2022 Product Demonstration Team Briefing

Be on time. Everyone has a schedule. Be ready to go 20 or 30 minutes prior to your product demonstration run. Be at your engineering room 10 or 15 minutes prior to your presentation. Weight measurements happen prior to your product demonstration time. The pool deck coordinator will not wait if you are still trying to get your weight done when your product demo time is scheduled.

Missing your run: If your vehicle is not functioning and you cannot make your product demonstration run, send a team member to inform the pool deck coordinator that you are not showing up. Otherwise, we may come looking for you. Please let us know.

Communicate with the station judges. Let the judges know what task you are working on. If you have multiple video monitors, let the judges know what monitor is doing the active mission. The more information you give your judges, the easier it will be for them to score you properly. If you think you have completed a mission, ask the judges.

This is especially important if more than one thing is going on at once. If you are doing float math, using AI to detect morts on the video, or are showing your photomosaic on a separate screen, let the judges know – especially since it is probably not the pilot doing this.

No tasks can be done after the 15-minute time period. All the tasks must be done within the 15-minute mission time. That includes all calculations, report of length measurements, and the photomosaic. If the judges do not see the finished product by the end of the 15-minute mission time, you will not receive points for it.

Teams must have passed safety inspection. All teams MUST have their blue, passed safety check card. If you do not have this, you do not get into the water. No exceptions. If you do not have it, you need to retrieve it. Time will not stop while you are retrieving your card.

5-minute setup time. Teams have 5 minutes to set up. Teams may put their vehicles into the water and test power/motors/etc. ROVs cannot descend and check out the missions during set up; they should go no deeper than 0.5 meters. Teams must start at the surface, side of the pool. If a team does not finish setting up within 5 minutes, their mission time starts. They can continue setting up and/or repairing their vehicle during mission time. If a team finishes setting up early, they do not get additional mission time. They can choose to start early or they can wait until their 5 minutes is up.

15-minute product demonstration time. Teams have 15 minutes to complete all the mission tasks. The judges will award points as you accomplish tasks. When the mission time ends, you receive points for the tasks that you have accomplished but cannot receive any additional points.

5-minute demobilization time: After the mission run, teams have 5 minutes to pack up and exit the station. The judges may need the CEO to remain a bit longer to confirm points, but the rest of the team and their equipment should be moved out of the area.

Time bonus: To receive a time bonus, teams must have completed all the tasks perfectly and have received no penalty points.

PRODUCT DEMONSTRATIONS

Order of tasks. Teams can start with part of any of the three tasks. Teams can go back and forth between the tasks as desired.

A few tasks logically have to be done in order: DEPLOYING YOUR VERTICAL PROFILING FLOAT IS INDEPENDENT OF CALCULATING WHERE THE GO-BGC FLOAT WILL NEXT APPEAR – AND RETRIEVING THE FLOAT. You can deploy your float at any time – you do not need to do the math first.

Weight:
Your will be weighed prior to each product demonstration run.

Once your ROV is weighed, team members cannot retrieve additional items for the vehicle or mission run. If you do, your ROV must be weighed again.

Launching Through the Hole in the Ice

Teams must launch their vehicle through the 1 meter x 1 meter hole in the ice. When your ROV is in the water, the tether must be through the hole in the ice the entire product demonstration run. Items can surface anywhere along the edge of the pool, with one exception. The GO-BGC float must surface through the hole. Other items can, be do not have to, surface through the hole in the ice.

TASK 1: Marine Renewable Energies

1.1 Replacing a damaged section of an inter-array power cable

This task must be completed in order. You cannot move on to the next step unless you have completed the prior step. That DOES NOT mean you cannot stop partway through and move on to something else, but you cannot continue the steps of this task if you cannot complete one of the steps of the task.

The mission is the same, but the mission props are slightly different between EXPLORER and PIONEER/RANGER:

- RANGER & PIONEER cables have U-bolts and 1-inch end caps
- EXPLORER do NOT have U-bolts but have the 1-inch end caps.

CONDUCTING A VISUAL INSPECTION OF THE CABLE: 5 POINTS
There will be a spot of brown paint – at least 1.5 cm in diameter – so it is not going to be small.
This will be on the pipe (not on a 1-inch end cap).

It may be on the bottom side or back side of the pipe, but it will not be hidden inside a cradle.
You receive 5 points when you identify that brown spot, meaning showing the station judges on a monitor.

CUTTING THE CABLE ON BOTH SIDES OF THE DAMAGED SECTION – 5 POINTS EACH, 10 POINTS TOTAL
This task simulates cutting the cable by pulling pins. You will need to pull the pins out. 5 points for each one, 10 points total.

Since this is simulating cutting the pipe – you can leave the pin on the bottom. In the real world it would not be an actual pin so it would not be actual debris.

REMOVING THE DAMAGED SECTION OF CABLE – 5 POINTS
In this case, removing is taking it out of the cradles and back to the surface, side of the pool.
When it is removed from the water, on the surface, side of the pool, the team receives 5 points.

And as a side note – your ROV CAN bring up (or down), multiple items at once. So you could pair bringing up the damaged section of cable with bringing up other things, such as the seagrass and failed buoyancy module.

INSTALLING A NEW SECTION OF CABLE – 10 POINTS
This is the one exception to doing this task 1.1 in order **IF (and only IF)**
Once you have removed the damaged section of cable from the cradles, but before you bring it up to the surface, you can install the new one. So if you brought the new one down and were holding it, you could grab the new one out of the cradle, put the new one in, and secure it before bringing the damaged one back up.

Installing the new cable is defined as placing it in BOTH cradles. It must be positioned between the two pipes on either side. When it is in the cradles and positioned between the others, the teams receive points.

SECURING THE NEW SECTION OF CABLE IN PLACE WITH WET-MATEABLE CONNECTORS – 5 POINTS EACH, 10 POINTS TOTAL
The wet-mateable connectors will be held onto the new section of cable via Velcro. This will not be a Velcro hooks to Velcro loops attachment, but a loops to loops – so it creates a little tension, but not a true Velcro stick.

IF ONE OF THESE FALLS OFF, YOU WILL EITHER NEED TO ASCEND TO THE SURFACE TO PLACE A NEW WET MATEABLE CONNECTOR ONTO the SECTION OR NOT RECEIVE POINTS FOR THIS TASK.

Once it is installed, the ROV must slide the wet-mateable connectors to the ends, where the will VELCRO attach to the hooks on the ends of the adjacent pipes. Teams will receive 5 points for each, 10 points total.

1.2 Replacing a damaged buoyancy module on an inter-array cable of a floating offshore wind turbine

REMOVING THE FAILED BUOYANCY MODULE

RELEASING THE CLAMP – 5 POINTS
The failed buoyancy module is held on by a small amount of tension and the fact that it is positively buoyant and on the underside of the pipe.

The failed buoyancy module will be attached to the blue section of pipe, which is part of the overall cable. It will be on the section of blue pipe without the Velcro underneath.

Teams must turn it and/or pull it off the pipe to get it to come off of the pipe. When it is no longer in contact with the blue pipe, teams will receive 5 points.

RECOVERING THE FAILED BUOYANCY MODULE – 5 POINTS
Once it is off the cable, teams can return it to the surface, side of the pool for 5 points.

ATTACHING A NEW BUOYANCY MODULE
The new buoyancy module will be on the surface, side of the pool.

ATTACHING THE NEW BOUYANCY MODULE – 5 points
The new buoyancy module will be on the surface, side of the pool.
It must be attached to the section of blue pipe with the Velcro underneath. When the foam is over the pipe, even if the Velcro is not attached, teams will receive 5 points.

SECURING THE CLAMP – 5 POINTS
Once there is a Velcro – Velcro attachment and the new buoyancy module stays on the pipe after being released by the ROV, you will receive 5 points.

NOTE: This could be done in conjunction with attaching the new buoyancy module.
If you attach it and it stays on after releasing it, you receive both sets of 5 points at once (10 total).

As a side note: How long does it have to stay on?

Once your judges award you points for it, the points will remain, even if it gets bumped or comes off after that. Usually just a couple of seconds after you have released it is enough for the judges to give the points.

1.3 Monitoring the Environment

DEPLOYING A HYDROPHONE TO DETECT AND RECORD THE PRESENCE OF MARINE MAMMALS

DEPLOYING THE HYDROPHONE – 5 POINTS
The hydrophone will be on the surface, side of the pool. It must be placed within the orange square.

The Base MUST be completely within the orange square – and not on top of the orange pipe – for the full five minutes. If the hydrophone comes out (ROV runs into the rope and drags it out), the time will restart. The hydrophone must be completely inside the pipe for 5 minutes.

RECOVERING THE HYDROPHONE TO EVALUATE DATA – 5 POINTS
This must be done after 5 minutes! When you deploy the hydrophone, the judges will note the time on the score sheet. The judges will let you know when 5 minutes or 2 minutes have elapsed. After that time, you can recover it. Recovery is defined as bringing the hydrophone to the surface, side of the pool.

Hint: It might not be ideal to wait until the 9:55 mark to deploy the hydrophone if you are hoping to have enough time to receive the points to recover it.

REMOVING A GHOST NET CAUGHT ON THE WIND TURBINES SUBSTRUCTURE

PULLING A PIN – 10 POINTS
The ghost net will be floating above the inter-array cable, attached by a rope. A pin will hold the rope in place; the pin goes through a hole in the PVC pipe and through a loop in the rope. Teams will receive 10 points when they pull the pin.

Again, since the pin is simulating cutting, it is not considered debris. You can leave it on the bottom or can bring it back if you choose.

REMOVING THE GHOST NET FROM THE WATER – 5 POINTS
Once the ghost net pin is pulled, the net will float to the surface and must be returned to the surface, side of the pool.

1.4 Piloting into the resident ROV docking station
At the end of all of the missions and just before the 15 minutes are up, teams can pilot their ROV into the docking station.

ONCE A ROV IS INTHE STATION (AFTER INFORMING THE JUDGE YOU ARE DOING SO) TEAMS CANNOT RECEIVE ANY ADDITIONAL POINTS. THE MISSION IS OVER AT THIS POINT.

If a team accidentally drifts into the docking station during the 15-minute product demonstration, that is fine. The mission will not end. Only when they tell the judges they are docking and do so that the mission is over.

There is a ½-inch end cap painted red near the center of the back wall of the docking station. To successfully dock, teams must pilot their ROV to push this red end cap. Pushing it will bring a magnet close to a magnetic reed switch. That will activate the circuit and an LED will light at the surface, on the control station. At the World Championship, having that LED light up will indicate successful docking.

Teams will get 15 points for doing this autonomously. To do so, teams must position the ROV just outside the entrance and go hands free. Teams may hit a button or two to start the process, but after that, the ROV must move in on its own.

Alternatively, teams may drive their vehicle manually into the docking station for 5 points.

TASK 2: OFFSHORE AQUACULTURE AND BLUE CARBON

2.1 INSPECTING AN OFFSHORE AQUACULTURE FISH PEN

INSPECTING THE NETTING TO IDENTIFY DAMAGED AREAS

FLYING A TRANSECT LINE TO IDENTIFY DAMAGED AREAS – 25 / 15 POINTS
This will be a line following mission. The large mesh netting attached to a PVC frame will be hanging on the side of the pool. The line is red colored rope on the mesh net.

Teams must start at one end and follow the red line across to the other end, then move vertically, across again, move vertically, and across once again to the other end.

The ROV must be close enough that the camera inspecting the netting does not see the adjacent horizontal section of red rope.

This can be done autonomously by piloting the ROV to the starting point and going hand-off, then the ROV follows the line. This is worth 25 points

Or it can be done manually by piloting along the line for 15 points.

If you are not successful, you can try again – either manually or autonomously.

IDENTIFYING AND COUNTING DAMAGED NET AREAS – 5 points
As you are inspecting, you can look for damaged areas. All damaged areas will be within 20 cm of the red rope – so fairly close. Damaged areas will be sections cut out of the mesh netting. There will be 2 to 5 damaged sections

You must tell the judges how many damaged areas there are and in what quadrants they are in – top left, top right, lower left, lower right.

REPAIRING A DAMAGED SECTION OF NETTING – 10 POINTS
After you identify how many damaged areas there are, you must patch one of them. It does not matter which one you patch; choose any of them. There will be a patch available at the surface, side of the

pool. The patch must completely cover the damaged section to get points. It does not need to be on straight, but it does need to be on and cover the entire damaged section.

REMOVING MARINE GROWTH

REMOVING ENCRUSTING MARINE GROWTH – 5 POINTS
There will be an encrusting marine growth attached to the netting by a small rectangle of Velcro. Your ROV must remove it. It can be left on the bottom; does not need to be returned to surface as it is not considered debris.

REMOVING ALGAL MARINE GROWTH – 5 POINTS
There will be three algal marine growths secured into the PVC framework of the netting. It should not be too difficult to pull these out; they are inserted into 3/16-inch holes drilled into the pipe.

You must remove all three, so they are no longer in contact with the netting. You will receive 5 points once you get all 3 out. These do not need to be returned to the surface, side of the pool.

MAINTAINING A HEALTHY ENVIRONMENT

MANAGE MORTALITIES BY REMOVING MORTS FROM THE FISH PEN

USING AI TO DIFFERENTIATE MORTS FROM LIVE FISH – 10 POINTS
Just before the mission starts, you will receive a video from inside the fish pen.

These will be available on a thumb drive at each mission station. The link will also be printed out, so if needed, it can be hand entered into a search to find the proper video.

Teams must create an AI program to differentiate between live fish and morts in the video. The video will be approximately 1 minute long (59 seconds to 1:05). Your program must highlight morts with a red box.

Inform the judges when you are ready to do this. One of the judges can watch and verify the program is working.

USING AI to differentiate morts from live fish is independent of collecting the mort and inserting it into the collection tube. You do not need to create an AI in order to pick up the mort in the pool.

COLLECTING A MORT – 5 POINTS
There will be one mort on the bottom of the pool. The EXPLORER Mort does not have rope grab point. RANGER and PIONEER morts do have a rope loop to grab. The Mort must be collected, which means that it must be under control of the ROV and no longer touching the bottom of the pool in order to get points.

INSERTING THE MORT INTO THE COLLECTION TUBE – 5 POINTS
Teams must put the plastic fish into the 5-gallon bucket. When fish is in the bucket, teams receive 5 points. The mort must be in the bucket, not resting or sitting on top. One end can stick out bit, but as much of the fish as possible should be in the bucket.

MEASURE FISH SIZE

DETERMINE THE AVERAGE SIZE OF THE FISH COHORT WITH 2 CM – 15 POINTS
There will be 3 more of the plastic fish with flotation to hold them above the bottom. Each fish will be cut and "elongated" with PVC pipe.

Teams must measure the length of each fish. The length measurement is from the front of the head to the tip of its tail. If you are measuring the fish via an estimation method, you MUST tell the judges how you are estimating the length of the fish. You are not permitted to guess randomly.

You must provide the judge with your math – length of the 3 fish measured and the estimated length of the fish. If you are within 2 cm, you will receive 15 points.

DETERMINE THE BIOMASS OF THE FISH COHORT – 5 POINTS
There will be a fish information sheet at the station area. This will have the average length of the fish, number of fish in the pen, a, and b parameters.

TEAMS MUST ATTEMPT TO MEASURE THE LENGTH OF THE FISH BEFORE CALCULATING THE BIOMASS. The length measurement does not need to be correct, but teams do need to try to measure the average fish length. If they do not, they cannot turn over the fish information sheet to continue this task.

Regardless of whether or not the average size is correct, teams will receive the fish information. Using those numbers, teams will calculate the biomass of the fish in the pen. Teams must be within 5 kg. Teams only receive one chance to do their calculations. If they are not correct, they may not try again.

Teams can use EXCEL or another program, or a calculator. Whatever they need to do the math.

FARM SEAGRASS

PRUNE AN EXISTING SEAGRASS BED – 5 points
There will be a seagrass bed on the bottom. It should not be in the green square but will be nearby. Teams must pick it up and return it to the surface, side of the pool to get points.

PLANT A NEW SEAGRASS BED – 5 points
On the surface, side of the pool there will be a seagrass bed. This one will have mesh attached. This seagrass must be placed completely inside the green square on the bottom. It cannot be on top of PVC or one foot outside of the square. It must be completely inside the green square and no longer in contact with ROV in order to receive points.

TASK 3: Antarctica Then and Now – Endurance22 and MATE Floats!

3.1 MATE Floats!
RECOVERING A GO-BGC FLOAT TO CONDUCT DIAGNOSTICS

DETERMINING THE LOCATION WHERE THE FLOAT WILL NEXT SURFACE – 5 POINTS
This must be done prior to recovering the GO-BGC float. Once you recover the GO-BGC float, you can no longer make these calculations.

On the station table there will be a laminated sheet of paper with:

- Current Speed
- Current Direction
- Time (in hours) until next surface event

In your team folder, you will have two blank grid maps, one for each mission attempt. This is the exact same as the one posted on the competition website.

You will use the information to determine the square where the float will next surface. The map will have a grid and the starting area marked. Teams must use the information provided to map out the square where the GO-BGC float will next surface.

In order to receive points:

- EXPLORER teams must be the exact square to receive 5 points
- RANGER/PIONEER teams must be within 1 square – either the designated square or an adjacent one to receive 5 points

If possible, tell your judges the distance the float traveled east as well as north or south. If you can also tell them how many squares the float moved both east as well as north or south, it will make it easier for them to score your team correctly.

For example, do not simply show them your grid map with a square marked; tell them the float moved 29 squares east and 8 squares south (if that is what your calculations showed). You could also tell the judges the float moved 68.13 km east and 15.79 km south.

RECOVERING THE FLOAT – 10 POINTS
The float will be on the surface, inside a red square. Teams must grab the float, get it under the red square, and return it to the side of the pool. THE GO-BGC FLOAT MUST SURFACE THOUGH THE HOLE IN THE ICE.

DESIGNING AND CONSTRUCTING AN OPERATION VERTICAL PROFILING FLOAT

PRIOR TO THE COMPETITION, BUILDING A FLOAT – 5 POINTS
Teams must build an operational float prior to the competition. Teams attempting this mission must have submitted a design document of their float (non-ROV device).

TEAMS SHOULD ALSO BRING THEIR DESIGN DOCUMENT TO SHOW THE STATION JUDGES.

THE DOCUMENT MUST SHOW WHETHER THE TEAM IS USING A BUOYANCY ENGINE OR WHETHER THEY ARE USING PROPELLER THRUST TO MOVE. A BOUYANCY ENGINE IS ANYTHING THAT MOVES AIR/WATER AROUND INSIDE OR PUMPS WATER OR AIR IN AND OUT OF THE BOUY.

THE FLOAT MUST MOVE UP AND DOWN INDEPENDENTLY. THE ROV CANNOT PUMP AIR INTO IT, NOR CAN IT BE CONNECTED TO THE SURFACE BY AN AIR TUBE OR TETHER. IT MUST ASCEND AND DESCEND ON ITS OWN INDEPENDENTLY.

DEPLOYING THE FLOAT IN THE DESIGNATED AREA – 5 POINTS
If documentation is provided to the judges, teams can attempt to deploy their float in the yellow square on the surface of the pool.
To receive points for deploying, the float MUST be released from the ROV, no longer in contact with the ROV, and it MUST be floating on surface inside the yellow square.

FLOAT COMPLETES VERTICAL PROFILES
Once it has been deployed, the float should attempt to complete two vertical profiles. Using a buoyancy engine, the float must go from the surface down to the bottom then back to surface, which is 1 profile, and teams will receive 15 points.

Note, the float does not need to come up in the yellow square; it can surface anywhere in the mission area.

Then the float must complete a 2nd profile – descend the ascend – to receive 10 additional points.

PIONEER and RANGER teams can use a motor and propeller to move the float up and down – i.e., NOT use a buoyancy engine – but they received less points. Teams that use a motor/propeller to move their float receive 5 points for 1st vertical profile, 10 additional points for a 2nd profile.

A buoyancy engine is moving fluid (air, water, oil) around the float to change it buoyancy. It can bring water in from outside or push water out from inside.

- A motor can move the fluid and still be considered a buoyancy engine.
- The motor cannot turn a propeller.

If a motor is turning a propeller – that is not using a buoyancy engine. RANGER and PIONEER can do this but will receive fewer points.

3.2 Endurance22
FINDING AND MAPPING THE LOCATION OF THE ENDURANCE

FLYING A TRANSECT OVER THE AREA OF THE WRECK – 10 POINTS
Teams must fly a transect over the area of the wreck. The ROV must start on one side of the transect and move from one end to the other. While flying the transect, the blue pipes in view at all times, but the red pipes further out must never be in view.

You can designate a certain camera for this task. Let the judges know which screen is showing the transect. On that video screen, the blue pipes must be in view at all times, the red pipes must never be in view.

MAPPING THE WRECK – 5 POINTS
There are 8 rectangles in the wreck area. Teams need to map which rectangles contain the wreck. Teams MUST create their own map on a video screen, they cannot do this on paper. The image should show the 8 rectangles of wreck area. Teams must draw the wreck in the proper rectangles; if part of the wreck is in that rectangle, it should be included.

TEAMS CANNOT SUBMIT A PHOTO FOR THIS TASK. Teams cannot use a look down photo as their map. The map must be digitally created with lines and the wreck drawn in the proper rectangles. There will be some benthic species on the map that do not need to be included in the map (but can be).

CREATING A PHOTOMOSAIC OF THE WRECK

COLLECTING THE IMAGES OF ALL SECTIONS – 5 POINTS
The first part requires taking 8 photos. A separate image of each rectangle must be taken. You cannot take a larger image and split it up. Each photo MUST be one entire rectangle. It can include sections of the nearest adjacent rectangles, but nothing beyond that; it cannot show two or more complete rectangles. The judges must be able to see these 8 images. Teams can move the ROV anywhere they want to take the 8 photos.

CREATING THE PHOTOMOSAIC – 20 POINTS
Teams must take their 8 photos and stitch these into a photomosaic. This can be done autonomously or manually.

AUTONOMOUS:
Team members can transfer the 8 photos to a computer device at the station manually, but the photos cannot be manipulated in any way. You must send the 8 photos taken by the ROV. The program must stitch them together into a photomosaic, lining up the edges of the rectangles as best as possible.

MANUAL:
A team member at the mission station takes the images and, using a computer, cuts and pastes the images into a photomosaic.

MEASURING THE LENGTH OF THE WRECK FROM BOW TO STERN – 10 POINTS

Finally, although it does not have to the be final task – teams must measure the length of the wreck from bow to stern without touching it! How you measure this is up to you – but let your station judges know how you are accomplishing this. For example, if your team is estimating the length from something in view, tell the station judges what you are doing and how you are making your estimation. When you have your length measurement, inform the station judges.

TOUCHING THE WRECK – AT ANY TIME – IS A 5 POINT PENALTY – WHICH YOU CAN GET UP TO 5 TIMES

Make sure you are aware of your surroundings and do not bump into the wreck. Keep your tether up off the bottom of the pool and not dragging around behind you.

AFTER THE PRODUCT DEMONSTRATION RUN

The station judges will total your score and review that score with the team CEO. THIS IS VERY IMPORTANT. If you feel the judges made a mistake, deal with it then. Inform the judges then and there that you think they did not score your run appropriately.

Before the CEO leaves the station, they will initial the score sheet. If you think there is an issue, do not sign off. Let the judges know what that issue is and resolve it then. Once the CEO signs off, there is no challenging scores at a later time.

GENERAL INFORMATION

EVERYTHING MUST BE DONE IN THE 15 MINUTE TIME PERIOD. TEAMS CANNOT TURN IN CALCULATIONS OR RESULTS AFTER THE 15 MINUTE TIME IS OVER.

Talk to your judges – let them know what you are doing – and how you are doing it, including Taking measurements, creating your photomosaic, and any autonomous functions.

REFERENCES

- See the Prop Building Instructions for images and measurements of the missions.
- See the Fly-Through for a video representation.
- Check the competition manual for more details.
- See the score sheets that are posted for the product demonstration.

Good luck everyone!!!