (70 points)

Each team should prepare a technical report document and send it before the Competition.

3.1.2 Cost analysis (20 point)

Each team should prepare cost analysis and send it before the competition.

3.1.3 Safety Document & Software Safety Check (20 point)

Each team will be asked to deliver a safety document prior the competition.

Note: All rules are mentioned in the Safety section.

3.2 Challenge Day

The challenge will be divided into three sections as following.

3.2.1 Safety Check (20 points)

Each team will perform the safety check according to the specifications described in the Safety section, teams that cannot pass the check will not enter the trial.

Each team has two trials each trial has its own safety check.

3.2.2 Missions

Senior category will have 300 points on missions for three tasks while the two other categories will have only 200 points for two tasks.

Each team will have two trials including safety. Each trial will be 15 minutes. Each team will have 5 minutes setup things in the station and 5 minutes to leave the station. The 15 minutes is for all the required underwater tasks.

3.2.3 Presentation (50 points)

Each team will be required to perform a 10-minute pitch presenting their work, the pitch will be followed by 10 minutes of Q&A for evaluation by the judging panel.

4 Challenges Brief

4.1 Underwater Archaeological Exploration

The underwater city of Thonis or Heracleion have captivated archaeologists for centuries, shrouded in mystery as remnants of its prosperous past lay forgotten beneath the sea. These ancient Egyptian cities, once bustling centers of trade and religion, risked fading into oblivion along with their physical remains, leaving behind nothing but ancient accounts and fading inscriptions.

Driven by the accounts of renowned historian Herodotus, archaeologists turned their attention to Abu Qir Bay, situated just west of the Nile Delta. Their relentless curiosity was rewarded in 2000 when they uncovered two sets of ruins patiently waiting beneath the murky waters and buried in the sand.

Known as Thonis in ancient Egypt and Heracleion in Greek, the sunken city of Thonis-Heracleion held significant historical and cultural importance as one of ancient Egypt's principal port cities. Its establishment in the 8th century BCE preceded Alexandria by several centuries, solidifying its role as the primary trading hub of the region. Its strategic location near the Canopic Mouth of the Nile transformed it into a vibrant center of international commerce, connecting diverse cultures and facilitating the exchange of goods and ideas.

The legendary status of this sunken city had long been confined to ancient texts and rare inscriptions found on land. According to Herodotus, the renowned Greek historian, a majestic temple was erected in Thonis-Heracleion to commemorate the exact spot where the legendary hero Heracles first set foot on Egyptian soil. This tale resonated throughout Greek mythology, leading to the city being named Heracleion in honor of the great, semi-divine hero. Herodotus

further alluded that even the famous Helen of Troy and her lover Paris visited Thonis-Heracleion before the Trojan War, adding an aura of myth and romance to the city's history.

The discovery of Thonis-Heracleion beneath the waters of Abu Qir Bay has unveiled an ancient metropolis that played a pivotal role in Egypt's maritime history. Through ongoing archaeological exploration and the retrieval of invaluable artifacts, we continue to unravel the secrets of this submerged city, shedding light on the rich tapestry of ancient Egyptian civilization and its interconnectedness with the wider Mediterranean world.

4-1*: Scuba diver in Abu Qir Bay with ancient hieroglyphs*

4.2 Harmful Algal Blooms

Harmful algal blooms (HABs) pose a significant threat to aquatic life and human well-being, occurring when specific types of algae experience rapid growth and release toxins. These blooms can persist for varying durations, ranging from a few days to several months. However, the consequences extend beyond the bloom's lifespan. Once the algal bloom dies off, the decomposition process by microbes consumes additional oxygen, leading to the creation of oxygen-depleted
"dead zones" that can result in mass fish die-offs. When these dead zones expand over a substantial area and persist for an extended period, entire ecosystems suffer, with both fish and plants unable to survive.

In marine environments, harmful algal blooms are frequently referred to as "red tides" due to their visual manifestation of water discoloration. The causes of specific HABs can be complex and multifaceted. Some occurrences appear to be entirely natural, while others are attributed to human activities. Nutrient availability plays a crucial role, and in some locations, specific drivers such as excessive nutrient levels are linked to HABs. The most common nutrients associated with HABs are fixed nitrogen (including nitrates, ammonia, and urea) and phosphate. These nutrients often originate from sources like agriculture, industrial pollution, excessive fertilizer usage in urban and suburban areas, and urban runoff. Additionally, factors such as elevated water temperatures and poor water circulation contribute to the development and persistence of HABs.

To address the challenges posed by HABs, remotely operated vehicles (ROVs) offer valuable assistance in monitoring and early detection efforts. ROVs equipped with specialized sensors and imaging technologies can survey affected areas, collect water samples, and assess the extent and severity of HABs. This early detection enables prompt response measures to be implemented, mitigating the detrimental impact on ecosystems and safeguarding public health. By providing real-time data and facilitating targeted interventions, ROVs contribute to the effective management and control of harmful algal blooms, aiding in the preservation of aquatic environments and the well-being of surrounding communities.

Harmful algal blooms (HABs) can have severe health consequences, including the potential for fatality, depending on the specific type of algae involved. For instance, certain algae species like Alexandrium can contaminate seafood, leading to paralytic shellfish poisoning when consumed. This condition can result in paralysis and, in extreme cases, death. Another algae known as Pseudonitzschia produces a toxin called domoic acid, which, when consumed at high levels, can cause a range of symptoms such as vomiting, diarrhea, confusion, seizures, permanent short-term memory loss, and even death.

In freshwater environments like the Great Lakes and other drinking water sources, HABs are predominantly dominated by the cyanobacteria Microcystis. This organism produces a liver toxin that can lead to gastrointestinal illness and damage to the liver. It is important to note that certain populations, such as children and the elderly, may be particularly vulnerable to the toxins released by HABs. Additionally, communities heavily reliant on seafood consumption face potential long-term health effects due to frequent, low-level exposures to HAB toxins.

Understanding the risks associated with HABs is crucial for safeguarding public health. Efforts to monitor, detect, and mitigate HABs play a vital role in protecting vulnerable populations and ensuring the safety of drinking water sources and seafood supplies. By employing monitoring technologies, such as the use of ROVs, early detection of HABs can be achieved, enabling prompt actions to minimize exposure and mitigate the health risks associated with these harmful algal blooms.

4-2: Red HABs

4-3: toxic green HABs

4.3 Underwater Internet Cables:

Underwater internet cables, also known as submarine or subsea cables, are the lifelines of global communication networks. These cables form the backbone of the internet, facilitating the transmission of vast amounts of data across continents and connecting countries and continents in a seamless web of information exchange.

Submarine cables are essentially fiber optic cables designed to withstand the harsh conditions of the ocean floor. They are constructed with multiple layers of protective materials, including durable metal and polyethylene, to shield the delicate optical fibers within. These fibers, thinner than a human hair, are made of glass or plastic and carry pulses of light that encode and transmit data at incredible speeds.

The installation of submarine cables is a complex and meticulous process. Specialized ships, known as cable-laying vessels, are used to lay the cables on the ocean floor. Prior to deployment, careful planning is undertaken to select the optimal route, taking into consideration factors like depth, geology, and existing infrastructure. The cables are then lowered to the seabed, guided by remotely operated vehicles (ROVs) or divers, and secured to prevent damage from underwater currents or fishing activities.

The global network of submarine cables spans thousands of miles, crossing oceans and connecting continents. These cables are strategically routed to link major cities and data centers worldwide, ensuring efficient and reliable data transmission. They are typically interconnected at landing points, which are specially designated locations where the cables reach the shore and connect to terrestrial networks.

The capacity of submarine cables is continuously expanding to meet the ever-growing demand for data transmission. Modern cables can carry terabits of data per second, enabling high-speed internet connectivity and supporting a wide range of digital services, including video streaming, cloud computing, and global communication.

While submarine cables are designed with resilience and redundancy in mind, they are not invulnerable to damage. Threats such as natural disasters, ship anchors, fishing activities, and even intentional sabotage can disrupt or damage these cables. However, extensive monitoring systems are in place to detect cable faults and quickly initiate repairs, minimizing downtime and ensuring the continuity of global communication.

5 Discover Category Challenges

See appendix A for all playground specifications and items.

Task 1 Tomb exploring Discover (100 points):

In this Task, participants will encounter an ancient Egyptian pharaoh's tomb, and their ROV (Remotely Operated Underwater Vehicle) will be tasked with exploring the tomb and gathering crucial information. This includes documenting the artifacts within the tomb, recording inscriptions on the walls, and potentially uncovering any treasures that may have been left behind by the pharaoh.

Task 1.1 (30 points):

In the water, there will be a tomb featuring a door and walls, but no ceiling. Inside the tomb, there will be specific items that the pilot and copilot need to identify using their cameras and present their findings to the judge. The items within the tomb consist of a simulated Pharaoh Coffin, represented as a cuboid box, a simulated Pharaoh Treasure, represented as a cubic box, and inscriptions on the walls, which will be simulated as a vertically placed banner containing a single hieroglyphic symbol.

For every successful identification, the team will earn 10 points. The identification process involves the pilot or co-pilot pointing at the item on the screen and verbally communicating their observations to the judge, explaining what they have discovered.

Task 1.2 (45 points):

The team is required to create a map either on paper or using numerical representations to depict the layout of the tomb. Drawing the map accurately will earn the team 15 points. Additionally, for each correct position of an item on the map, the team will receive an additional 10 points. This means that the map task has a total of 45 points available for scoring.

Note that while the map does not need to be highly detailed in terms of drawing or dimensions, the team must ensure that the placement of objects on the map matches their actual locations within the tomb.

Task 1.3 (25 points):

Team should draw the hieroglyphic symbol in the inscriptions. Drawing the correct symbol will earn the team 25 points, while drawing any other symbol will only award them 10 points.

Task 2 Underwater Infrastructure Inspection Discover (100 points):

ROVs (Remotely Operated Vehicles) play a crucial role in examining and evaluating the state of submerged infrastructure, including pipelines, cables, and offshore platforms. Particularly in regions like the Middle East, where extensive oil and gas exploration and production take place, ROVs are instrumental in monitoring the structural integrity of underwater installations and identifying potential leaks or damages.

Task 2.1 (40 points):

In the pool, there will be four vertical internet cables simulated as water PVC pipes. Some of these cables will be defective, indicated by a red area painted on them. Teams are required to identify all the defective cables by accurately stating their locations among the cables to the judge. Successfully completing this task will earn the team 40 points. If the team fails to identify all the cables, they will receive points only for the cables they successfully identified.

Task 2.2 (50 points):

There will be a simulated pipeline consisting of five circles. Each team needs to navigate through all five circles, which are held by PVC pipes of varying heights, diameters and are not aligned in a straight line. When the ROV passes through the circle, the team will earn 10 points.

Task 2.3 (10 points):

Each team should make a show by their ROV with a maximum duration of one minute to impress the viewers.

Note that by making this task the ROV can't make any other tasks and it means the end of the trial.

6 Junior Category Challenges

See appendix A for all playground specifications and items.

Task 1 Tomb exploring Junior (100 points):

In this Task, participants will encounter an ancient Egyptian pharaoh's tomb, and their ROV (Remotely Operated Underwater Vehicle) will be tasked with exploring the tomb and gathering crucial information. This includes documenting the artifacts within the tomb, recording inscriptions on the walls, and potentially uncovering any treasures that may have been left behind by the pharaoh.

Task 1.1 (30 points):

In the water, there will be a tomb consisting of walls and a door, but without a ceiling. Inside the tomb, there will be several items that the pilot and copilot need to recognize and identify using their cameras, reporting their findings to the judge. The items within the tomb include a simulated Pharaoh Coffin represented as a cuboid box, Pharaoh Treasure represented as a cubic box, Two Papyrus paper roll simulated as a 0.5-inch PVC pipe with a height of 20 cm, and inscriptions on the walls simulated as a vertically placed banner containing hieroglyphic symbols.

For each successful identification of an item, the team will earn 5 points. The identification process involves the pilot or co-pilot pointing at the item on the screen and verbally communicating their exploration findings to the judge. However, the team can only identify two out of the four items to receive the full points.

The team's ROV is responsible for retrieving any two items from the tomb to the surface. Retrieving in this context refers to safely bringing the items outside the water with the assistance of the tether man. If any item is accidentally dropped in the water, the ROV is capable of retrieving it. The team will earn 10 points for successfully bringing one item to the surface.

Task 1.2 (45 points):

The team is required to create a map either on paper or using numerical representations to depict the layout of the tomb. Drawing the map accurately will earn the team 15 points. Additionally, for each correct position of an item on the map, the team will receive an additional 10 points. This means that the map task has a total of 45 points available for scoring.

Note that while the map does not need to be highly detailed in terms of drawing or dimensions, the team must ensure that the placement of objects on the map matches their actual locations within the tomb.

Task 1.3 (25 points):

Team should draw the hieroglyphic symbol in the inscriptions. Drawing the right symbol will get the team 25 points, drawing any other symbol will get the team only 10 points.

Task 2 Harmful Algal Blooms (HABs) Junior (100 points):

In this task, there is an algae-infested area that needs to be assessed. The goal is to estimate the size of the algae area and collect a sample for scientists to study and determine the type of algae. **Task 2.1 (30 points):**

An area called **Area A** will be marked on a horizontally placed 1x1 m^2 banner on the ground. This area will be divided into 100 equal squares, some of which will be green and others white. Teams must count the number of green squares and estimate the percentage of green squares compared to the total area. Utilizing image processing can simplify this task but it's allowed to done manually. The team will earn 5 points for the count and 10 points for the accurate percentage calculation.

Once the percentage is calculated, the judge will provide the team with a photograph of the same area taken one month prior on an A4 paper. The team should estimate the percentage and determine if it has increased or decreased. Scoring will be 5 points based on the correct percentage estimation and 10 points on the correct observation of the trend (increase or decrease).

Task 2.2 (35 points):

Teams need to collect three algae samples from the water to study their toxicity. An area called **Area B** will contain several algae, represented by green ropes inserted in a net. The ROV should retrieve three of these ropes from the water's surface. Each retrieved rope will be considered a toxic item, and the team will receive -5 points for any rope left in the water outside the algae area. Teams will earn 10 points for each successfully retrieved algae.

Appendix B includes a table of toxic Harmful Algal Blooms (HABs), which lists the organisms, water type, color, and toxin. The judge will provide the team with a row from this table with an item missing. The team should identify the missing item correctly to earn 5 points. Team can prepare a paper to know what is messing.

Task 2.3 (25 points):

Once the algae type is known, the team needs to apply treatment and install a net to prevent fish from entering the area and being exposed to toxins. The treatment will be represented by a red rope, 50 cm in length, which must be fully inserted within Area B. Successfully placing the entire rope inside the area will earn the team 10 points.

Additionally, there will be a cube made of PVC with dimensions 30 * 30 * 30 cm^3. Its sides and top face will be covered with nets, and it will be open at the bottom. The ROV should cover all of Area B with this cube. Successfully installing the cube will earn the team 15 points.

Task 2.4 (10 points):

Each team should make a show by their ROV with a maximum duration of one minute to impress the viewers.

Note that by making this task the ROV can’t make any other tasks and it means the end of the trial.

7 Senior Category Challenges

See appendix A for all playground specifications and items.

Task 1 Tomb exploring Senior (100 points):

In this Task, participants will encounter an ancient Egyptian pharaoh's tomb, and their ROV (Remotely Operated Underwater Vehicle) will be tasked with exploring the tomb and gathering crucial information. This includes documenting the artifacts within the tomb, recording inscriptions on the walls, and potentially uncovering any treasures that may have been left behind by the pharaoh.

Task 1.1 (30 points):

The tomb will be located underwater and will have a door and walls but no ceiling. Inside the tomb, there will be various items to be identified, including a Pharaoh Coffin (simulated as a cuboid box), Pharaoh Treasure (simulated as a cubic box), and two Papyrus paper rolls (simulated as 0.5-inch PVC pipes, each 20 cm tall). Additionally, there will be inscriptions on the walls in the form of a vertically placed banner with hieroglyphic symbols.

The pilot and co-pilot should use their cameras to recognize and identify these items to the judge. The team will earn 5 points for each correctly identified item, and they should identify all the items to receive full points. The ROV should retrieve the two Papyrus paper rolls to the surface, and successful retrieval will earn the team 10 points.

Task 1.2 (20 points):

The team should create a numerical map of the tomb manually or automated. Drawing the map will earn the team 5 points, and correctly positioning the items on the map will earn an additional 10 points, totalling 20 points for the map task. If the team uses an automated map, they will receive a bonus 10 points.

Note: The map does not need to be highly detailed in terms of drawing or dimensions, but the positions of the items cannot be changed.

Task 1.3 (50 points):
Team may measure all the dimensions of the coffin and the dimensions of the door of the tomb to know if the door could pass the coffin or not. The team should illustrates to the judge how they measured the required dimensions.

Team should measure only the height of the door and the length of the coffin to get the full points. There will tolerance for 2 cm in each length. If the team get only one length right will get only 10 points. But if the team get the two lengths right team will achieve 25 points.

As we illustrated there will be inspections with some symbols, there will be data set attached with the rule book in the website.

Team should use this data set and build an AI model to recognize the symbols on the banner. Team should submit 5 max papers to illustrate how they made the model and all the model results.

Team will get 5 points when submitting right data and 20 points for recognizing all the symbols correctly.

Task 2 Harmful Algal Blooms (HABs) Senior (100 points):

In this task, there is an algae-infested area that needs to be assessed. The goal is to estimate the size of the algae area and collect a sample for scientists to study and determine the type of algae.

Task 2.1 (30 points):

An area called **Area A** will be marked on a horizontally placed 1x1 m^2 banner on the ground. This area will be divided into 100 equal squares, some of which will be green and others white. Teams must count the number of green squares and estimate the percentage of green squares compared to the total area. Utilizing image processing can simplify this task but it's allowed to done manually. The team will earn 5 points for the count and 10 points for the accurate percentage calculation.

Once the percentage is calculated, the judge will provide the team with a photograph of the same area taken one month prior on an A4 paper. The team should estimate the percentage and determine if it has increased or decreased. Scoring will be 5 points based on the correct percentage estimation and 10 points on the correct observation of the trend (increase or decrease).

Task 2.2 (45 points):

The team needs to collect three algae samples from the water to study their toxicity. An area called "Area B" will contain several algae, represented by green ropes inserted in a net. The ROV should retrieve three of these ropes from the water's surface. Each successfully retrieved rope will be considered a toxic item, and the team will receive -5 points for any rope left in the water outside the algae area. The team will earn 10 points for each successfully retrieved algae.

A table in **Appendix B** provides information on toxic Harmful Algal Blooms (HABs), including the organisms, water type, color, and toxin. The judge will provide the team with a row from this table with a missing item. The team should correctly identify the missing item to earn 5 points. Team can prepare a paper to know what is messing.

Task 2.3 (45 points):

In this task, the objective is to apply treatment to the affected area and install a net to prevent fish from entering the area and being exposed to toxins. The treatment will be represented by a red rope, 50 cm in height, which must be fully inserted within Area B. Successfully placing the entire rope inside the area will earn the team 5 points.

Additionally, there will be a vertical net made of PVC rods. The net will be rolled around four PVC rods ¾ inch and 30 cm tall each. These rods will be floating in the water. Around Area B, there will be four fixed 2-inch PVC rods or more, each 10 cm tall, arranged to form a square. The team's task is to install the 30 cm tall rods inside the 10 cm tall rods to enclose Area B.

Task 3 Underwater Infrastructure Inspection Senior (100 points):

ROVs (Remotely Operated Vehicles) play a crucial role in examining and evaluating the state of submerged infrastructure, including pipelines, cables, and offshore platforms. Particularly in regions like the Middle East, where extensive oil and gas exploration and production take place, ROVs are instrumental in monitoring the structural integrity of underwater installations and identifying potential leaks or damages.

Task 3.1 (45 points):

In this task, there will be four internet cables inside the water. Two of these cables will be defective and will be simulated as ½-inch PVC pipes with a length of 50 cm. The defective cables will have a red area painted on them.

The teams' objective is to identify the two defective cables and their locations among the cables. Successfully identifying the cables will earn the team 5 points. After identifying the cables, the team should remove the old cables and install new ones.

The old cables should be brought back to the surface to determine the cause of the defect. The old cables will be installed in two 2-inch PVC pipes and held by 2 pins. When removing the cable the ROV should remove the two pins to release the cable and then remove it. When installing the cable, the ROV should first install the cable and then the 2 pins. The team will earn 5 points for removing all the pins and an additional 5 points for removing the cable.

Similarly, the team will earn 5 points for installing all the cables and an additional 5 points for installing the pins. This allows for a total of 20 points for removing two cables and 20 points for installing two cables.

Task 3.2 (30 points):

In this task, there will be a pipeline that needs to be inspected. The pipeline will be simulated as three circles. Each team should navigate through all three circles without rotating the ROV, as it represents a pipe. The team will earn 10 points for successfully navigating each circle.

The circles will be positioned above the ground with a height of 10 cm, but they will not be in the same horizontal line. The diameter of each circle will be 80 cm. If the height of your ROV is greater than the circle diameter, please contact us for further instructions.

The ROV is allowed to rotate only within the circles without touching them. Contact with the circles is forbidden and will require the team to go back and retry the circle.

If the ROV completes the entire path autonomously without pilot intervention, the team will receive a bonus of 10 points.

Task 3.3 (25 points):

In this task, there will be a lost cable that could be located anywhere. The ROV should search for the cable and retrieve it from the water. Finding the cable will earn the team 10 points, while successfully retrieving the cable to the surface will earn the team an additional 15 points.

The cable will be simulated as a 1/2-inch PVC pipe with a height exceeding 1.5 meters. The team may use a non-ROV device to assist in retrieving the cable, but this device should operate without human interference. Humans are only allowed to turn it on and off.

8 Penalties and Disqualifications

Attempting to cheat in any way leads to disqualification.

Failure to respect the referees or the organizers leads to disqualification.

Failure to pass the safety check will result in your exclusion from the underwater mission.

The ROV that cannot pass the size and weight measurements will be disqualified, but the team can still participate in the other challenge stages.

Participation of mentors, coaches or any person not registered with the team in any activity (mission, safety, or swindling) that results in a 5-point penalty.

If the team exceeds the time allowed to leave the Pool, a penalty of 3 points will be imposed it is deducted for each additional minute.

25 ROV and station specifications

9.1 Power Sources

The power sources for the competition include AC voltage, which will vary based on the regional competition. Additionally, there will be 12V and 48V DC voltage options available, with connectors such as Anderson Power pole (red and black), SBS50 Anderson, and XT60H.

In the Senior category, the competition will provide a power supply limited to 48 volts and 30 amps. For the Junior category, a power supply limited to 12 volts and 30 amps will be provided.

Teams have the option to use their own power supply, but it must pass the safety check.

External power sources are not allowed. All components of the vehicle, including motors, valves, cameras, and modules, should be powered through the main supply.

Power conversion is not permitted until the power reaches the vehicle. The device should have a maximum fuse rating of 10 amps or less.

9.2 Vehicle Specifications

For the Senior category, vehicles must adhere to a maximum diameter of 90 cm and a maximum weight of 35 kg.

Vehicles exceeding these limits will not be permitted to compete in the Underwater Mission.

Modifications to the vehicles after the size and weight measurements are taken are not allowed.

Pneumatics and hydraulics are allowed.

Safety Rules

10.1 Safety criteria

The motors are shrouded and can't be harmful.

All the components are sealed well.

A main fuse is installed in the ROV input.

No any exposed wires.

There are AC and DC labels on each device.

Safety of additional devices.

No sharp edges.

All the previous points will be 5 points each.

10.2 Safety Check Rules

Only four members from each team will be permitted to participate in the Onsite Safety Check.

Each team will be required to perform a dry test to assess the functionality of the vehicle.

If the team utilizes their own power supply, it must undergo testing.

Teams utilizing fluid power will be asked to test the fluid elements and their source.

Teams should consider the judges' comments and attempt to resolve any issues within a maximum of 20 minutes. If the problems are not resolved within this timeframe, the team will not be allowed to proceed with the Underwater Mission.

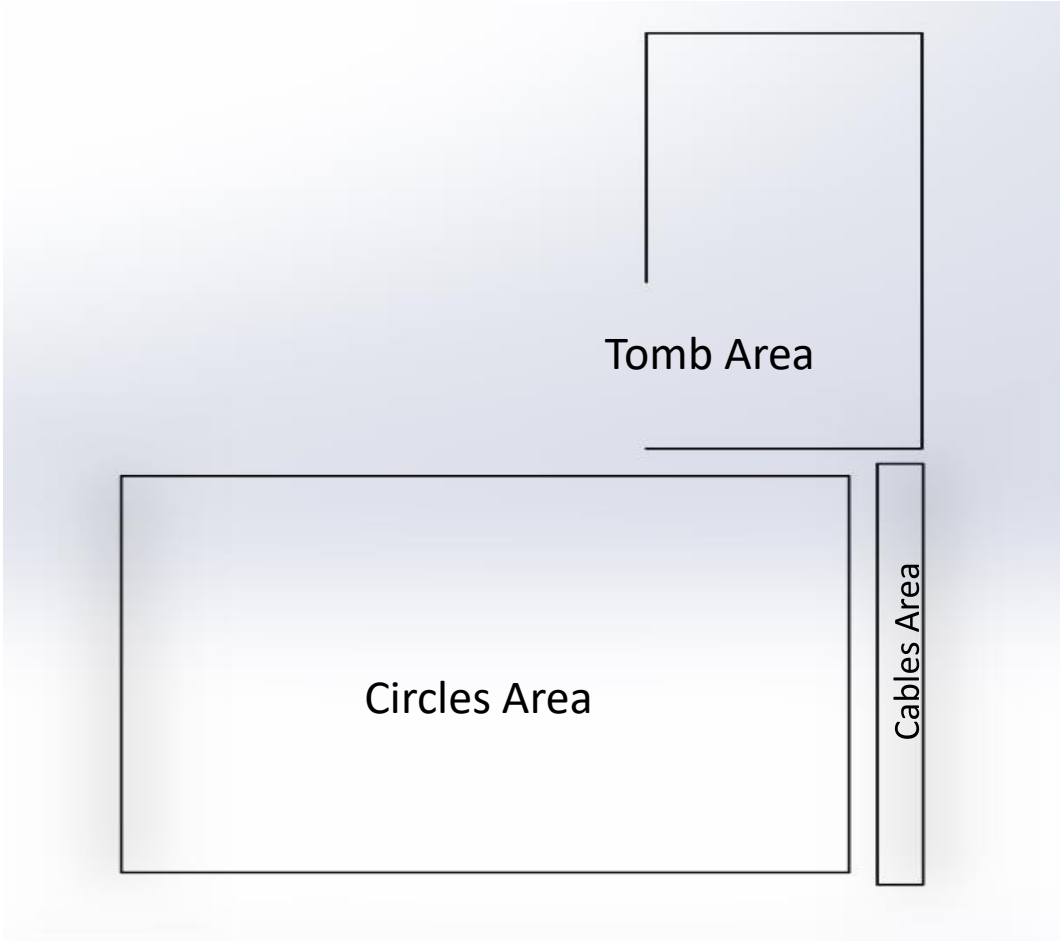
Teams will lose Safety Check points for each component that prevents them from passing the check. However, the team must still address the issues to be eligible for participation in the Underwater Mission.

Teams that pass the safety check will receive a card indicating their readiness for the Underwater Mission. The card will be collected and verified by the pool judge from the team before commencing the Underwater Mission.

Appendix A

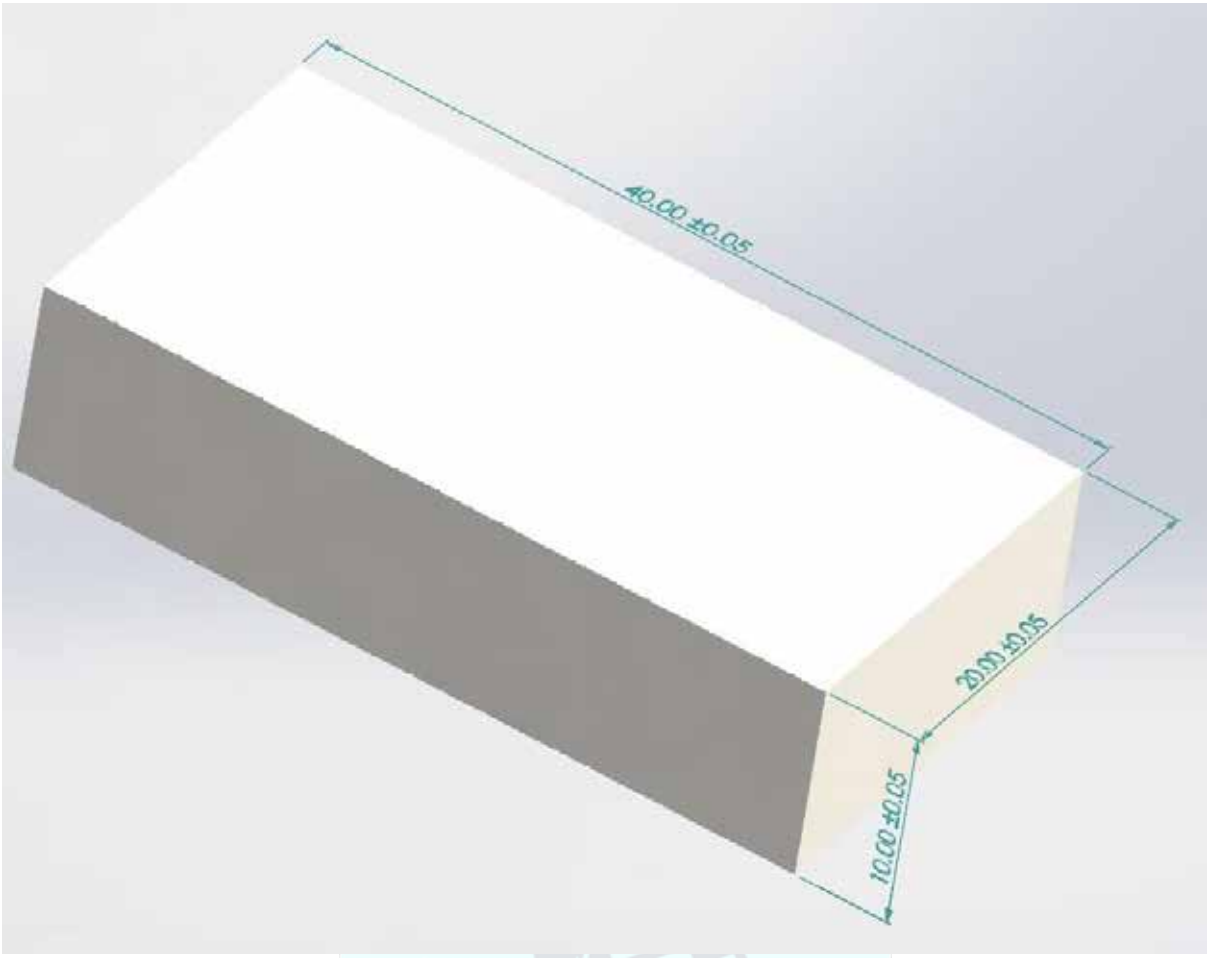
Discover Playground specifications

Playground layout

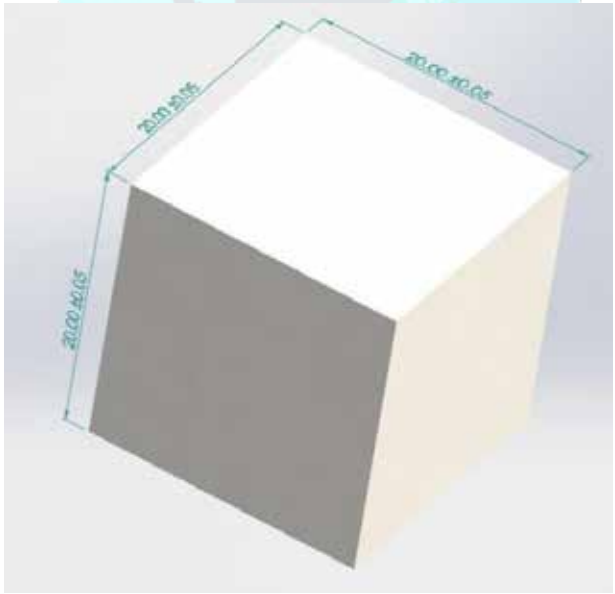


0-1: Discover playground layout

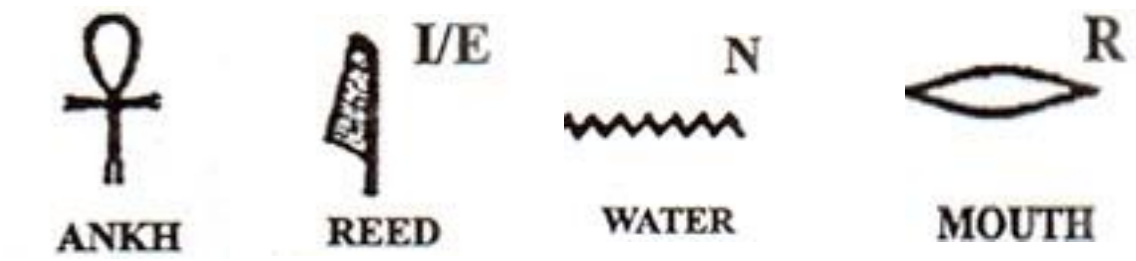
Task 1:



simulated Pharaoh Coffin, represented as a cuboid box, the color will be White and all dimensions in cm

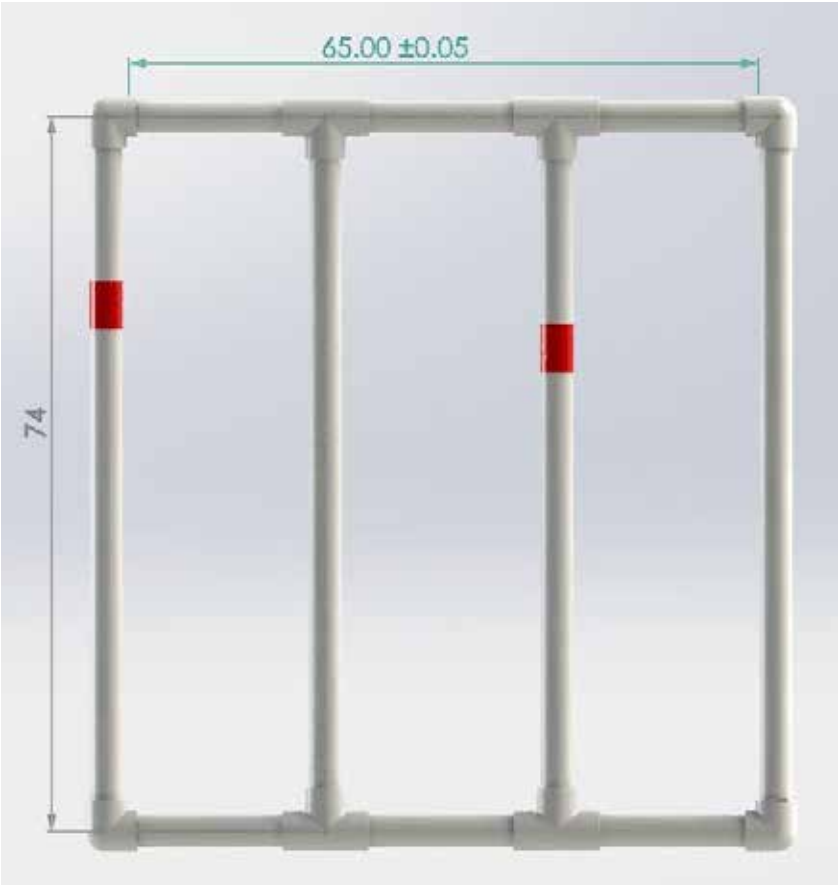


simulated Pharaoh Treasure, represented as a cubic box, the color will be White, all dimensions in cm

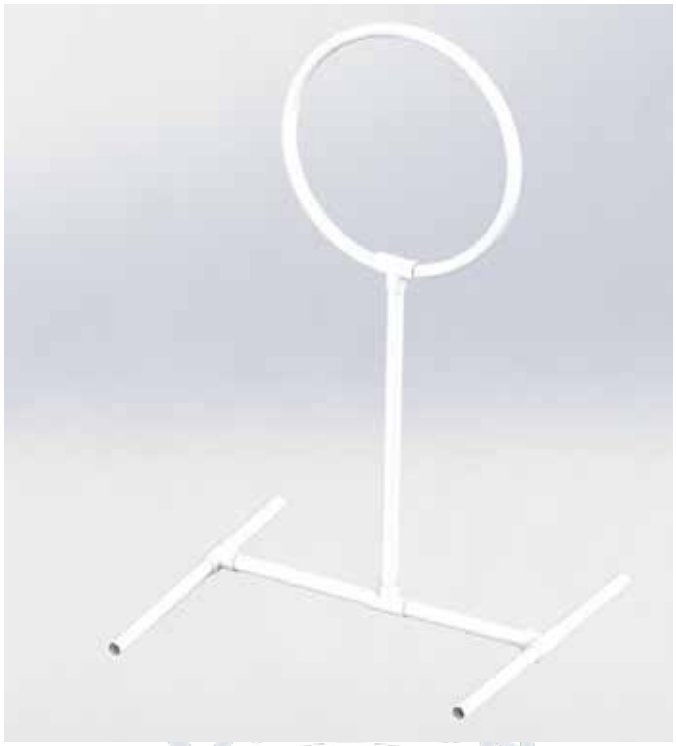


one of these symbols will be in the inscriptions banner at the wall

Task 2:



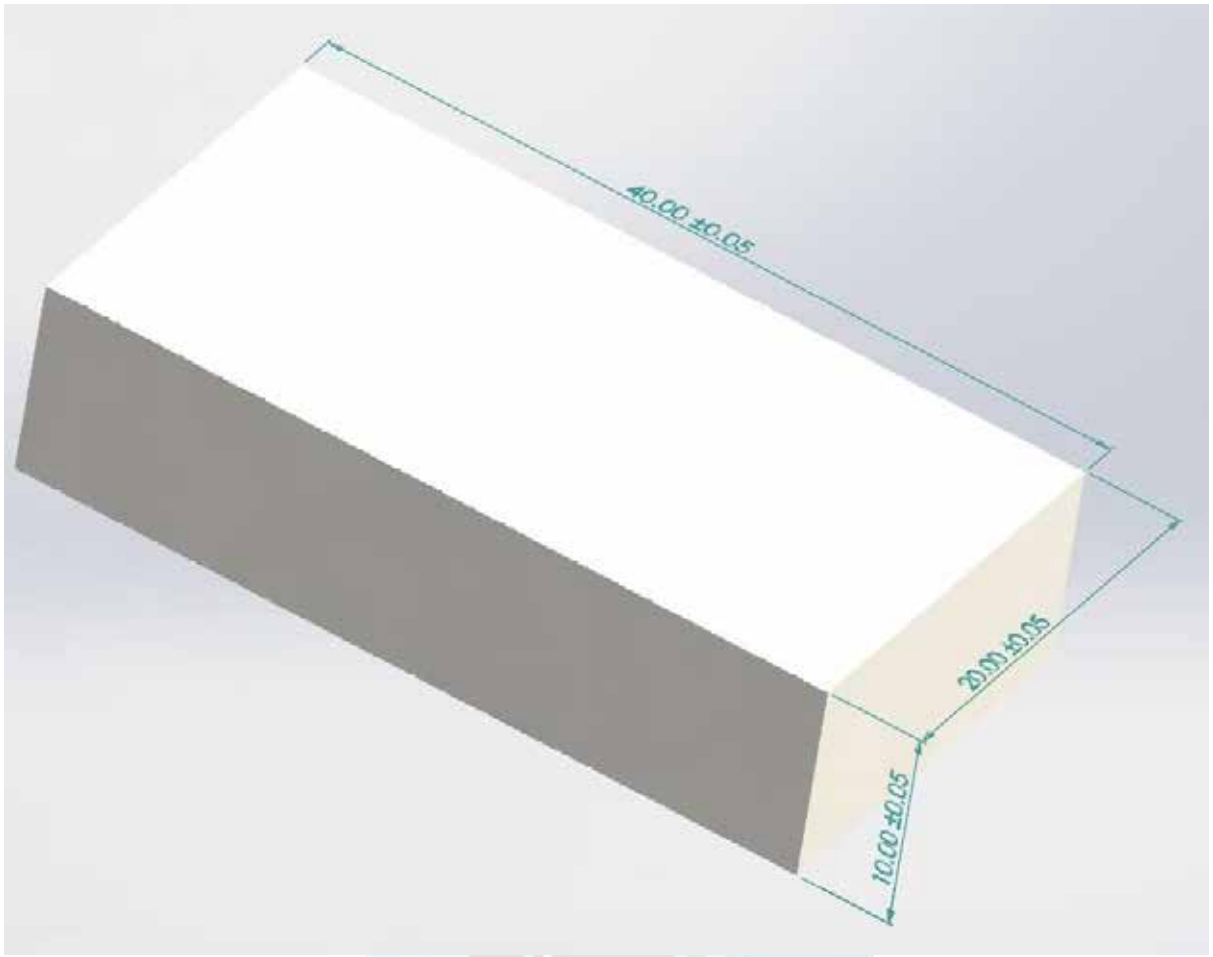
Example of cables with red area in defected cables. All cables simulated as 1-inch white PVC pipes, all the dimensions in cm.



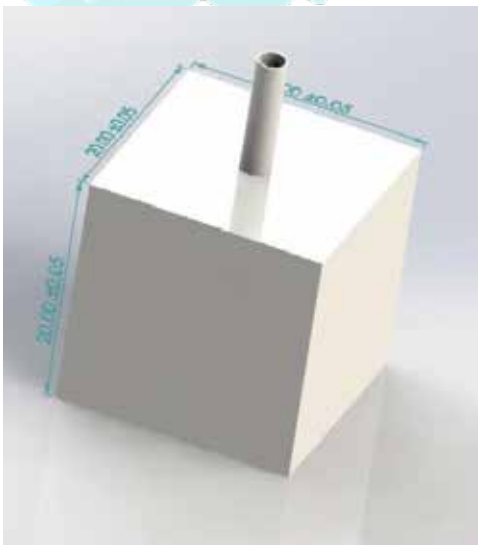
the circles will have variable heights from the ground and variable diameters but the smallest diameter will pass the ROV easily.

Junior Playground Specifications

Task 1:

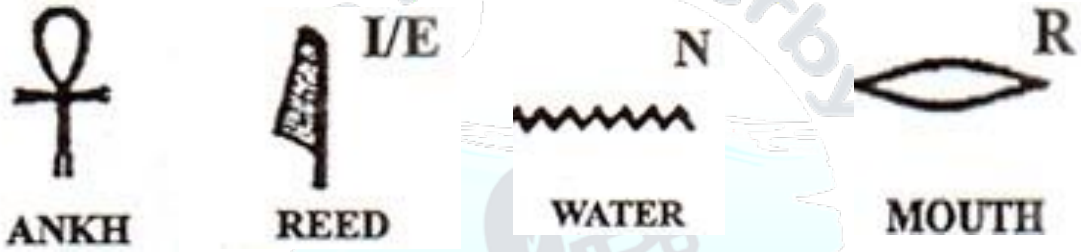


Simulated Pharaoh Coffin, represented as a cuboid box, the color will be White and all dimensions in cm



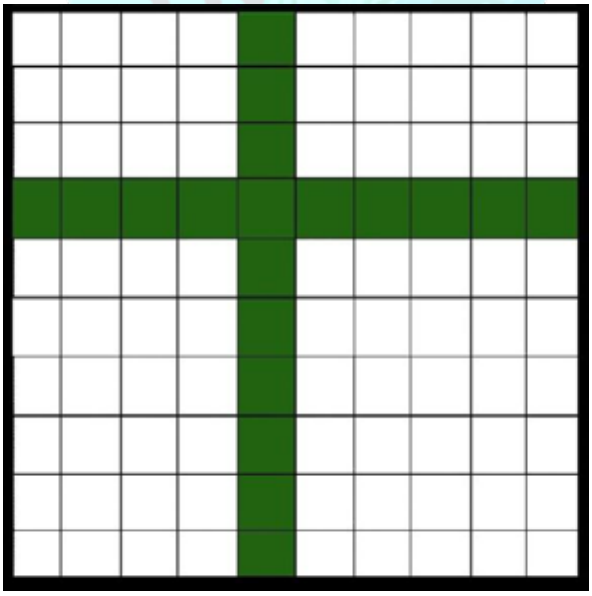
simulated Pharaoh Treasure, represented as a cubic box, the color will be White, all dimensions in cm and the PVC cylinder is 1-inch

Papyrus paper roll and it will be simulated as 1/2 - inch PVC pipe it will put inclined on vertical surface. The color might be white or green.

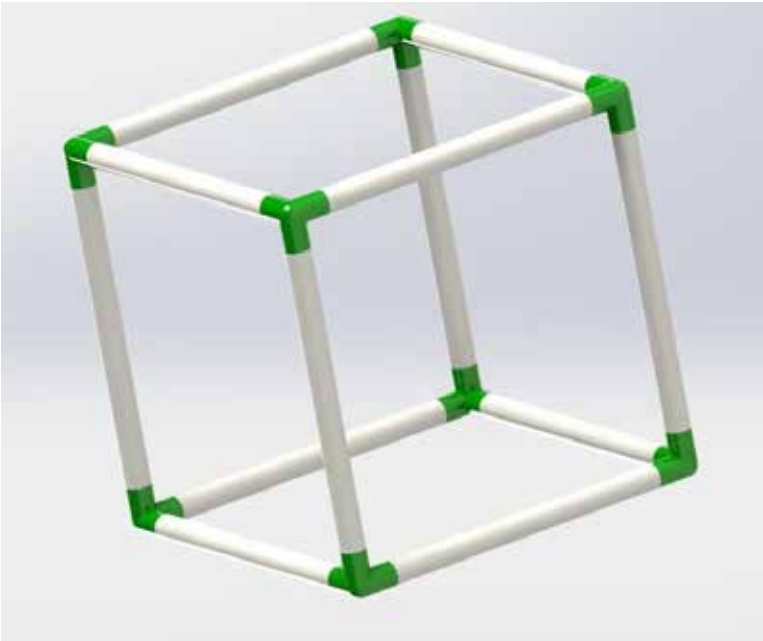


some of these symbols will be in the inscriptions banner at the wall

Task 2:



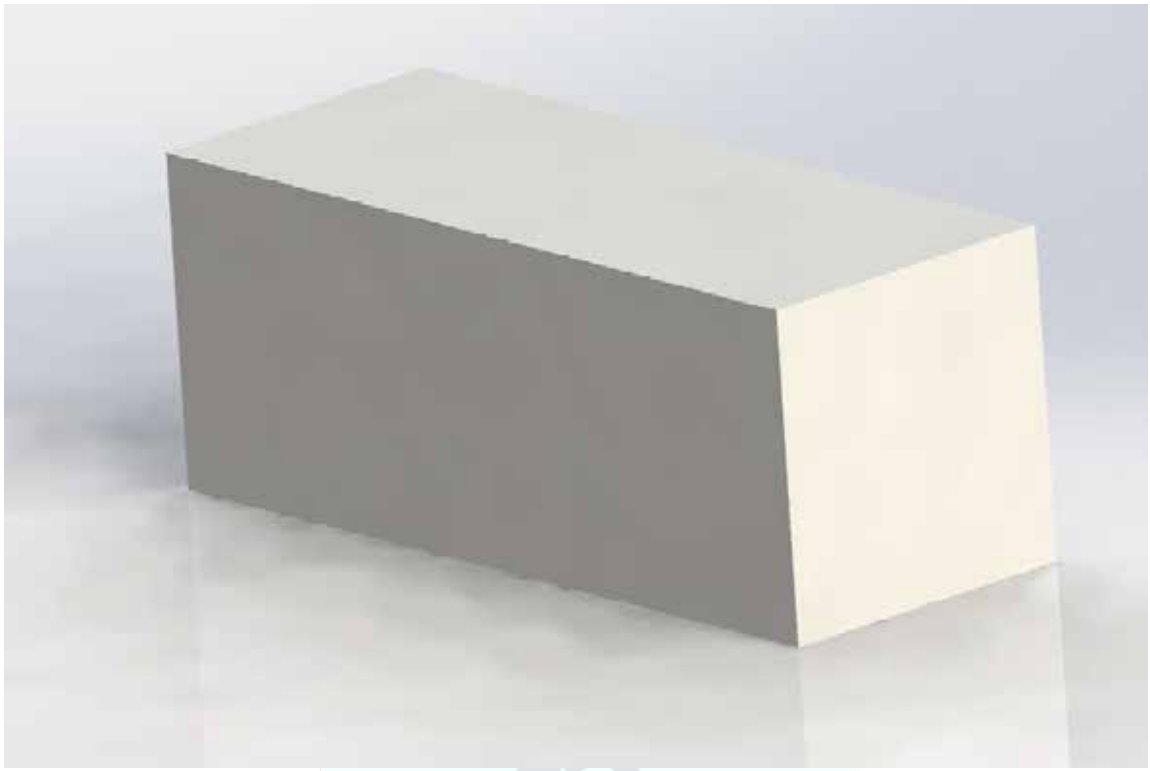
Sample of Area A



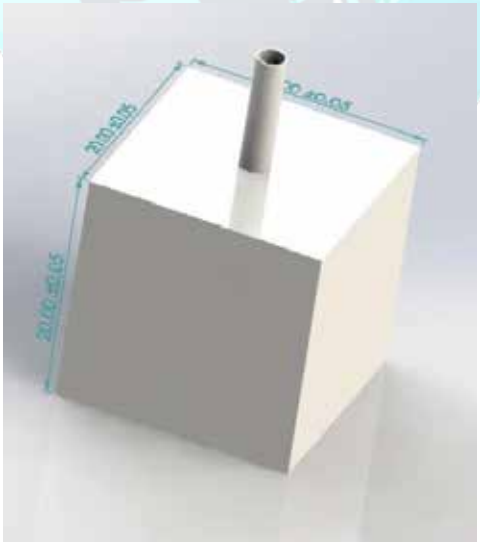
Cube made of PVC with dimensions 30 * 30 * 30 cm^3 and ½-inch PVC pipe also there's a net will be installed on the cube.

Senior Playground Specifications

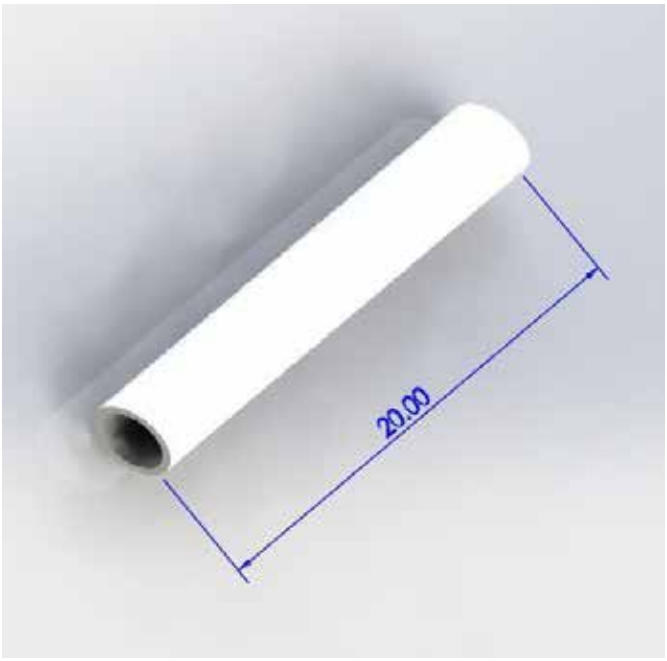
Task 1:



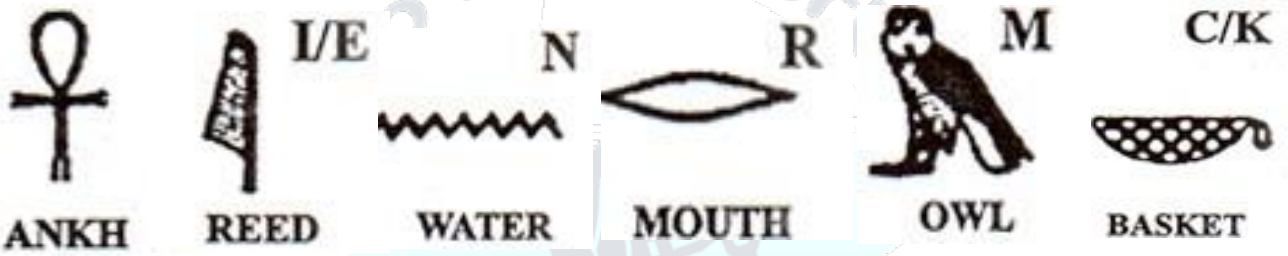
Simulated Pharaoh Coffin, represented as a cuboid box, the color will be White



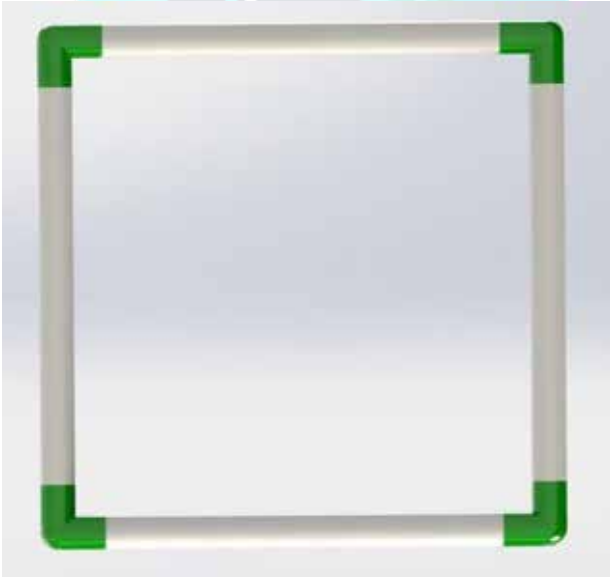
simulated Pharaoh Treasure, represented as a cubic box, the color will be White, all dimensions in cm and the PVC cylinder is 1-inch



Papyrus paper roll and it will be simulated as 1/2 - inch PVC pipe it will put inclined on vertical surface. The color might be white or green.

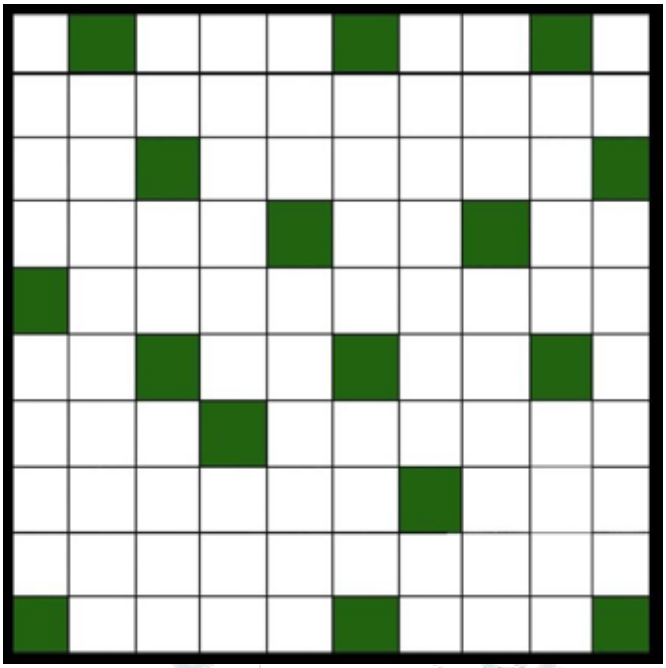


some of these alphabets will be on the on inscriptions banner but a real photo of real inscriptions, so all the teams should collect well data and not use these symbols.

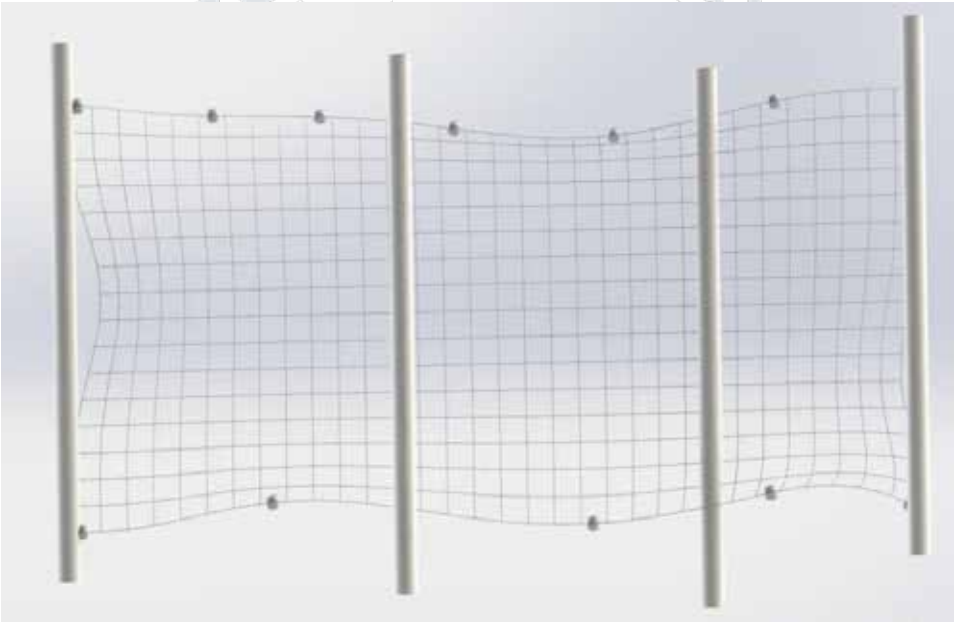


The Tomb door is simulated as PVC white square with green elbows.

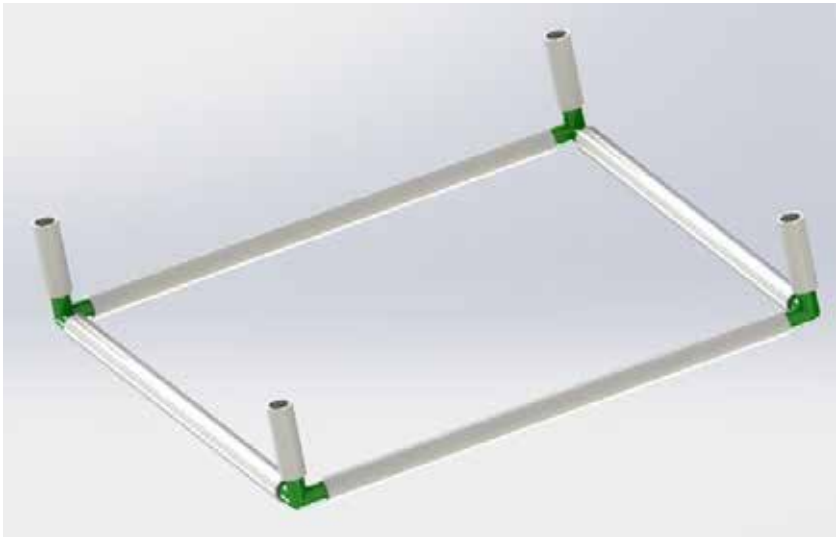
Task 2:



Sample of Area A

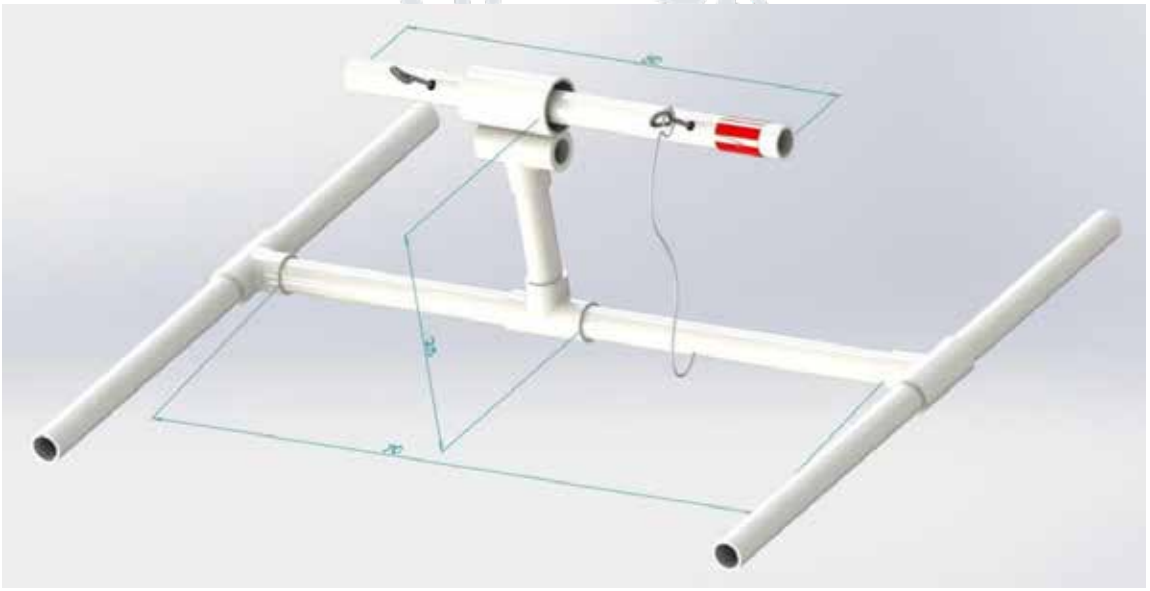


Vertical net with the 4 rods to be installed in the base rods, the 4 rods are 3/4-inch PVC pipes with 30 cm length



The base around Area B is consists of 4 PVC rods 2-inch or more

Task 3:



the defected cable will be simulated as ½-inch PVC installed in 2-inch PVC pipe. 2 inch PVC is higher than the ground by 25 cm. The pipe that holds the cable housing vertically is centered. The cable pipe has length of 50 cm and two holes for two pins, each hole is far for 10 cm from the end and has 1 cm diameter. The pins will have 5 mm diameter. The four cables will be beside each other with distance of 50 cm or more between them. All dimension in cm

The diameter of the circle is 80 cm and the center of its holder is 10 cm above the ground.

Appendix B

HAB's table

Alexandrium sp.	Salt	Red or brown	Saxitoxins
Cyanobacteria	Fresh	Blue-green	Cylindrospermopsin
Gambierdiscus	Salt	Orange	Ciguatoxins
Karenia brevis	Salt	Red	Brevetoxins
Pseudo-nitzschia	Salt	Red or brown	Domoic acid
Microcystis	Fresh	Blue-green	Microcystin