COMPETITION MANUAL

MATE ROV COMPETITION

2026

PIONEER

2026 MATE ROV COMPETITION:

Pushing Performance: Science, Technology, & Discovery in Harsh Environments

PIONEER CLASS COMPETITION MANUAL

For general competition information, including a description of the different competition classes and eligibility requirements, visit Compete.

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Edits:
December 16, 2025:
References: Two references are out of date, two new references linked
Task 2.5: eDNA biodiversity sensor renamed eDNA sensor.
Task 2.5: pg. 41. Station judge will provide companies with the data.

OVERVIEW

From Technical Talents to Teamwork, Problem-Solving, Creativity, and Critical Thinking: MATE Develops Skills for Success in the Workforce.

As you prepare to develop and deploy technologies to monitor ocean conditions and understand ecosystems, make sure to find a moment to reflect on the skills that you are developing to allow you to tackle these tasks. These are the skills that you will take with you along your educational journey and pathway into the workplace.

They also happen to be the skills that are in high demand by employers around the globe. Machine learning, data analytics, AI, video marketing, critical thinking, creativity, collaboration, time management, and leadership – articles published by LinkedIn and Forbes Magazine highlight these technical and employability (aka "Soft") skills as the most "in-demand for the next 10 years" and, likely, beyond.

A number of these skills could be described as "entrepreneurial," part of a skill set that also includes the ability to understand the breadth of business operations (from using data to make informed financial decisions to researching and critiquing potential design solutions and producing content for media outreach); acknowledge your strengths (and weaknesses!); work as an integral part of a team; and apply technical knowledge and skills in new and creative ways. By developing a business acumen, a mindset for innovation and collaboration, and an understanding of how to take environmental, social, and governance (ESG) factors into consideration when making business decisions, you will be well prepared for the global workplace and ready to tackle today's (and tomorrow's!) challenges.

As you read through this manual you will see the following icons:*

These icons correspond to the employability (orange) and ROV-specific (green) knowledge and skills that you gain as you build your ROV and prepare for the competition and which of the various competition requirements – from Product Demonstration to Engineering and Communication – help to develop each of these skills.

**These icons are from* Evaluate-Compete*, which is designed to help give you a competitive edge in preparing for the competition and the workforce! High school and college teams are invited to participate in the projects pilot testing phase. Visit Evaluate-Compete for more information.*

THINK OF YOURSELVES AS ENTREPRENEURS

The MATE ROV Competition not only encourages you to reflect on the skills that you develop, but for more than a decade has also challenged you to think of yourself as an entrepreneur, embrace the skills that being one requires, and transform and organize your team into a start-up company. Use the following questions as a guide to assist you with this process:

- What is your company name?
- Who are its leaders, including the:
    - CEO (chief executive officer – the leader)
    - CFO (chief financial officer who oversees the budget and spending)
- Who manages Government and Regulatory Affairs (i.e. who's in charge of reviewing the competition rules and making sure that they are understood and followed by everyone)?
- Who is responsible for research and development (aka R&D)?
- Who is responsible for system(s) engineering? Design integration? Testing? Operations?
- Who is responsible for fund-raising, marketing, and media outreach?
- Who is the company's ESG research and engagement analyst?
- What other positions might you need? (Depending on your personnel resources, more than one person may fill more than one role.)
- What products and services do you provide?
- Beyond MATE, who are your potential clients?

MATE ROV COMPETITION PHILOSOPHY

In short, the MATE ROV Competition's philosophy is about **student learning**. It is student-centric and student-driven. It is about the knowledge and skills gained through participating in the competition and what you're learned prepares you for your future career in the ocean STEM workforce – and beyond.

The 2026 MATE ROV Competition continues to embody this philosophy as well as MATE's tradition of engaging and empowering participants to do "good for good" for our planet and global community. And with that, you are presented with a request for proposals (RFP), the specifics of which are included below.

PIONEER CLASS DEMONSTRATION

All PIONEER class companies are required to submit a video that:

- Demonstrates the ability of their vehicle to perform specific tasks.
- Shows compliance with MATE's design, build, and safety specifications.

Video specifications:

Video specifications: The video MUST show the following ROV features for the specified amount of time. Companies can choose to narrate the video to help explain how their vehicle meets these required specifications. Alternatively, a MATE official may schedule a video conferencing session

with the company. During the session, companies must visually show, and answer questions about, the following ROV features.

The video MUST show in this order:
IMPORTANT NOTE!!! PIONEER class companies may power their ROV using either a 48-volt or a 12-volt supply. Additional details on PIONEER power supplies can be found in section 3.3 Electrical.

1. If using 48 volts, 15 seconds (or more) of the 48-volt power supply **(ELEC-002P).**
2. If using 48-volts, 15 seconds (or more) showing a properly sized Littelfuse. The company MUST use a ruler to show that this fuse is within 30 cm of Anderson Powerpole connectors. **(ELEC-008P, ELEC-010P)**.
   If using 12 volts, 15 seconds (or more) showing a properly sized fuse within 30 cm of the main point of connection. The company must use a ruler to show this distance **(ELEC-008P)**.
3. 30 seconds (or more) of the inside of the control box showing the wiring and components. If the company uses a control box, 30 seconds showing the inside of the control box including the wiring and components. MATE will be looking for:
   - No exposed wiring **(ELEC-017P)**.
   - That the control box is neatly laid out with attention to workmanship. **(ELEC-022P)**.
   - Separation and identification of 120VAC wiring from DC and control voltages. **(ELEC-023P**). If 120VAC is not used in the control box, you should video a slide stating that AC power is not used in the control box.

   If the company does not use a control box, 15 seconds (or more) showing the entire control system (controller, laptop/computer, etc.).
4. If using 48 volts, 15 seconds (or more) in the control system showing that there is no conversion of the 48V until it reaches the ROV. Power supplies, ESCs, H-Bridges or other voltage conversion devices are not allowed on the surface. **(ELEC-003P & ELEC 004P)**.
5. 30 seconds (or more) showing any hydraulic / pneumatic systems including an on/off valve, a pressure release valve and a regulator in the system **(FLUID-004, FLUID-008),** and that any pressurized cylinder, pressure storage device meets the MATE specifications of **(FLUID-009, FLUID-011). Note for 2026:** 15 seconds (or more) showing the specifications for pneumatic components, including the pressure rating of any tubing used. In addition, the type of fluid should be clearly stated in the video (**FLUID-001, FLUID-005).** If the vehicle does not use fluid power**, you should video a slide stating that Fluid Power is not used on this ROV for 10 seconds.**
6. 15 seconds (or more) showing the top-side strain relief. The video must show the tether and wires, with strain relief, entering the control station or topside controller **(ELEC-024P).**
7. 15 seconds (or more) showing the bottom-side strain relief. The video must show the tether entering the ROV and strain relief for the tether **(ELEC-024P).**
8. 60 seconds (or more) total, 10 seconds (or more) per side of the ROV (4 sides plus top and bottom) showing that all motors are waterproofed, and propellers are shrouded and

protected with guards. There are no sharp edges or elements of the ROV that could cause damage **(MECH-006, ELEC-017P).**

Video demonstrating specific tasks: Following those requirements, the video must demonstrate that the ROV can complete the following product demonstration tasks. The ROV must complete all the tasks within 15 minutes.

The UNCUT video must show the vehicle:

1. Launching safely from the side of the pool and maneuvering to the tasks.
    a. See specifications **(MECH-004 & MECH-005).**
2. Completing the required tasks. This includes:
    a. Collect species from the coral garden
        i. Collect one basket star and return it to the surface, side of the pool
        ii. Collect one coral species and return it to the surface, side of the pool
    b. Service the Holyrood subsea observatory
        i. Recover the old eDNA sensor
        ii. Install a new eDNA sensor
    c. Powering an oil platform from a wind turbine
        i. Retrieve the power connector from the wind farm subsea station
        ii. Remove the cover from the oil platform port
        iii. Install the power connector into the oil platform port

    NOTE: For this demonstration, companies only need to collect one basket star and one coral species. The coral species can be recovered by either the substrate or by the coral (e.g., colored chenille pipe cleaners). All product demonstration tasks required for the demonstration video should follow the rules noted in the Product Demonstration notes.

The camera angle must demonstrate that the ROV is under its own power and not assisted by humans when in the water. The MATE ROV Competition requires that the camera show the complete ROV in the field of view at all times. A video that cuts between camera angles will not pass the demonstration requirement of "uncut" footage. The video is permitted to show a split screen or may incorporate a separate window showing the ROV camera or other footage. However, the video MUST show an uncut view of the vehicle from launch to completion of the tasks. The tasks must be completed within 15 minutes.

Companies may complete the tasks in any order they wish.

Note for 2026!!!
* Companies that advance from a PIONEER class regional do not need to submit a task demonstration video but **MUST** submit the design and safety specifications video**.**

See Documentation Submissions Guidelines for submission information. Additional submission information can be found in SUBMISSION GUIDELINES AND KEY DEADLINES.

Companies are allowed to make minor changes to their ROV after their video demonstration, but the overall systems must be the same. Minor changes include adding/removing buoyancy, adding tools/sensors that were not used for the demonstration, etc. The frame, motor configuration, and the control system must be the same for the video demonstration and the World Championship competition. Safety inspectors will refer to images of the vehicle and control system taken from the demonstration video. Vehicles with different systems will not pass the safety inspection.

NOTE for 2026!!!

PIONEER class companies are encouraged to contact the regional coordinator closet to them about opportunities to showcase their vehicles, volunteer as judges, and/or otherwise participate in regional events.

Regional competitions benefit from the participation of PIONEER class companies by:

- Showcasing PIONEER ROVs to RANGER, NAVIGATOR and SCOUT class companies to help them to learn about advanced systems and get ideas for "next year"
- Inspiring RANGER, NAVIGATOR, and SCOUT students to see what's possible if they continue to progress through the competition classes
- Providing examples of educational pathways and potential post-secondary institutions and programs to continue to pursue STEM learning
- Having access to additional volunteers and judges

Companies benefit from attending the regional by:

- Having access to product demonstration props and the opportunity to conduct a "wet" run
- Receiving feedback from safety inspectors, including identification of potential safety violations and what can be done to enhance their vehicle from a safety standpoint
- Receiving technical help from engineers and technicians as well as from other companies
- Gaining insight and sharing ideas with other companies
- Earning points for the corporate responsibility portion of the competition
- Recruiting graduating high school students to your college/university and your ROV team

PART 1: PRODUCT DEMONSTRATION

OVERVIEW

PIONEER class companies will take part in ONE product demonstration that consists of four distinct tasks:

TASK #1: ***Seabed 2023: A Kaleidoscope of Corals in Cold Water***
TASK #2: ***SmartAtlantic Alliance: Better Information, Better Decisions***
TASK #3: ***Wind-Powered Offshore Oil Platform: Scalable Solutions for Global Energy Needs***
TASK #4: ***MATE Floats Under the Ice***

NEW for 2026!!!
Hosting the World Championship in St. John's, Newfoundland and Labrador allows MATE to offer students the incredible opportunity to operate their technologies in unique, one-of-a-kind venues. These venues include an ice tank (where a thin layer of ice will cover the surface), a wave tank (where waves *and* wind can be generated), and a flume tank (where a current will be created).

Companies will compete in three distinct product demonstrations. The tasks will be divided amongst the three venues; ROVs will operate in the wave and flume tanks, while floats will operate in the ice tank (see PRODUCT DEMONSTRATION for information on which tasks will be at which venue).

The flume tank is located at the Marine Institute of Memorial University, while the ice and wave tanks are located at the National Research Council, which is located 3 km (1.9 miles) away. Given the distance between and uniqueness of these venues, companies will receive only ONE attempt at each product demonstration task. All three product demonstration scores (along with the collaborative task) will be added to the engineering and communication and safety scores to determine the total overall score for the competition.

NOTE: Regional competitions may not divide the tasks into different product demonstration attempts; all four demonstration tasks may be included in each product demonstration run. Regional competitions may not include all four tasks of the product demonstration. Regional competitions may also provide companies with more than one attempt at the product demonstration. If competing at a regional event, contact your regional coordinator or visit your regional contest's website to determine what will take place at your regional competition. Regardless, the product demonstration score will be added to your ENGINEERING & COMMUNICATION and SAFETY scores to determine your total, overall score for the competition.

SCORING OVERVIEW

The competition consists of product demonstrations, engineering and communication, and safety with the following scoring breakdown:

- **Product demonstrations**
    - 350 points (max), plus a time bonus
    - Weight restrictions

        - 10 points (max)
    - Product demonstration organizational effectiveness
        - 10 points (max)
    - Jobsite Safety & Environmental Analysis
        - 5 points (max)
- **Engineering & Communication**
    - Technical documentation
        - 100 points (max)
    - Engineering presentations
        - 100 points (max)
    - Marketing displays
        - 50 points (max)
    - Company Spec Sheet
        - 20 points (max)
    - Corporate Responsibility
        - 20 points (max)
- **Safety**
    - Initial Safety and Documentation Review
        - 20 points (max)
    - Safety and Workmanship Inspection
        - 50 points (max)
    - Jobsite Safety and Environment Analysis (JSEAs)
        - 10 points (max)

TOTAL POINTS = 745

NOTE: Regional contests may not require all of the Engineering & Communications components or offer the opportunity to earn points for Corporate Responsibility. If competing at a regional event, contact your regional coordinator or visit your regional contest's website for more information.

TIME

NEW for 2026!!!

Each product demonstration includes:

- 5 minutes to set up at the product demonstration station
- 15 minutes to attempt the tasks
- 5 minutes to break down and exit the product demonstration station

Your company will have 5 minutes to set up your system, 15 minutes to complete the tasks, and 5 minutes to demobilize your equipment and exit the product demonstration station. During the 5-minute set-up, you may place the ROV in the water for testing and/or trimming purposes. The 15-

minute demonstration period will begin after the full 5 minutes of set up time expires, regardless of whether the company is ready to start the product demonstration. It may begin sooner if your CEO notifies the product demonstration station judges that your company is ready to begin.

At any time during the demonstration, you may pilot your ROV to the surface and remove the vehicle from the water for such things as buoyancy adjustments, payload changes, and troubleshooting, but the 15-minute product demonstration clock will only stop if a judge determines it is necessary for reasons beyond your control. Otherwise, the clock will only stop after all of the tasks are successfully completed and the ROV has been piloted to the surface, side of the pool and is withing the grasp of a company member. Your ROV is not required to return to the surface between tasks.

Your 5-minute demobilization will begin as soon as the 15-minute demonstration time ends, regardless of where your ROV is located (i.e., still at depth, on the surface, etc.).

Regional competitions may alter the set-up, product demonstration time, or demobilization time. If competing at a regional event, contact your regional coordinator or visit your regional contest's website to verify the timing of your product demonstrations.

TIME BONUS

Companies will receive a time bonus for product demonstration Tasks 1 – 3 if you:

1) successfully complete all the tasks,
2) return your ROV to the surface under its own power so that it touches the side of the pool, and
3) physically touch your vehicle before the demonstration time ends.

Companies will receive 1 point for every minute and 0.01 point for every second under 15 minutes remaining.

The MATE Floats! mission will not be awarded a time bonus for early completion.

CONTEXT & NEED

What's in store for the 2026 MATE ROV Competition season? Interesting (and challenging!) mission scenarios, including a first-time ever operating environment and technology-integration task for teams advancing to the World Championship. But we're getting ahead of ourselves!

This season, alongside the Decade of Ocean Science for Sustainable Development (2021-2030), the MATE ROV Competition is highlighting priorities of the Decade of Action for Cryospheric Sciences (2025-2034). Endorsed by the United Nations, the Decade of Action for Cryospheric Sciences is a global effort to boost research, strengthen international collaboration, drive action, and raise awareness about the vital role of Earth's frozen regions. The initiative calls on scientists, technologists, governments, and communities worldwide to unite to protect the cryosphere and safeguard the billions of people who depend on it for their livelihoods and survival.

The cryosphere includes polar ice sheets and sea ice, mountain glaciers, snowpacks, ice on lakes and rivers, and permafrost (soils that stay below 0°C for years). Although it may seem remote, the

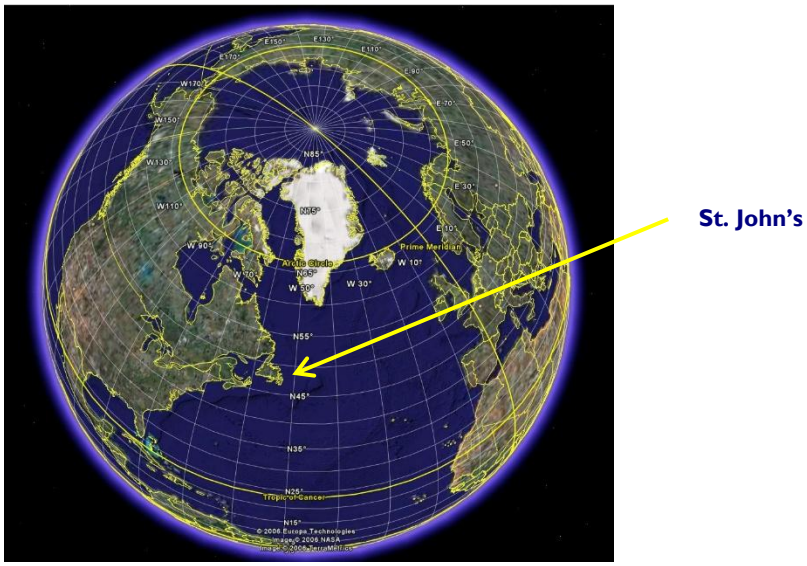
cryosphere covers a huge area, around 10% of the Earth's land, and stores most of the planet's freshwater. About 70% of the world's fresh water is locked up in the cryosphere. This means most river water and drinking water ultimately come from snow and ice melt.

The UN resolution that established the Decade of Action for Cryospheric Sciences calls on us to achieve the following 4 goals to deepen our understanding of cryospheric changes and develop solutions:

- Advance scientific research and monitoring
- Raise awareness
- Support adaptation
- Build on global initiatives, like the Decade of Ocean Science for Sustainable Development

If we are to attempt to achieve these goals, we'll need technologies capable of performing in cold, icy, harsh environments – and facilities in which to test them.

It seems quite fitting, then, that the 2026 MATE World Championship is taking place in the city of St. John's. Located ~2,100 km south of the Arctic Circle, St. John's is the capital of the province of Newfoundland and Labrador, Canada, on the "Eastern Edge" of North America. The oldest city in North America, St. John's offers old-world charm, unique architectural, historic and natural attractions, and is located in close proximity to spectacular coastlines, historic villages, and a diverse selection of wildlife.



Even more relevant for the 2026 season, the city is also home to Marine Institute (MI) of Memorial University of Newfoundland and the National Research Council Canada's (NRC) world-class facilities. MI houses the world's largest flume tank, with a water capacity of 1.7 million liters and water velocity ranging from 0–1 meters per second. The flume tank's viewing gallery has a 20 meter-by-3 meter viewing window and seats 150 people. The NRC includes an ice tank and offshore engineering basin. In the ice tank, the water surface can be frozen, and the air temperature maintained at a uniform –30 to 15 degrees Celsius to simulate the polar environment. The offshore

engineering basin is used to simulate the extreme ocean environment; waves, wind, and currents can be controlled to achieve various sea states.

The ability to simulate harsh, extreme conditions in a controlled environment not only makes these facilities unique, but is also sought after by organizations, institutions, and corporations from around the world that understand the need to push the performance of their technologies before deploying them in the real world. Scientists, engineers, and technicians use the facilities at the MI and NRC to demonstrate and test the vehicles, instrumentation, and equipment that supports their research, data collection, mapping, exploration, and energy operations to prove their real-world readiness because "if it works here, it will work anywhere."

This year, those teams that advance to the MATE World Championship will have access to these facilities and that same opportunity to push the performance of their technologies. (As they say at The Launch, MI's state-of-the-art marine base in Holyrood, NL, "[it's] as real as it gets.") While not staged in an ice tank, offshore engineering basin, or flume tank, the 2026 mission tasks will be equally as unique and challenging at MATE regional events, where ROVs and vertical floats will be pushed to perform in new and innovative ways.

While the specific mission tasks (including the first-ever staged in saltwater debuting at the MATE World Championship 😉) may come as a surprise, the following sentence should not. This competition season, MATE's 24th, the "client" is us: our global community of learners, inspired by the ocean, innovating and collaborating to address environmental and societal challenges.

This year the MATE ROV Competition is challenging its community to design and build a remotely operated vehicle and the necessary sensors, tooling, and complementary technologies to tackle mission tasks that include demonstrating the efficacy of offshore wind turbines in powering offshore oil rigs; mapping the seabed and documenting discoveries; deploying instrumentation and monitoring the health of cold-water habitats; and operating equipment under the ice. Equipped with scientific data (and discoveries!) and technology solutions, and with an understanding of the actions that we need to take, we can proactively and confidently move from the ocean – and cryosphere – we have to the ocean, fluid and frozen, that we want.

It should also come as no surprise that our success depends on an appropriately educated and skilled workforce, one that is aware of and informed about the challenges we face and prepared to apply its knowledge and skills to tackling them.

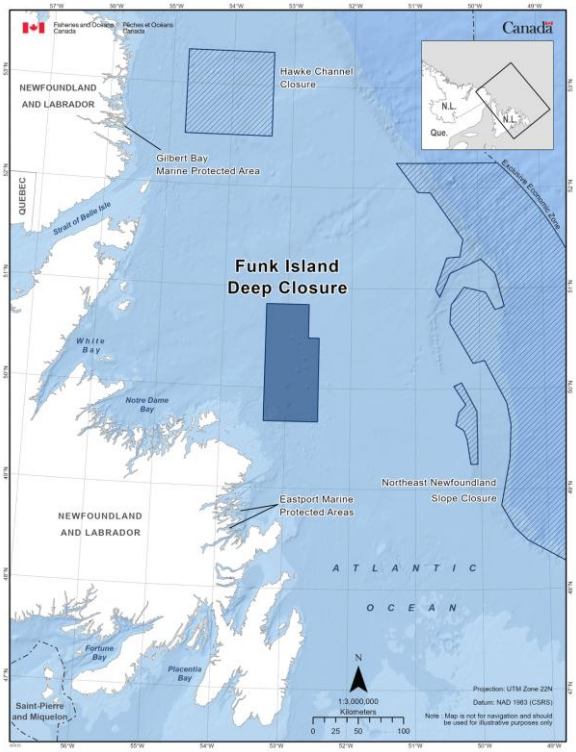
REQUEST FOR PROPOSALS (RFP)

1. General
    a. Overarching:
    Ocean Decade Challenges for collective impact:
    #9: Skills, knowledge, and technology for all
    #10: Skills, knowledge, technology and participation for all
    Decade of Action for Cryospheric Science Goals

Advance scientific research and monitoring
Raise awareness
Support adaptation
Build on global initiatives

b. Mission Task 1: *Seabed 2023: A Kaleidoscope of Corals in Cold Water*
Ocean Decade Challenges for collective impact:
#2: Protect and restore ecosystems and biodiversity
#8: Create a digital representation of the ocean

In addition to hosting the 2026 MATE World Championship, the Marine Institute of Memorial University conducts research and student training cruises in the waters around Newfoundland and Labrador. On a recent training expedition to the Funk Island Deep marine refuge, located off the northeast coast of Newfoundland, researchers discovered an amazing (and rare) site – a densely populated soft coral garden on the seafloor.



A map of the Funk Island Deep Marine Refuge. Funk Island Deep Closure.

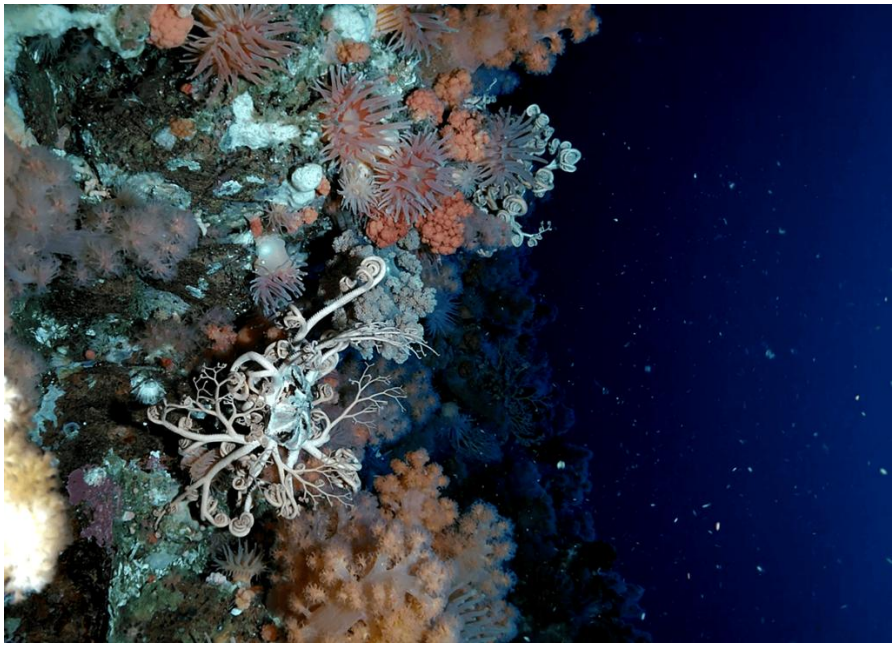
Less familiar than the hard corals that comprise warm-water coral reefs, cold-water soft corals are found worldwide in all oceans, from the tropics to the polar regions, typically in the deep sea where temperatures are cold. They can be found from a few meters deep to over 6,000 meters, often on underwater mountains, seamounts, and continental slopes.

Soft-bodied corals of the species captured by video in the Funk Island Deep are known to be abundant in the northwest Atlantic, but what made this sighting so extraordinary was both the

density and the extent of the corals. Researchers estimate the area of the coral garden to be around 10,000 square meters. What was also surprising was the depth; finding such dense concentrations of corals at depths of less than 200 meters are rare.

The corals are so densely packed that researchers are unable to see the seafloor. Rare Coral Habitat Discovered using Rayfin Camera — SubC Imaging.

Using video footage, researchers were able to identify at least two different species of coral, along with other marine life, such as sponges, basket stars, anemones, crabs, arthropods, and fish. It marks the first time such a habitat has been documented in these waters. It also speaks to the potential for other, equally unique and surprising, discoveries to be made as scientists, engineers, and technicians continue to survey and map the seafloor.



Cold water soft corals found in the Funk Island Deep marine refuge. Rare Coral Habitat Discovered using Rayfin Camera — SubC Imaging.

Finding the coral garden in the Funk Island Deep is only the beginning; researchers at the Marine Institute are eager to study and understand it, including the number of coral species present, their interaction with the substrate, and their relationship with the other species that inhabit the ecosystem. And, as part of the Institute's 4D Oceans Lab mission, they are also interested in further imaging and mapping it; while the ocean contributes significantly to Canada's economy, less than 10% has been adequately mapped and the spatial distribution of most species is not well understood.

These efforts will likely include photogrammetry, another "tool" that researchers can use to create maps and images of an area. Photogrammetry is a method of approximating a 3D structure using two dimensional images where photographs are stitched together using software to make a 3D model. It can support scientists by providing an efficient way to characterize this cold-water coral ecosystem as well as monitor future changes in it.

And while the strong currents that sweep over and around the ridge on which the corals are located can make studying and monitoring the ecosystem challenging, the Marine Institute houses the ideal training facility for operating in a current. The Marine Institute's Flume Tank, the world's largest, will offer coral garden researchers the opportunity to practice maneuvering and maintaining position in a simulated environment, enabling and empowering their work to understand this kaleidoscope of coral colors in the cold ocean.

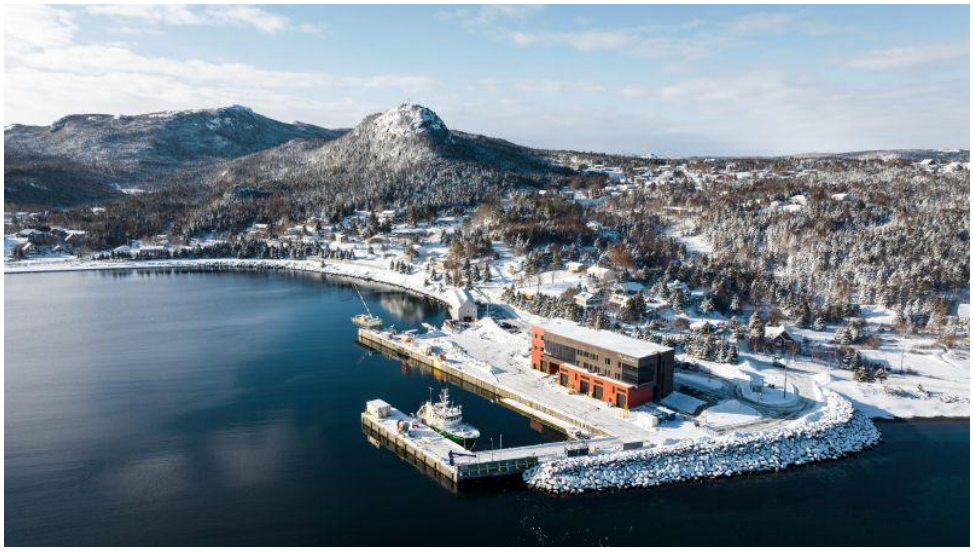
The Flume Tank. Photo from Marine Institute.

c. Mission Task #2: *SmartAtlantic Alliance: Better Information, Better Decisions*
   Ocean Decade Challenges for collective impact:
   #2: Protect and restore ecosystems and biodiversity
   #7: Expand the Global Ocean Observing System

The SmartAtlantic Alliance is an initiative of the Marine Institute of Memorial University of Newfoundland's Centre for Applied Ocean Technology and the Centre for Ocean Ventures and

Entrepreneurship (COVE) of Halifax, Nova Scotia. The Alliance supports operational efficiency, situational awareness, and safety in the marine environment; its buoy data, weather forecasts, and information products contribute to the country's coastal and ocean management efforts and are available for free to the public via its website.

Part of the SmartAtlantic Alliance, the Holyrood Subsea Observatory was installed in February 2021 to enable real-time monitoring of the ocean and marine life in Conception Bay. Located approximately four kilometers north of the Marine Institute's Holyrood Marine Base (also known as The Launch), the observatory sits in water depths of 85 meters and sends real-time data to the marine base via a fiber-optic cable on the seafloor. The observatory is expandable and will also serve as a development, testing, and demonstration facility for subsea instrumentation intended for harsh environment operation.



The Launch in Holyrood

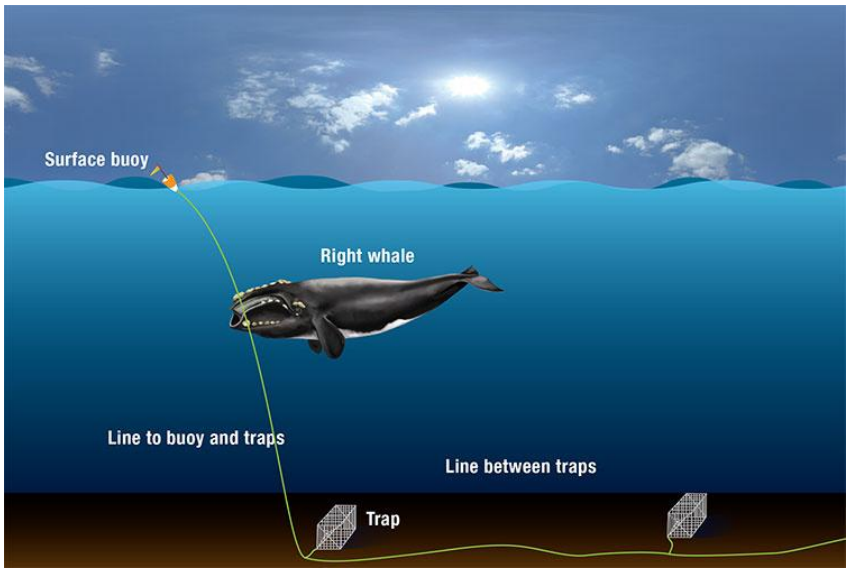
One such instrument is an eDNA sensor. eDNA technology allows for the detection and monitoring of species using DNA fragments shed by organisms in the water column. It involves collecting and processing water samples (and not organisms!) to sequence for DNA, providing a non-invasive, cost-effective, and comprehensive approach to determining the presence of species in ocean ecosystems. eDNA is a powerful tool for cataloging biodiversity; combining it with video, images, and data will help to paint a more accurate and complete picture of the environment and ecosystem.

An eDNA sensor. [Detecting fish with the innovative Fish Sensing Box]

The camera currently installed on the Holyrood Subsea Observatory also serves as a powerful tool for cataloging organisms. The camera transmits live video feed to the marine base for five minutes every hour. The video is used to identify organisms and determine their frequency, which provides an estimate on patterns and trends of diversity within the habitat and can be used to validate eDNA data – and vice versa.

While the Holyrood Subsea Observatory has been instrumental in detecting and identifying marine life, there is one species of interest that, because it inhabits shallow depth, has escaped detection. Native to central Europe, the European green crab, *Carcinus maenas*, is an invasive species in North America and in 2007, it was confirmed in the waters of Newfoundland and Labrador. The crab is naturally aggressive, consumes many native shellfish and finfish, and can damage sensitive eelgrass habitats. Current efforts are underway to mitigate their spread. These include physically removing crabs from the environment – without mistakenly removing look-alike native crab species.

Better information, better decisions – that is what new technology can enable, and that is certainly the case with the North Atlantic Right Whale. These whales are classified as critically endangered, with the population estimated at less than 400 individuals, including less than 80 breeding females. One of the issues faced by the Northern Right Whales is entanglement with fishing gear, particularly the lines used in lobster traps common in the area. Scientists and engineers have developed and are working with companies to field-test on-demand (also known as ropeless or buoyless) fishing technology. One such system replaces the vertical line in the water column with a bottom-stowed coiled rope and buoy in a weighted cage on the lobster trap. Fishers send an acoustic signal, which releases the buoy to the surface where it can immediately be recovered and hauled into their boats, increasing their reliability and efficiency all the while reducing the risk of entanglement for the whale and other marine species.



North Atlantic Right Whale | NOAA Fisheries

How to avoid colliding with an iceberg is another situation where better information is key to making better decisions. Icebergs are common in Newfoundland and Labrador waters and, while awe-inspiring when seen aboard a tour boat, can pose a threat to offshore structures, including oil platforms and their subsea assets and infrastructure. St. John's is a hub for the province's offshore petroleum industry, with four major offshore oil platforms, Hebron, Hibernia, Terra Nova and Sea Rose, within 350 km of the city. A collision with an iceberg could be disastrous, damaging the structure, endangering the lives of personnel, and potentially threatening the environment, especially given that roughly 90% of an iceberg's mass is underwater. Iceberg avoidance is a crucial consideration for platform operators, making monitoring instrumentation and data products like those provided by the SmartAtlantic Alliance all the more critical for ensuring operational efficiency, situational awareness, and safety in the marine environment.

Left: Famous Icebergs of Newfoundland & Labrador - Newfoundland and Labrador, Canada. Right: The Hibernia oil production platform, one of four installations located off the coast of Newfoundland (www.hibernia.ca)

d. Mission Task #3: *Wind-Powered Offshore Oil Platform: Scalable Solutions for Global Energy Needs*
   Ocean Decade Challenges for collective impact:
   - **#4: Develop a sustainable and equitable ocean economy**
   - **#5: Unlock ocean-based solutions to climate change**
   - **#6: Increase community resilience to ocean and coastal risks**
   - **#7: Expand the Global Ocean Observing System**

Meeting the world's energy needs now *and* into the future is a tricky business. No one source can do the trick. Energy portfolios – of a single country or the entire world – should include a diversity of sources, strategically balanced to meet the demand while also prioritizing sustainability, reliability, a healthy environment, and livelihoods. A diversified energy portfolio is also crucial for reducing dependency on a single energy source, which in turn increases energy security and minimizes environmental impacts.

It is a delicate balance, but one that can be achieved when people, companies, and world governments work together to brainstorm and advance practical, scalable solutions that take these factors into consideration. As the saying goes, where there's a will, there's a way. However, in many cases, the former holds back the latter.

But that is not the case with Equinor's Hywind Tampen, the world's first floating wind farm built specifically to power offshore oil and gas installations. A marriage of renewable and non-renewable energy production, the Hywind Tampen wind farm supplies power to Equinor's Snorre and Gullfaks platforms in the Norwegian North Sea.

The farm uses 11 floating wind turbines to supply renewable electricity to the Snorre and Gullfaks offshore oil and gas platforms, reducing their emissions (and carbon footprints) and maintaining the quality of work life for platform personnel, all the while developing new offshore wind technology. Hywind Tampen became fully operational in August 2023; it is estimated that the farm provides 35% of the annual power demand for the two platforms.

Hywind Tampen will be a test bed for further development of floating wind farms, exploring the use of new and larger turbines, installation methods, simplified moorings, and concrete substructures. It will also be used to test the integration of gas and wind power generation systems, a hybrid strategy used to ensure grid stability and reliability by balancing the inherent variability and intermittency of wind energy with the flexible, on-demand power of natural gas.

Offshore wind turbines and the Snorre oil and gas platform. [World's Largest Floating Offshore Wind Farm Officially Opens]

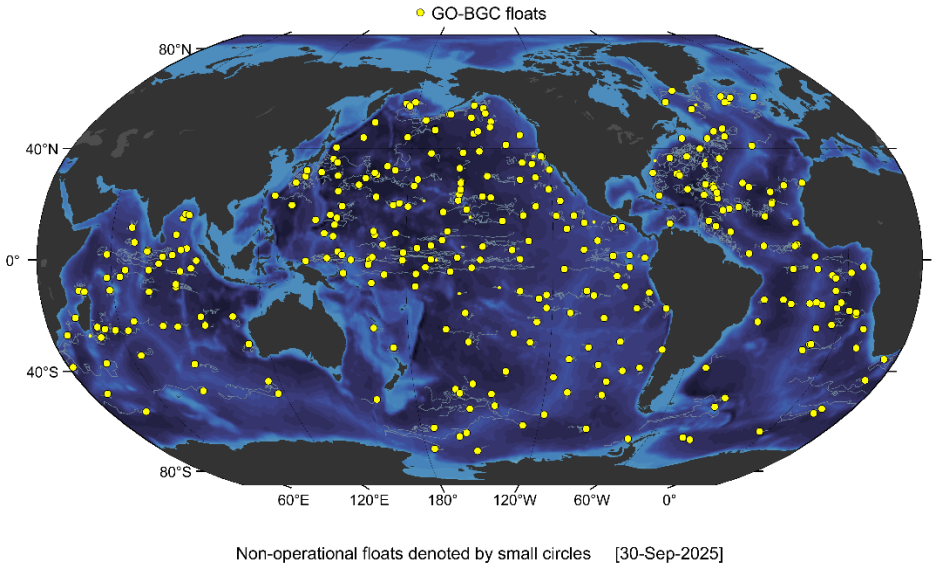
Expanding hybrid systems like Hywind Tampen will mean additional construction of floating wind farms and the infrastructure to connect energy production platforms. Installing floating turbines involves driving anchors, known as micropiles, into the seafloor. Drilling into the sediment is a noisy process; in an effort to prioritize a healthy environment – and to meet the regulatory requirements associated with subsea projects – bubble curtains are often used. Air hoses are laid in rings around the construction site, and compressed air is pumped into rings, creating a curtain of bubbles. The air bubbles absorb sound energy, reducing noise and the risk to marine life.

The early success of Hywind Tampen shows that the model is both practical – and scalable – and can be part of a diversified energy portfolio. It also shows that, where there is a will, there is a way.

A bubble curtain around the area during installation of an offshore wind farm in Germany. Bubble curtain - Wikipedia

e. Mission Task #4: MATE Floats Under the Ice
   Ocean Decade Challenges for collective impact:
   - **#5: Unlock ocean-based solutions to climate change**
   - **#7: Expand the Global Ocean Observing System**
   - **#8: Create a digital representation of the ocean**

MATE Floats! 2026 is inspired by the National Science Foundation (NSF)-funded GO-BGC Project. The goal of GO-BGC is to build a global network of profiling floats with chemical and biological sensors to monitor circulation, chemistry, biology, and overall ocean health. Scientists, engineers, and technicians are using NSF grant funds to build and deploy 500 robotic ocean-monitoring floats around the globe. GO-BGC hit the 300 mark, with 325 out of the targeted 500 GO-BGC floats deployed or en route to be deployed from research vessels.



*GO-BGC Float locations as of September 30, 2025 (*Array Status | GO-BGC).

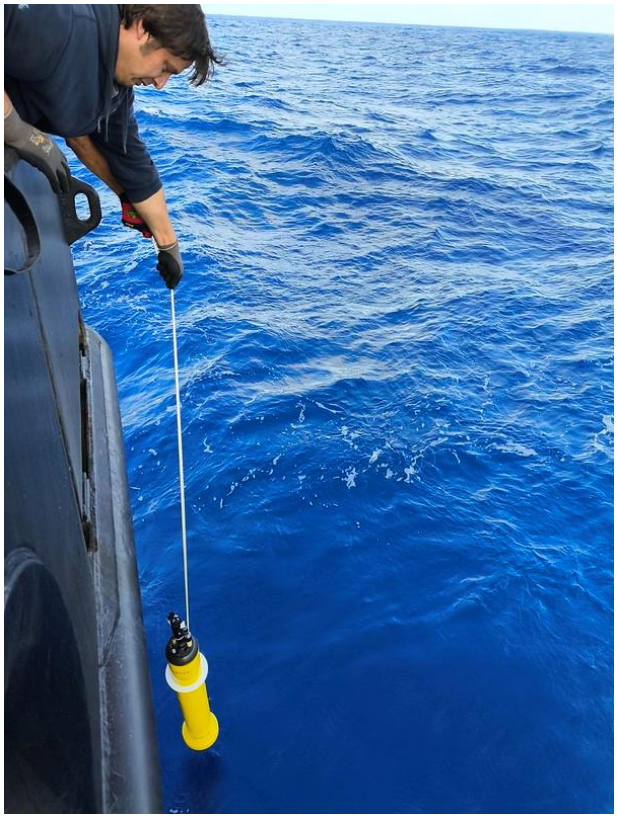
Given the location of the 2026 MATE World Championship, this year's *MATE Floats!* mission scenario takes place UNDER the ice. For regional competitions, this translates to a simulated under-ice task; for companies competing at the World Championship, this means operating under an ice sheet grown in the National Research Council's (NRC) ice tank. At 90 meters long, 12 meters wide, and 3 meters deep, the NRC's ice tank is one of the largest facilities of its kind in the world. With temperatures ranging down to -25°C , this indoor, refrigerated facility simulates realistic Arctic and northern marine conditions and has the ability to grow ice at 2.5 millimeters an hour.

Operating floats in polar waters where they may encounter ice is a real-world challenge faced by GO-BGC float technicians. Sensors and antennas, not to mention the float itself, run the risk of being damaged if the float attempts to surface with an ice sheet overhead. There is also the possibility of floats becoming entrained in sea ice and crushed. Therefore, floats deployed in polar

waters must be engineered with ice-avoidance capabilities and with the ability to store data during under-ice profiles and delay transmission until the float is clear to surface in open water. "Ice-avoidance capabilities" translates to sensors measuring water temperature and chemistry to assess if ice is detected as the float ascends to the surface, along with the decision-making capability (i.e., an ice-avoidance algorithm) to reverse course and descend rather than continuing to surface.

Simulating this within the context of a MATE ROV Competition mission task presents some challenges, especially without the ability to replicate the precise real-world conditions – even in an ice tank – that would allow a float with ice-avoidance capabilities to detect ice and reverse course

So, instead of ascending to the surface and transmitting data to the mission station, companies participating in the 2026 MATE ROV Competition are challenged to design and build a float that ascends to a specific depth below the surface and holds that position for a defined period of time before initiating another descend to depth. Only after the float is recovered is it tasked with transmitting its data to the mission station.



Deploying a GO-BGC float (GO-BGC | Global Ocean Biogeochemistry Array)

2. Mission Scope and Purpose

This and the following sections contain the technical specifications and requirements for ROV services needed to support the **Pushing Performance: Science, Technology, & Discovery in Harsh Environments**. In 2026, ROV services include:

1. Task 1. Seabed 2030: A Kaleidoscope of Corals in Cold Water
    - Collect species (basket stars and coral species) from the coral garden
    - Create a 3D image of the coral garden either autonomously, manually (CAD), or manually (paper)
    - Maintain position / fly a transect in a current to create a video of the coral garden
2. Task 2. SmartAtlantic Alliance: Better Information, Better Decisions
    - Determine the number of invasive European Green crabs in the sample using image recognition or manually and upload data to the Invasive Species form
    - Survey an iceberg and measure its keel depth
    - Use the location, heading and keel depth of the iceberg to determine the threat level of the iceberg to the four oil platforms
    - Simulate an acoustic release of a retrieval buoy on whale safe fishing gear and recover the lobster pot
    - Attach a recovery line to the buoy anchor and return the line to the surface, side of the pool
    - Replace an eDNA sensor, connecting the new sensor to the Holyrood subsea observatory
    - Analyze data to determine frequency seen
    - Remove biofouling from the observatory's camera
3. Task 3. Wind-Powered Offshore Oil Platform: Scalable Solutions for Global Energy Needs
    - Place a bubble curtain around the designated location and install a micropile
    - Retrieve the power connector from the wind farm subsea station and lay the cable through a waypoint
    - Remove the cover from the oil platform port and install the power connector
4. Task 4. MATE Floats Under the Ice
    - Prior to the competition, design and construct an operational profiling float
    - Float communicates with the mission station prior to descending
    - Float completes two vertical profiles under the ice
    - Float maintains depth at 2.5 meters and 40 cm
    - Float communicates data to the mission station after recovery
    - Data is graphed as depth over time

3. Specifications

See the specific tasks described below as well as the **VEHICLE DESIGN & BUILDING SPECIFICATIONS** and **COMPETITION RULES** sections.

4. Maintenance and Technical Support

The company shall warrant the ROV and associated systems and equipment for at least the duration of the product demonstrations. Repair or replacement shall be at the company's expense, including the cost of shipping the ROV to and from the competition facility.

During regional events, the company shall provide at least one day of technical support to resolve hardware, software, and operational issues. They shall provide at least three days of the same for the World Championship event.

5. Shipping and Storage

Refer to Shipping Information for specifics on shipping to the MATE World Championship site.

Delivery of the ROV and associated systems and equipment shall be no later than the date of the geographically closest regional contest or by the final check-in day of the MATE World Championship (June 24, 2026).

6. Evaluation Criteria
    a. Technical documentation
    b. Engineering presentation
    c. Marketing display
    d. Company spec sheet
    e. Corporate responsibility (optional)
    f. Product demonstration
    g. Safety

7. References
    a. General
        - United Nations Decade of Ocean Science for Sustainable Development
        - 17 UN Sustainable Development Goals
        - 10 Challenges - Ocean Decade
        - A Hotter Future Is Certain, Climate Panel Warns. But How Hot Is Up to Us
        - ESG (environmental, social and governance)
        - Decade of Action for Cryospheric Sciences (2025-2034)
        - Photos from the 2015 World Championship in St. John's | Flickr

    b. Task 1: Seabed 2030: A Kaleidoscope of Corals in Cold Water
        - Rare Coral Habitat Discovered using Rayfin Camera
        - 'Corals as far as the eye can see' a rare find for Marine Institute researchers
        - Spotting soft coral garden off Newfoundland 'once in a lifetime' opportunity, researcher says
        - Photogrammetry - NOAA Ocean Exploration

    c. Task 2: SmartAtlantic Alliance: Better Information, Better Decisions
        - European Green Crab in Newfoundland Waters
        - European Green Crab
        - Identification Guide for Eastern Canada Crabs - Wanted Invaders
        - Hibernia
        - Hibernia Platform Collision Avoidance - Offshore Energy Surveillance System

- Infographic: How Newfoundland deals with its yearly iceberg rush
- North Atlantic right whale
- Whalesafe fishing gear
- SmartAtlantic - Holyrood Buoy 2
- SmartAtlantic - Holyrood Subsea Observatory
- BeWild & Fugro Launch Remote Ecology Survey at CrossWind
- The BeWild project: Advancing marine biodiversity monitoring at offshore wind farms
- Detecting fish with the innovative Fish Sensing Box
- ~~Seeing, hearing and testing underwater~~
- ~~Marine biodiversity assessment using eDNA sequencing~~

d. Task 3: Wind-Powered Offshore Oil Platform: Scalable Solutions for Global Energy Needs
    - How to meet global energy demand in the age of electricity?
    - Fugro Blue Essence Completes First Remote Offshore Wind ROV
    - Hywind Tampen: the World's largest floating wind farm and the first for oil platforms
    - Remote Anchoring & MicroPiler (RAMP)

e. Task 4: MATE Floats Under the Ice
    - GO-BGC | Global Ocean Biogeochemistry Array
    - Expanding Fleet of Autonomous Floating Robots Targets Deeper Understanding of Global Ocean Dynamics
    - Profiling Floats in SOCCOM: Technical Capabilities for Studying the Southern Ocean
    - Ice tank – 90 m research facility - National Research Council Canada

WEIGHT RESTRICTIONS

Considering some of the environments in which the ROVs will be operating, an ROV weight requirement has been included in the request for proposals (RFP). Lighter vehicles will be given special consideration and vehicles above a certain weight will not be considered. The dimensions of the ROV may be limited by product demonstration tasks.

Note for 2026!!!

All weight measurements will include the vehicle and all tools and components. The weight measurement will NOT include the tether. The following will NOT be included in the weight measurement:

- The topside control system and the tether
- The vertical profiling float
- Any independent sensors if removable from the ROV

At the World Championship, companies will complete their ROV weight measurements during their onsite safety inspection. The weight measurement will be documented on the weight score sheet and included as part of the overall score.

Note: Regional competitions may handle size and weight measurements differently. Regional competitions that combine all the tasks into one product demonstration run may weigh vehicles prior to each run. For PIONEER class companies competing at a regional event, contact your regional coordinator or visit your regional contest's website for more information.

Weight measurements will be conducted using a digital scale. In addition, companies must be able to personally transport the vehicle and associated equipment to the product demonstration station and to the engineering presentation room. ROV systems must be capable of being safely hand launched.

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

Weight (in air)	
< 18 kg	**+10 points**
18.01 kg to 25 kg	**+5 points**
25.01 kg to 35 kg	**+0 points**

Vehicles greater than 35 kg in weight will not be allowed to compete in the product demonstration.

A video showing a simulated weight measurement is posted here.

PRODUCT DEMONSTRATION

IMPORTANT NOTE: Questions about the competition, the production demonstrations and design and building specifications should be posted to the MATE ROV Competition Forum Board. Questions will be answered by MATE ROV Competition staff so that all companies can see the questions and answers. This will also help to avoid duplicate questions. That said, please make sure that your question(s) has not already been asked – and answered – before posting. It is up to you and your company to read, comprehend, and comply with ALL rulings posted on the site. All pertinent rulings will be posted to the 2026 Official Rulings thread, which will be pinned to the top of the forum board.

ORGANIZATIONAL AND OPERATIONAL EFFECTIVENESS

Companies will receive up to 10 points for Organizational and Operational Effectiveness. This includes points for teamwork, collaboration and communication, project management, problem solving and the ability to deal with obstacles, and system design and control.

Organizational and operational effectiveness is included on the product demonstration rubric posted here. This rubric will be posted by March 1, 2026. In the meantime, companies may refer to the previous year's rubrics for a general idea of the categories and points.

TASK 1: *Seabed 2030: A Kaleidoscope of Corals in Cold Water*

This task involves the following steps:

Task 1.1 Collect species from the coral garden

- **Collect two basket stars and return them to the surface, side of the pool – 5 points each, 10 points total**
- **Collect two coral species and return them to the surface, side of the pool**
    - **Collect coral by the substrate only – 10 points each, 20 points total**
    - **Collect corals not by the substrate – 5 points each, 10 points total**

Task 1.2 Coral garden ridge modelling

- **Via photogrammetry, autonomously create a scaled 3D model of the coral garden – up to 40 points**
    - **Create a 3D model of the coral garden – up to 20 points**
        - **Model shows all 8 targets – 20 points**
        - **Model shows 4 to 7 targets – 15 points**
        - **Model shows 1 to 3 targets – 10 points**
        - **Model shows 0 targets – 5 points**
    - **Measure the length of the coral garden within 5 cm – 10 points**
    - **Scale the 3D model using the length of the coral garden – 5 points**
    - **Use the properly scaled 3D model to estimate the height of the coral garden (within 5 cm) – 5 points**

Or

- **Manually (CAD) create a scaled 3D model of the coral garden – up to 30 points**
    - **Measure the length of the coral garden (within 5 cm) – 10 points**
    - **Measure the height of the coral garden (within 5 cm) – 10 points**
    - **Create a scaled 3D model of the coral restoration area displaying the length and height measurements – 10 points**

Or

- **Manually (paper) create a 3-view technical drawing of the coral restoration area – up to 20 points**
    - **Measure the length of the coral garden (within 5 cm) – 5 points**
    - **Measure the height of the coral garden (within 5 cm) – 5 points**
    - **Create a technical drawing on paper of the coral garden, including the measured length and height with at least 3 views (top, front, and side) – 10 points**

Task 1.3 Fly a transect over the coral garden

- **At the World Championship**

    - **Maintain position over the coral garden in a current to create a video of the coral garden – 15 points**
- **At a regional competition**
    - **Fly a transect to create a video of the coral garden – 15 points**

Total points = 85 points

Product Demonstration Notes:

Task 1.1 Collect species from the coral garden
At the World Championship, Task 1.1 collect species from the coral garden will take place in the Flume Tank.

Companies must collect two basket stars and two coral species and return them to the surface, side of the pool. The basket stars and coral species will be located on the bottom of the pool within 2 meters of the coral garden.

Two basket stars, simulated by O-balls with a ½-inch PVC base will be located near the coral garden. Companies will receive 5 points for successfully returning each basket star to the surface, side of the pool, 10 points total. Successfully returning a basket star to the surface, side of the pool is defined as removing it from the water and placing it on the pool deck.

Basket stars will weigh less than 15 Newtons in water.

Two coral species will also be located on the coral garden. Coral species will be constructed of colored chenille pipe cleaners attached to a 2-inch end cap with 2-inch knockout cap, and a ½-inch PVC base. The end cap and pipe will be the "substrate" of the coral.

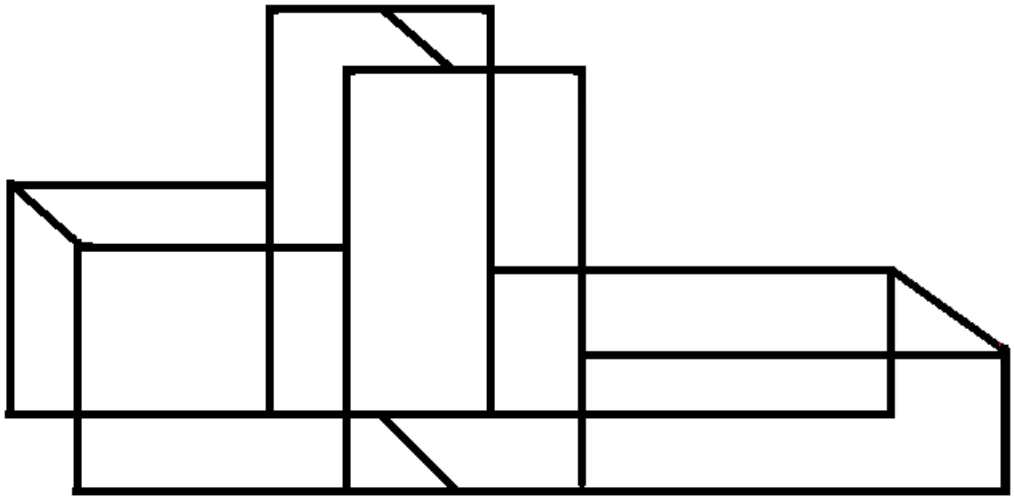
Companies will receive 10 points for successfully collecting a coral species by the substrate, 20 points total. Companies will receive only 5 points for successfully collecting the coral not by the substrate, 10 points total. Successfully collecting a coral species is defined as removing it from the water and placing it on the pool deck. Collecting the coral species by the substrate is defined as removing it and placing it on the pool deck only touching the 2-inch end cap or PVC pipe and not the chenille pipe cleaners. Companies may receive points for collecting one coral by the substrate and one coral not by the substrate.

Corals will weigh less than 15 Newtons in water.

Task 1.2 Coral garden ridge modelling
At the World Championship, Task 1.2 coral garden ridge modelling will take place in the Flume Tank.

Companies must measure the coral garden and create a 3D model of the garden area. The coral garden will be constructed from ½-inch PVC pipe, will be between 1 meter and 2.5 meters in length, approximately 36 cm wide and an unknown height. Eight 10 cm x 10 cm colored squares,

constructed from corrugated plastic sheeting, will be attached to the PVC of the coral garden. These will be targets for modelling the coral garden.



The coral garden

Companies choosing to create a 3D model of the coral garden autonomously must use photogrammetry to create a 3D model of the coral garden in a CAD program with the proper dimensions displayed. Companies may manually maneuver around the coral garden to take photos. Companies may transfer any images from the ROV to a computer or device at the mission station. This transfer does not have to be done autonomously; it can be accomplished "by hand." Companies are permitted to place an object of known dimensions (e.g., a ruler) on or near the coral garden to assist in the measurements. Note that this object of known dimensions will count as debris if it is not under control of the ROV or removed from the pool by the end of product demonstration time.

Companies will receive up to 20 points for successfully modeling the coral garden via photogrammetry. Successfully modeling the coral garden via photogrammetry is defined as the coral garden displayed as a 3D image on a screen at the product demonstration station. The image should be able to be rotated so that the station judge can view it from any angle. The 3D image must show all eight targets (10 cm x 10 cm colored squares). Companies that display all eight targets on their model will receive 20 points. If four to seven targets are displayed on the model, companies will receive 15 points. If one to three targets are displayed, companies will receive 10 points. If no targets are displayed, but the company does display a 3D model, companies will receive 5 points.

Companies must also measure the length of the coral garden and use that length to scale the 3D image accordingly. Companies will receive 10 points for successfully measuring the length of the coral garden. Successfully measuring the length of the coral garden is defined as the company's measurement being within 5 cm of the true length. Companies must show the station judge their measurement or explain how they are estimating the measurement; companies may not guess.

Once the company provides their length measurement (regardless if it is within 5 cm), the station judge will provide the company with the true length of the coral garden. A company that does not attempt to measure the length will not receive the true length of the coral garden from the station judge and therefore cannot complete the scaling or height estimation steps.

Companies should use the true length provided by the station judge to scale their 3D model of the coral garden. Companies will receive 5 points for successfully scaling their 3D model and displaying the length measurement on that model. Successfully scaling the model and displaying the length is defined as the station judge being able to see the true length displayed on the 3D model.

Using the scaled length of the 3D model, companies must estimate the height of the coral garden. The height includes the height of any PVC tees on top of the coral garden; the height measurement is from the bottom of the coral garden structure to the top of the coral garden. Companies will receive 5 points when they successfully estimate the height of the coral garden within 5 cm. Successfully estimating the height of the coral garden is defined as using the 3D image properly scaled for length to determine the height. The station judge must be able to see the height displayed on the 3D model, and that height must be within 5 cm of the true height.

Companies choosing to create a 3D model of the coral garden manually using CAD must first measure the length and height of the area.

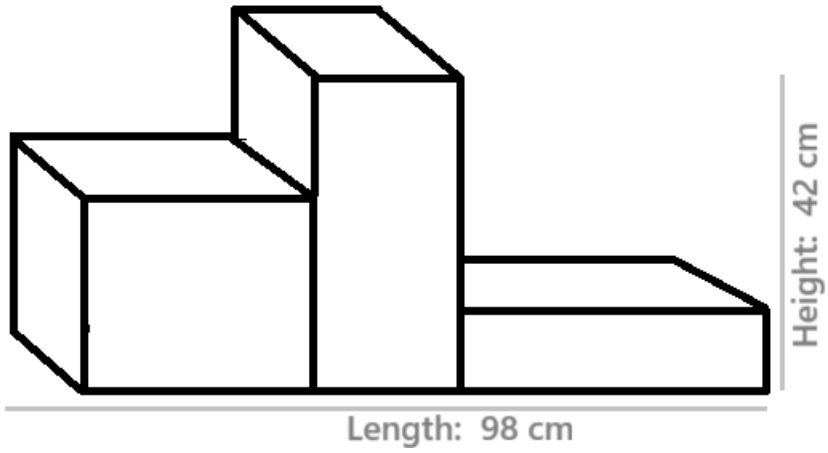
Companies must measure the length and height of the coral garden. Companies will receive 10 points for successfully measuring the length of the coral garden. Companies will receive 10 points for successfully measuring the height of the coral garden. Successfully measuring the length and height of the coral garden is defined as the company measurement within 5 cm of the true length or true height. The height includes the height of any PVC tees on top of the coral garden; the height measurement is from the bottom of the coral garden to the top of the coral garden. Companies must show the station judge both of their measurements or explain how they are estimating the measurement; companies may not guess. Companies are permitted to place an object of known dimensions (e.g., a ruler) on or near the coral garden to assist in the measurements. Note that this object of known dimensions will count as debris if it is not under control of the ROV or removed from the pool by the end of product demonstration time.

Companies should then create a 3D model of the coral garden in a CAD or other program. Companies may input their measurements manually into a CAD or other program to create their 3D model. The length and height measurements should be included in the 3D model, even if those measurements are incorrect. Companies will not receive points for properly measuring the dimensions of the coral garden area but can still receive points for modeling the area with the measurements taken.

Companies will receive 10 points for successfully modeling the 3D coral garden manually. Successfully modeling the coral garden is defined as the model of the coral garden displayed as a CAD model on a screen at the station and the length and height dimensions included on the model.

The 3D model should be able to be rotated and viewed from any angle. The length and height dimensions measured by the company must be included on the model.

The 3D model should only include the basic structure of the coral garden. The manual 3D CAD model does not need to incorporate each section of PVC pipe and each fitting. A general model, showing three rectangular prisms, should be displayed. The targets do not need to be displayed on the 3D model created manually.



A 2D representation of a manually created 3D CAD model consisting of three rectangular prisms. Length and height dimensions are included.

Companies choosing to create a 3D model of the coral garden manually on paper must first measure the length and height of the coral garden.

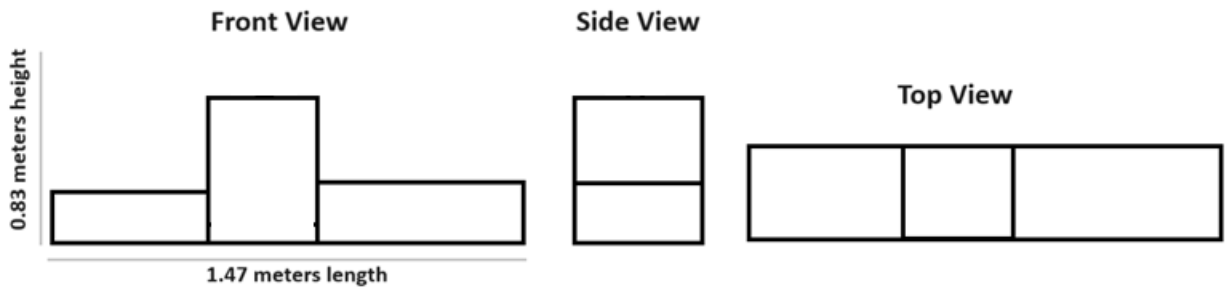
Companies must measure the length and height of the coral garden. Companies will receive 5 points for successfully measuring the length of the coral garden. Companies will receive 5 points for successfully measuring the height of the coral garden. Successfully measuring the length and height of the coral garden is defined as the company measurement within 5 cm of the true length or true height. The height includes the height of any PVC tees on top of the coral garden; the height measurement is from the bottom of the coral garden to the top of the coral garden. Companies must show the station judge both of their measurements or explain how they are estimating the measurement; companies may not guess. Companies are permitted to place an object of known dimensions (e.g., a ruler) on or near the coral garden to assist in the measurements. Note that this object of known dimensions will count as debris if it is not under control of the ROV or removed from the pool by the end of product demonstration time.

Companies should then create a technical drawing consisting of three views – front, top, and side – of the coral garden. The length and height measurements should be included on the technical drawing, even if those measurements are incorrect. Companies will not receive points for properly measuring the dimensions of the coral garden but can still receive points for creating a technical model the coral garden with the measurements taken.

Companies will receive 10 points for successfully creating the technical drawing of the coral garden. Successfully creating a technical drawing is defined as all three views shown to the station

judge. The front view must include both the length and height measurements taken by the company.

The technical drawing should only include the basic structure of the coral garden. The manual paper model does not need to incorporate each section of PVC pipe and each fitting. A general model, showing three rectangular prisms, should be displayed. The targets do not need to be displayed on the 3D model created manually.



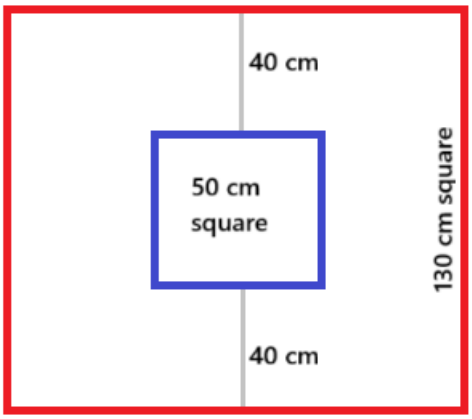
Technical drawing of a coral garden area showing a front view, side view, and top view.

The MATE ROV Competition will not provide paper. Companies planning to create a technical drawing should bring their own paper. All work must be done at the mission station and during the production demonstration time.

NOTE: Companies will only receive points for one method of modeling the coral garden. However, companies may attempt more than one method. For example, a company could manually create a 3D image of the coral garden while a computer program works to autonomously create a 3D model. If the program is successful at creating the model autonomously, the company would receive 40 points. But if the program is not successful, the company would still receive 30 points for successfully creating the 3D image manually.

Task 1.3 Fly a transect over the coral garden
At the World Championship, Task 1.3 fly a transect over the coral garden will take place in the Flume Tank.

At the World Championship, companies must maintain their position over the coral garden in a current. The coral garden will be a 50 cm blue square painted blue. An additional 130 cm square will surround the coral garden area. These additional lengths of pipe will be painted red. The transect area will be located on the bottom of the pool.



A diagram of the transect area at the World Championship. The blue and red lines are painted ½-inch PVC pipes, the gray lines are white PVC pipe.

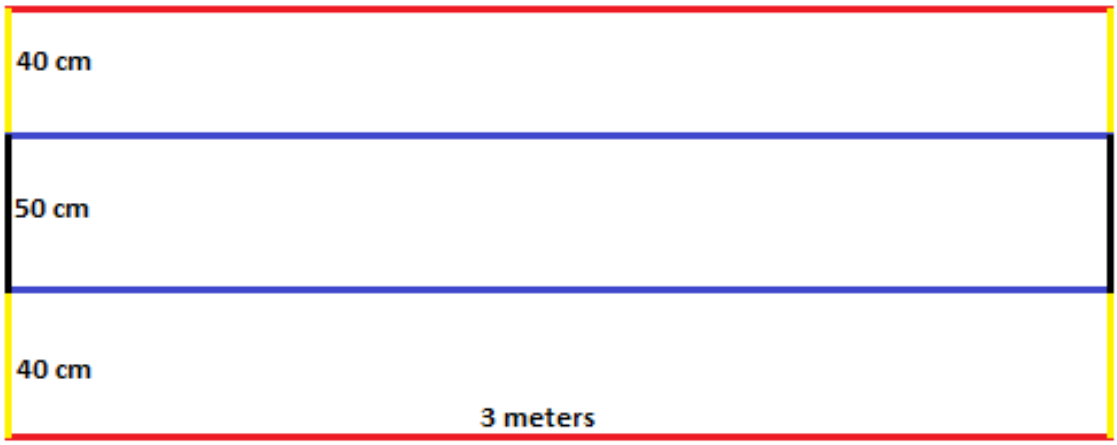
Companies must maintain position over the area in a current for 30 seconds, displaying the video image of the transect area (blue square) on a display for the station judge. Companies will receive 15 points for successfully maintain position over the area for 30 seconds. Successfully maintaining position is defined as the entire blue square in the video display for the entire 30 seconds, but no portion of the red square visible in the video display. If any section of the red pipe is seen in the video display, or if the entire blue square is not seen in the video display at all times, the ROV has failed to maintain position. Holding position must be done for 30 consecutive seconds. If the team fails to maintain position, they may reposition and restart the mission but must maintain position for a new consecutive 30 seconds.

A video showing successful and unsuccessful maintaining position over the coral garden area can be seen here.

If companies have multiple camera views from the ROV, companies should indicate to the station judge which video screen shows maintaining position over the coral garden. That video screen must comply with the maintaining position specifications; other video displays could show a wider view.

At PIONEER class regional competitions, companies must fly a transect line over an area. The area will be simulated by a ½-inch PVC pipe rectangle 3 meters long by 0.5 meters wide. The 3-meter lengths of PVC pipe that make up the “top” and “bottom” of the area will be painted blue. The 0.5-meter “ends” of the transect area will be painted black.

An additional 3-meter length of PVC pipe will be located 40 cm from the top and bottom of the search area. These additional lengths of pipe will be painted red. The 0.4-meter “ends” of these transect areas will be painted yellow. The transect area will be located on the bottom of the pool.



A diagram of the transect area. The blue, red, yellow, and black lines are painted ½-inch PVC pipes.

Companies must fly a transect line over the area, displaying the video image of the transect on a display screen for the station judge. Companies will receive 15 points for successfully flying a transect. Successfully flying a transect over the area is defined as starting at one end of the transect and moving to the other end of the transect. Starting at one end of the transect is defined as the ROV directly above the black length of PVC pipe on either end of the transect.

The ROV must also remain at a certain height over the transect area. While flying the transect, both blue painted PVC pipes must be in the video display at all times and neither red pipe may be visible in the video display. If any section of red pipe is seen in the video display, or both blue pipes are not seen in the video display at all times, the ROV has failed to successfully fly the transect.

A video showing successful and unsuccessful flying of the transect line can be seen here.

If companies have multiple camera views from the ROV, companies should indicate to the station judge which video screen shows the flying the transect task. That video screen must comply with the flying the transect specifications; other video displays could show a wider view.

TASK 2: *SmartAtlantic Alliance: Better Information, Better Decisions*

This task involves the following steps:

Task 2.1 Mitigate invasive species

- **Determine the number of invasive European Green crabs in the sample**
  - **Using image recognition – 15 points**
  - **Manually – 5 points**
- **Upload the data to the Invasive Species Form – 5 points**

Task 2.2 Iceberg tracking

- **Track icebergs headed towards offshore oil platforms**

- **Survey the iceberg at five points around its perimeter – up to 10 points**
    - **Survey all five points – 10 points**
    - **Survey one to four points – 5 points**
- **Measure the keel depth of the iceberg within 10 cm of true depth – up to 10 points**
    - **Within 5 cm of the true depth – 10 points**
    - **Within 5.01 to 10 cm of the true depth – 5 points**
    - **Greater than 10.1 cm of the true depth – 0 points**
- **Use the location, heading, and keel depth to determine the threat level of the iceberg to the four area oil platforms – up to 15 points**
    - **Determine the threat level to the offshore platform – up to 10 points**
        - **Correctly report the threat level to all four platforms – 10 points**
        - **Correctly report the threat level to only three platforms – 5 points**
    - **Determine the threat level to the offshore platform's subsea assets – 5 points**

Task 2.3 Testing whale safe fishing gear

- **Turn the handle to simulate the acoustic release of the retrieval buoy – 10 points**
- **Recover the lobster pot to the surface, side of the pool – up to 10 points**
    - **Recover the lobster pot off the bottom – 5 points**
    - **Return the lobster pot to the surface, side of the pool – 5 points**

Task 2.4 Recover the buoy anchor

- **Attach a recovery line to the buoy anchor – 10 points**
- **Return the line to the surface, side of the pool – 5 points**

Task 2.5 Service the Holyrood subsea observatory

- **Recover the old eDNA sensor**
    - **Recover the old sensor to the surface, side of the pool – 5 points**
    - **Analyze the sensor's data to determine the percent frequency seen of various organisms – 10 points**
- **Install a new eDNA sensor**
    - **Place the sensor in the designated area – 10 points**
    - **Connect the sensor to the Holyrood subsea observatory – 10 points**
- **Remove biofouling from the Holyrood subsea observatory camera – 10 points**

Total points = 135 points

Product Demonstration Notes:

Task 2.1 Mitigate invasive species

At the World Championship competition, Task 2.1 mitigate invasive species will take place in the Flume Tank.

Companies must determine the number of invasive European Green crabs in a sample. Crab images will be printed, laminated, and secured with clear tape to one side of a 50 cm x 50 cm length of corrugated plastic sheeting. Crab images will include a variety of European Green crabs,

native Rock crabs, and native Jonah's crabs. The images below will be used to represent each variety of crab. No additional photos or variations will be used. Images may be resized to be larger or smaller; images may be rotated to any angle on the corrugated plastic sheeting.

Left: European Green crab. Photo from European Green Crab. Center: Native Rock crab. Photo from European Green Crab. Right: Native Jonah crab. Photo from NicePNG. Individual crab images will be provided in the Product Demonstration Resources section of the MATE ROV Competition website.

Companies may use image recognition to count the number of European Green crabs in the sample. Companies will receive 15 points for successfully using image recognition to determine the number of European Green crabs in the sample. Successfully using image recognition to identify green crabs is defined as a computer program identifying and counting the green crabs. Companies may pilot their ROV manually to provide an image of the corrugated plastic sheeting with crab images then begin to run their program, but the program (and not company members using the ROV's video) must identify and provide a count of the European Green crabs. Identifying a European Green crab in the image is defined as the crab image being surrounded by a bounding box on the screen. Providing a count of the European Green crabs is defined as the total number of European Green crabs on the screen being displayed on the screen. For example, if 7 European Green crabs are in the video display, each should have a bounding box around it and the number 7 should be displayed on the video screen. Rock crab and Jonah crab images should not have a bounding box around them nor should they be included in the invasive crab count. Companies must show the station judge their video display showing the entire 50 cm x 50 cm area and all European Green crabs in the sample.

Alternatively, companies may manually determine the number of invasive European Green crabs in the sample. Companies will receive 5 points for manually determining the number of invasive European Green crabs in the sample. Manually determining the number is defined as a company member counting the number of European Green crabs and providing that count to the station judge.

For both image recognition and manually determining the number of crabs, companies only need to report the number of European Green crabs in the sample. Companies do not need to report numbers of native Rock crabs or native Jonah crabs. If using image recognition, Rock crab and Jonah crab images should not have a bounding box around them nor should they be included in the invasive crab count. For both image recognition and manually determining the number of crabs, companies will only receive one chance at informing the station judge of the correct number.

Companies may not guess at the number of European Green crabs; they must either show their image recognition count on the video display or manually count crabs so the judge can observe the count.

After determining the number of crabs in the sample, companies must upload data to the 2026 MATE ROV Competition – Invasive Species Reporting Form.

A QR code will be available at the mission station, allowing companies to access the form directly. Companies may complete the form on a computer, phone, or other device. When the form is completed and submitted, companies will receive a message confirming that their submission was successful. Companies must show that message, which will include the number of crabs that they determined were in the sample, to the station judge. Companies will receive 5 points when they successfully complete the Invasive Species Reporting form. Successfully completing the form is defined as showing the judge the confirmation of your successful submission.

Task 2.2 Iceberg Tracking

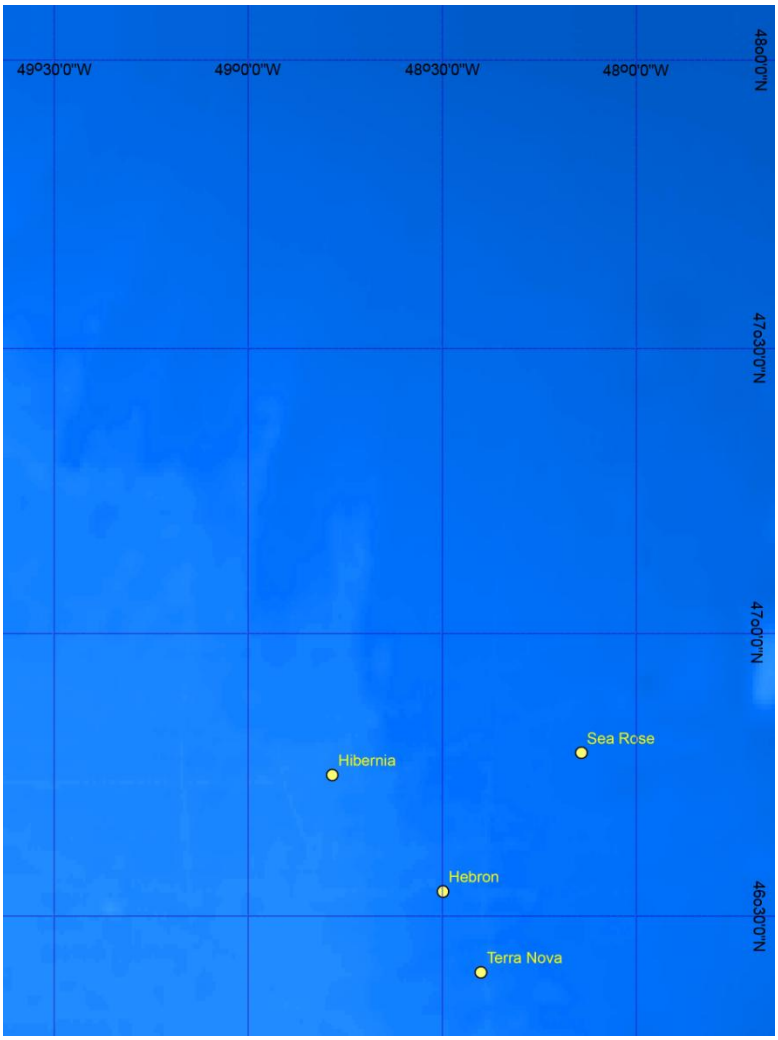
At the World Championship competition, Task 2.2 iceberg tracking will take place in the Flume Tank.

Companies must track icebergs as they head towards offshore oil platforms and their subsea assets. Companies must first survey the iceberg at five locations around its perimeter and measure the keel depth of the iceberg. The iceberg will be constructed from ½-inch PVC pipe and bubble wrap/clear plastic.

The iceberg will have five numbers attached to it, one at each corner and one on the bottom of a PVC length extending underwater. The numbers at the corners will be 15 cm below the surface and attached to a small rectangle of corrugated plastic sheeting. Companies will receive up to 10 points for successfully surveying all five numbers around the perimeter of the iceberg. Companies that only survey one to four of the numbers around the perimeter will receive 5 points. Successfully surveying a point is defined as showing the station judge in a video display each of the five numbers. Note the five numbers on each iceberg will be sequential, either 0 through 4 or 5 through 9.

Companies must also measure the keel depth of the iceberg. The keel of the iceberg will be constructed from ½-inch PVC pipe and will be extending down from one corner of the iceberg. This length will be between 0.5 meters and 1.5 meters in length. Companies must measure the depth that this PVC pipe extends down from the surface. Companies will receive 10 points for successfully measuring the keel depth of the iceberg within 5 cm of the true depth. Companies will receive 5 points if they measure the keel depth of the iceberg but are between 5.01 and 10 cm from the true depth. Successfully measuring the keel depth is defined as showing the station judge their measurement or explaining how they are estimating the measurement; companies may not guess at the keel depth.

Once the companies have surveyed the iceberg at all five locations around its perimeter, companies will receive the iceberg information sheet and an offshore oil platform map and data sheet. The iceberg information sheet will contain the location (longitude and latitude) of the iceberg, its heading, and a proper keel depth (reflecting a real iceberg). The offshore oil platform map will show the location of the four area oil platforms. This map will also include the following table showing the location of the platforms and water depth at each platform. This map and table will also be available in the Product Demonstration Resources section of the MATE ROV Competition website.



A map of the oil platforms.

Platform	Location		Ocean depth (m)
	Latitude	Longitude	
Hibernia	43.7504	-48.7819	-78
Sea Rose	46.7895	-48.1417	-107
Terra Nova	46.4	-48.4	-91
Hebron	46.544	-48.498	-93

A table of oil platforms location and depth.

Using this information, companies must determine the threat level for the four surface platforms. The threat levels are green, yellow, and red. If the iceberg is passing more than 10 nautical miles away from a platform, the iceberg poses a green threat level. If the iceberg is passing between 5 and 10 nautical miles from a platform, it poses a yellow threat level. If the iceberg is passing less than 5 nautical miles from a platform, it poses a red threat level. If the keel depth of the iceberg is 110% or greater than the depth of the water where the platform is located, it is never a threat to the platform as it will ground before reaching the platform. Threat level to the platform is green.

Note that 1 minute of latitude is equal to 1 nautical mile.

Companies will receive 10 points for successfully using the location, heading, and keel depth to determine the threat level to all four platforms. Successfully determining the threat level is defined as informing the station judge of the proper threat level, green, yellow or red, for each of the four oil platforms. Companies will receive 5 points if they are successful in determining the threat level to three platforms. Companies that are successful in determining the threat level to 2 or less platforms will receive 0 points.

Companies must also determine the threat level for the subsea assets. Any iceberg passing within 25 nautical miles of an oil platform could potentially be a threat for subsea assets. Companies will use the keel depth to evaluate the threat level to any iceberg that passes within 25 nautical miles of subsea assets.

- If the keel depth of the iceberg is 110% or greater than the depth of the water the platform is located in, it is never a threat to the subsea assets as it will ground before reaching the assets. Threat level to subsea assets is green. Note that at this keel depth, the threat to the surface platform is also green.
- If the keel depth of the iceberg is 90% to 110% of the depth of the water the platform is located in, the subsea assets are in critical danger. Threat level to the subsea assets is red.
- If the keel depth of the iceberg is 70% - 90% of the depth of the water the platform is located in, caution should be maintained as the keel may impact the seafloor. Threat level to the subsea assets is yellow.
- If the keel depth of the iceberg is <70% of the depth of the water the platform is located in, it is never a threat to the subsea assets. Threat level to subsea assets will be green.

Companies will receive 5 points when they successfully determine the threat level to the oil platform subsea assets. Successfully determining the threat level is defined as informing the station judge of the proper threat level, green, yellow or red, for each of the four platform subsea assets. There are no partial points; companies must correctly determine the threat level to all four subsea assets.

Companies may not guess at the threat levels for either the platforms or the subsea assets; companies must show the judge a map with the oil platforms and iceberg track. Companies may track the iceberg on a paper map (judges will have paper maps at the station upon request or

companies may bring their own paper maps) or companies may track the iceberg on a digital version of the map. See the Product Demonstration Resources section for maps.

Companies will only get one attempt to evaluate the threat levels for oil platforms and one attempt for the subsea assets. Companies that are incorrect may not re-evaluate the threat levels. Companies must report all threat levels during the product demonstration time; companies may not report to the judge after the time has ended.

Task 2.3 Deploy whale safe fishing gear
At the World Championship, Task 2.3 testing whale safe fishing gear will take place in the Offshore Engineering Basin Tank.

Companies must simulate the deployment and testing of whale safe fishing gear. A whale safe lobster pot will be on the bottom at the start of the product demonstration run. The lobster pot will be constructed from a milk crate with ½-inch PVC pipe and 3-inch PVC pipe. A corrugated plastic sheet attached to ½-inch PVC pipe will cover the 3-inch pipe that holds the 2-inch PVC pipe retrieval buoy. A length of rope, long enough for the buoy to reach the surface, will attach the buoy to the milk crate. Companies must turn a ½-inch PVC pipe handle to simulate an acoustic release of the retrieval buoy. Companies will receive 10 points when they successfully turn the handle and release the buoy. Successfully turning the handle and releasing the buoy is defined as the buoy no longer in contact with the 3-inch PVC pipe.

Companies must also recover the lobster pot to the surface, side the pool. A company unable to release the retrieval buoy will still be able to recover the lobster pot, but once the lobster pot is recovered, companies can no longer receive points for releasing the buoy. To recover the lobster pot, the ROV must lift the lobster pot off the bottom and return it to the surface, side of the pool. Companies may not drag the lobster pot across the bottom by pulling on the rope or buoy. Companies will receive 5 points when they successfully recover the lobster pot. Successfully recovering the lobster pot is defined as the lobster pot under control of the ROV and no longer touching the bottom. Companies will then receive 5 points for successfully returning the lobster pot to the surface, side of the pool. Successfully returning the lobster pot is defined as the milk crate removed from the pool and placed on the pool deck.

The lobster pot will weigh less than 20 Newtons in water.

Task 2.4 Recover the buoy anchor
At the World Championship, Task 2.4 recover the buoy anchor will take place in the Offshore Engineering Basin Tank.

Companies must attach a recovery line to the buoy anchor. The buoy anchor will be constructed from a 2-gallon bucket with a lid. A #310 U-bolt will be located in the center of the lid; companies will attach the recovery line to that U-bolt. Companies must provide their own recovery line and mechanism to attach their recovery line to U-bolt; MATE will **NOT** provide this. The recovery line is required to make a secure connection to the U-bolt. A secure connection means that the

attachment mechanism completely encompasses the U-bolt (a full 360° wrap around the U-bolt, such as a carabiner) and does not come loose once it is attached.

Companies will receive 10 points when they successfully attach the recovery line to the buoy anchor. Successfully attaching the recovery line to the buoy anchor is defined as the carabiner or other attachment device no longer in contact with the ROV and secured to the #310 U-bolt.

After attaching the recovery line to the U-bolt, companies must return to the surface, spooling out the line inside the device as they do so. Prior to connecting the device, the line is REQUIRED to be fully contained within the attachment mechanism or on the ROV. The line must spool out as the ROV returns to the surface; companies may not have any line/rope loose in the pool prior to connecting the line to the #310 U-bolt. If line is loose in the pool prior to attaching, companies will not receive points for this task. If the line is loose, companies may return to the surface and recoil the line into the attachment mechanism and try again. The mechanism must stay connected to the U-bolt for the entire product demonstration run. If the mechanism comes off of the U-bolt, companies will lose points for both attaching the line to the buoy anchor and returning the line to the surface, side of the pool. Companies may attempt to reattach the line to regain those points. Companies will receive 5 points when they successfully return the line to the surface, side of the pool. Successfully returning the line to the surface, side of the pool is defined as a company member on the pool deck holding the line, with the mechanism on the other end of the line attached to the U-bolt on the buoy anchor.

Task 2.5 Service the Holyrood subsea observatory

At the World Championship, Task 2.5 service the Holyrood subsea observatory will take place in the Offshore Engineering Basin Tank.

Companies must recover the old eDNA sensor to analyze its data. The eDNA sensor will be constructed from ½-inch and 2-inch PVC pipe. A 50 cm length of rope will act as a carrying mechanism. At the start of the product demonstration run, the old eDNA sensor will be on the bottom inside the designated area. The designated area will be a 50 cm square constructed from ½-inch PVC pipe painted yellow. Companies will receive 5 points when they successfully recover the old eDNA sensor to the surface, side of the pool. Successfully recovering the old eDNA sensor is defined as placing the sensor on the pool deck.

The old sensor will weigh less than 10 Newtons in water.

Once the old eDNA sensor has been successfully recovered, the station judge will provide companies with the frequency data. The frequency data will have ten species listed, along with the number of times that organism was seen in the videos from the Holyrood subsea observatory. To determine the percent frequency seen, companies must determine the occurrences of each species, calculate the total count of species, then divide each species frequency by the total count. Multiply by 100 to find the percentage frequency. Companies will receive 10 points when they successfully determine the percentage frequency seen of the various organisms. Successfully

determining the percentage frequency seen is defined as showing the station judge the percentage frequency for each of the ten species within the videos from the Holyrood subsea observatory.

Species	Number Seen
Snow crab (*chionecetes opilio*)	19
Acadian hermit crab (*Pagarus acadianus*)	3
Western Atlantic Hairy Hermit Crab (*Pagarus arcuatus*)	1
European Green Crab (*Carcinus maenas*)	9
Rock Crab (*Cancer pagurus*)	10
Jonah Crab (*Cancer borealis*)	5
Spiny Sunstar (*Crossaster papposus*)	8
Sea Urchin (*Stronglyocentrotus droebachiensis*)	10
Boreal Sea Star (*Boreal asterias*)	12
Daisy brittle star (*Ophiopholis aculeata*)	7

A frequency data table of species with numbers seen of each species. Companies calculate the sum total of numbers seen (in this case, 84).

Species	Number Seen	% frequency
Snow crab (*chionecetes opilio*)	19	22.61904762
Acadian hermit crab (*Pagarus acadianus*)	3	3.571428571
Western Atlantic Hairy Hermit Crab (*Pagarus arcuatus*)	1	1.19047619
European Green Crab (*Carcinus maenas*)	9	10.71428571
Rock Crab (*Cancer pagurus*)	10	11.9047619
Jonah Crab (*Cancer borealis*)	5	5.952380952
Spiny Sunstar (*Crossaster papposus*)	8	9.523809524
Sea Urchin (*Stronglyocentrotus droebachiensis*)	10	11.9047619
Boreal Sea Star (*Boreal asterias*)	12	14.28571429
Daisy brittle star (*Ophiopholis aculeata*)	7	8.333333333

A table showing species, numbers seen, and percentage frequency. Percentage frequency is calculated by dividing the number seen for each species by the total (84). For example, for the Snow crab, 19 species were seen out of 84, so the percentage seen in 22.62%.

Companies must then install a new eDNA sensor into the designated location. The sensor will be constructed from ½-inch pipe, 1-inch pipe and 2-inch pipe. A 50 cm length of rope will act as a carrying mechanism. The connector for the sensor will be constructed from ½-inch PVC pipe. 2 meters of cable will attach the sensor connector to the eDNA sensor. At the start of the product demonstration run the new eDNA sensor will be on the surface, side of the pool. The designated location will be the same as that of the old eDNA sensor. It will be a 50 cm square constructed from ½-inch pipe painted yellow. The old eDNA sensor must be recovered before the new eDNA sensor can be installed.

Companies will receive 10 points for successfully placing the new eDNA sensor in the designated location. Successfully placing the sensor is defined as the sensor no longer in contact with the ROV, completely inside the designated location, and upright. The sensor connector can still be on

board the ROV, but the sensor must no longer be in contact with the ROV. The sensor must remain upright and completely inside the designated area for the entire product demonstration run. If the connector comes out of the designated area, or falls over, companies will lose points for placing the sensor into the designated area. Companies may attempt to replace the sensor or turn the sensor upright to regain those points.

The new eDNA sensor will weigh less than 10 Newtons in water.

Companies must connect the new eDNA sensor to the Holyrood subsea observatory. The Holyrood subsea observatory will be constructed from ½-inch PVC, 1 ½-inch PVC and corrugated plastic sheeting. The connection port on the subsea observatory will be constructed from 1 ½-inch PVC pipe. Companies will receive 10 points when they successfully connect the new eDNA sensor to the Holyrood subsea observatory. Successfully connecting the sensor is defined as the connector no longer in contact with the ROV and inserted into the two openings of the connection port on the subsea observatory. The sensor connector must stay inserted into the port for the entire product demonstration run. If the connector is removed from the port at any time during the product demonstration run, companies will lose points for connecting the sensor to the Holyrood subsea observatory. Companies may attempt to reconnect the sensor to regain those points.

Companies must remove biofouling from the Holyrood subsea observatory camera. The camera biofouling area will be connected to the Holyrood subsea observatory. The camera will be simulated by two layers of corrugated plastic sheeting. The outer plastic sheet will be attached to the ½-inch framework of the observatory and have a 5 cm x 5 cm hole cut into it. The inner plastic sheet will rotate behind the outer plastic sheet. It will be attached to a ½-inch PVC tee that the ROV can rotate. The inner plastic sheet will be colored orange and blue; these colored areas will appear through the window cut into the outer layer. To simulate removing biofouling from the observatory, companies must spin the inner plastic sheeting three times around and then have the appropriate color appear through the window. The station judge will inform the company of what color should appear through the window, orange or blue.

Companies will receive 10 points when they successfully remove the biofouling from the Holyrood subsea observatory camera. Successfully removing the biofouling is defined as rotating the inner plastic sheeting three times around and having the appropriate color appearing through the window. Companies should show the station judge that the color in the window passes three times, demonstrating that the sheet has been rotated three times around. For example, if the station judge informs the company to have blue showing through the window, companies would rotate the inner sheeting until blue is showing, continue rotating it past that point until blue is not showing, continue rotating until blue is showing a second time, continue rotating it past that point until blue is not showing, then finally continue to rotate until blue is seen for the third time. When the entire window is fully showing blue (or orange if that is the color given by the station judge) for the third time, companies have successfully cleaned the camera. Companies may rotate the inner plastic sheeting either clockwise or counterclockwise, but all rotation must be in the same direction. The station judge must be able to see the proper color pass by for all three rotations.

TASK 3: *Wind-Powered Offshore Oil Platform: Scalable Solutions for Global Energy Needs*

This task involves the following steps:

Task 3.1 Micropile installation

- **Install a micropile to the seafloor to secure the wind turbine**
  - **Place a bubble curtain device around the micropile designated location – 10 points**
  - **Guide a micropile to the designated location – 10 points**
  - **Pull a pin to release the micropile – 10 points**

Task 3.2 Powering an oil platform from a wind turbine

- **Connect the wind farm power connector to the oil platform**
  - **Retrieve the power connector from the wind farm subsea station – 5 points**
  - **Lay the power connector cable through a waypoint away from the micropile – 10 points**
  - **Remove the cover from the oil platform port – 5 points**
  - **Install the power connector into the oil platform port – 10 points**

Total points = 60 points

Product Demonstration Notes:

Task 3.1 Micropile installation

At the World Championship , Task 3.1 micropile installation will take place in the Offshore Engineering Basin Tank.

Companies must place a bubble curtain device around the location designated for the micropile. The bubble curtain device will be located on the surface, side of the pool at the start of the product demonstration. The bubble curtain device will be constructed from ½-inch PEX tubing and rope. The designated location for the micropile will be constructed from ½-inch pipe, 2-inch pipe, a 3-inch to 2-inch reducer bushing, and corrugated plastic sheeting. The ½-inch pipe at the bottom of the micropile designated location will be painted orange. Companies must place the bubble curtain around the designated location.

Companies will receive 10 points for successfully placing the bubble curtain device around the designated location. Successfully placing the bubble curtain device is defined as the bubble curtain device no longer in contact with the ROV and completely surrounding the orange PVC pipe at the bottom of the designated location. Companies must place the bubble curtain prior to installing the micropile into the designated location. Once the micropile has been installed, companies may no longer receive points for placing the bubble curtain.

Companies must guide the micropile into the designated location. The micropile will be lowered from the surface by hand by company members at the side of the pool. The micropile cannot be carried down by the ROV, and the ROV may not touch the micropile until the installation is complete. The ROV's cameras can provide visual guidance for this task. Pilots observing the task through the ROV's cameras can provide verbal instructions to the company members at poolside to install the micropile into the designated location. For example, pilots may communicate to the poolside company members to move the micropile 20 cm to the right then lower it 50 cm. Pilots may also inform the poolside company member when micropile is successfully installed.

The micropile will be located on the surface, side of the pool at the start of the product demonstration. The micropile will be constructed from ½-inch PVC pipe with a rope connecting it to the surface. A pin will connect the rope to the 1-inch pipe. On the surface, companies will have a 3.1 meter length of ½-inch PVC pipe with a tee at the end. The rope from the micropile will pass through the tee; the 3.1 meter length of pipe will allow companies to extend their reach 3 meters out over the water. The designated location will be within 2 meters of the side of the pool. The designated location may be obscured from surface view by waves (World Championship offshore engineering basin) or by corrugated plastic (PIONEER class regionals).

Companies will receive 10 points when they successfully guide the micropile into the designated location. Successfully guiding the micropile to the designated location is defined as the micropile inside the 2-inch pipe of the designated location. The ROV may not touch, push or contact the micropile prior to pulling the pin to release the micropile. The micropile must be lowered from the surface by hand, with the pilot using the view from the ROV's camera to provide visual guidance and instructions the companies members guiding the micropile. Companies will be penalized five points each time their ROV touches the micropile prior to installation, up to two times (10 penalty points) total.

Once the micropile has been successfully guided into place and installed, companies must pull the pin to release the micropile. The pin will extend through two 3/16-inch holes drilled in the 2-inch pipe and through a loop in the rope. Companies may insert the pin before lowering it down from the surface, setting it to any location they prefer. Note that, however, if the micropile becomes detached from the rope prior to installation, companies will not be able to recover it. Once guided and installed into the designated location, companies may touch the micropile while attempting to pull the pin.

Companies will receive 10 points for successfully pulling the pin to release the micropile. Successfully pulling the pin to release the micropile is defined as the pin no longer in contact with the 2-inch pipe and the rope holding the micropile removed from the water. The pin is considered debris.

The micropile must remain installed for the entire product demonstration run. If the micropile is removed from the designated location at any time during the product demonstration run,

companies will lose their points for guiding it to the designated location. If the rope is still attached to the micropile, companies may attempt to reinstall the micropile to regain those points. If the rope is no longer in place, companies may no longer complete this portion of the task.

Task 3.2 Powering an oil platform from a wind turbine

At the World Championship, Task 3.2 powering an oil platform from a wind turbine will take place in the Offshore Engineering Basin Tank.

Companies must connect the oil platform to the power from the offshore wind farm. The oil platform will consist of only the power connection port; the wind farm will consist of only a subsea platform and power connector. Neither the oil platform nor the wind farm will have surface components; no ropes or lines will connect these subsurface assets to the surface. The oil platform power connector port will be constructed from 1 ½-inch PVC pipe and a ½-inch PVC framework. The wind farm power connector will be constructed from ½-inch PVC pipe with a screw hook as a carrying mechanism for the power connector. The platform will be constructed from ½-inch PVC pipe and corrugated plastic sheeting. Four meters of wire cable will connect the platform to the power connector.

Companies must retrieve the power connector from the wind farm subsea platform. Companies will receive 5 points when they successfully retrieve the power connector from the wind farm subsea platform. Successfully retrieving the power connector is defined as the connector in control of the ROV and no longer touching the platform or bottom of the pool. If the connector is dropped by the ROV at a later time, companies will not lose their points for retrieving the connector but may need to recover it to complete the remaining product demonstration tasks.

Companies must lay the power connector cable through a waypoint attached to the micropile. The waypoint will be constructed from ½-inch PVC pipe and will be located approximately 40 cm away from the micropile. Two lengths of ½-inch PVC will protrude vertically from the waypoint, companies must lay the power cable between those two lengths of pipe.

Companies will receive 10 points when they successfully lay the power connector cable through the waypoint. Successfully laying the power cable through the waypoint is defined as the wire cable of the power connector on the pool bottom and inside of the two vertical PVC lengths. The power connector cable must stay inside the waypoint for the entire product demonstration run. If the cable is removed from the waypoint at any time during the product demonstration run, companies will lose points for laying the cable through the waypoint. Companies may attempt to re-lay the cable into the waypoint to regain those points.

Companies must also remove the cover from the oil platform port. Companies may remove the cover from the oil platform port before or after they pick up the power connector. The oil platform port will be constructed from 2-inch PVC pipe. The cover of the port will be constructed from a 3-inch PVC end cap. A rope will act as a carrying mechanism for the cover.

Companies will receive 5 points when they successfully remove the cover from the oil platform port. Successfully removing the cover is defined as the cover under control of the ROV and no longer in contact with the connection port. The cover is considered debris; companies must return the cover to the surface or it must be under control of their ROV at the end of the product demonstration run.

Once the power connector has been retrieved and the cover has been removed from the oil platform port, companies must install the power connector into the connection port. The end of the connector will be covered by Velcro hooks. The inside of the port will be covered by Velcro loops.

Companies will receive 10 points when the connector is successfully installed into the port. Successfully installing the connector is defined as the connector no longer in contact with the ROV, the connector inserted into the 2-inch port, and the connector making a Velcro-to-Velcro stick. Once installed, the power connector must remain installed for the entire product demonstration run. If the connector becomes disconnected, companies will lose their points for installing the connector. Companies may attempt to reinstall the power connector to regain those points.

TASK 4: *MATE Floats Under the Ice*

Once again, this year the preview mission focuses on *MATE Floats!* and includes all of the details of this task as well as hints and specifications for building a vertical profiling float (non-ROV device). The mission outlined below will be included in the competition manuals as **one of the tasks** for the 2026 competition season.

MATE Floats! 2026 is inspired by the National Science Foundation (NSF)-funded GO-BGC Project. The goal of GO-BGC is to build a global network of profiling floats with chemical and biological sensors to monitor circulation, chemistry, biology, and overall ocean health. Scientists, engineers, and technicians are using NSF grant funds to build and deploy 500 robotic ocean-monitoring floats around the globe. GO-BGC hit the 300 mark, with 325 out of the targeted 500 GO-BGC floats deployed or en route to be deployed from research vessels.

Given the location of the 2026 MATE World Championship, this year's *MATE Floats!* mission scenario takes place UNDER the ice. For regional competitions, this translates to a simulated under-ice task; for companies competing at the World Championship, this means operating under an ice sheet grown in the National Research Council's (NRC) ice tank. At 90 meters long, 12 meters wide, and 3 meters deep, the NRC's ice tank is one of the largest facilities of its kind in the world. With temperatures ranging down to -25 °C , this indoor, refrigerated facility simulates realistic Arctic and northern marine conditions and has the ability to grow ice at 2.5 millimeters an hour.

Operating floats in polar waters where they may encounter ice is a real-world challenge faced by GO-BGC float technicians. Sensors and antennas, not to mention the float itself, run the risk of

being damaged if the float attempts to surface with an ice sheet overhead. There is also the possibility of floats becoming entrained in sea ice and crushed. Therefore, floats deployed in polar waters must be engineered with ice-avoidance capabilities and with the ability to store data during under-ice profiles and delay transmission until the float is clear to surface in open water. "Ice-avoidance capabilities" translates to sensors measuring water temperature and chemistry to assess if ice is detected as the float ascends to the surface, along with the decision-making capability (i.e., an ice-avoidance algorithm) to reverse course and descend rather than continuing to surface.

Simulating this within the context of a MATE ROV Competition mission task presents some challenges, especially without the ability to replicate the precise real-world conditions – even in an ice tank – that would allow a float with ice-avoidance capabilities to detect ice and reverse course

So, instead of ascending to the surface and transmitting data to the mission station, companies participating in the 2026 MATE ROV Competition are challenged to design and build a float that ascends to a specific depth below the surface and holds that position for a defined period of time before initiating another descend to depth. Only after the float is recovered is it tasked with transmitting its data to the mission station.

This task involves the following steps:

Design and construct an operational vertical profiling float

- **Prior to the competition, design and construct a vertical profiling float – 5 points**
- **Float communicates with the station prior to descending – 5 points**
- **Float completes two vertical profiles under the ice**
    - **Vertical profile 1**
        - **Float completes first vertical profile**
            - **Using a buoyancy engine – 10 points**
            - **Using a different mechanism – 5 points**
        - **Float maintains a depth of 2.5 meters for 30 seconds – 5 points**
        - **Float maintains a depth of 40 cm for 30 seconds – 5 points**
            - **Float breaks the surface or contacts the ice sheet – 5 point penalty**
    - **Vertical profile 2**
        - **Float completes second vertical profile**
            - **Using a buoyancy engine – 10 points**
            - **Using a different mechanism – 5 points**
        - **Float maintains a depth of 2.5 meters for 30 seconds – 5 points**
        - **Float maintains a depth of 40 cm for 30 seconds – 5 points**
            - **Float breaks the surface or contacts the ice sheet – 5 point penalty**
- **After recovery, float communicates with (transmits data autonomously to) the station**
    - **Float communicates data to the mission station – up to 10 points**

        - **Float communicates all data packets – 10 points**
        - **Float communicates at least one data packet – 5 points**
    - **Profile is graphed as depth over time – 10 points**

    OR

- **Company does not design and construct a vertical profiling float, or float does not communicate data to the mission station after recovery**
    - **Data provided by MATE is used to graph depth over time – 10 points**

Total points = 70 points

Product Demonstration Notes:
At the World Championship competition, Task 4.1 MATE Floats Under the Ice, will take place in the Ice Tank.

Prior to the competition, companies must build a float capable of completing a vertical profile (i.e., traveling from the surface to a depth of 2.5 meters, maintaining depth for 30 seconds, ascending to a depth of 40 cm and holding at that depth for 30 seconds) and collecting and transmitting data to the mission station.

Companies that design their float with a buoyancy engine will receive additional points. A buoyancy engine moves fluid from inside the float to outside the float, displacing seawater and changing the density of the float. Using motors to move air or liquid does constitute a buoyancy engine. Using motors as thrusters to directly move the float, by turning a propeller or emitting a jet of water, is not using a buoyancy engine. Companies that do not use a buoyancy engine to complete their vertical profiles will receive fewer points. The float must also be capable of communicating data to a receiving device (i.e., the receiver) located at the surface at the mission station. The company is responsible for designing and constructing both the transmitter on the float and the receiver that displays the data at the mission station.

Companies must submit a non-ROV device document outlining their float design, detailing its operation, and demonstrating that it does not violate any safety rules. This document must also detail the onboard battery design, fuse size for safe discharge of the current, and how the float communicates with the company's receiver at the mission station. See DOC-004 for more details. This non-ROV device document must be submitted in advance of the competition. Companies will receive 5 points for designing and building a float. Successfully designing and building a float is defined as submitting a non-ROV device document that meets the requirements of DOC-004, i.e., the float has a mechanism to move the float vertically in the water column and transporting the float to the product demonstration station.

Companies competing at a regional may or not be required to submit float documentation. Contact your regional coordinator or visit your regional contest's website to determine if you must submit your float design document prior to the competition. IF REQUIRED BY THE REGIONAL

COMPETITION, COMPANIES MUST SUBMIT FLOAT DOCUMENTATION OR THEY WILL NOT BE RECEIVE POINTS FOR DESIGING AND BUILDING THE FLOAT.

Companies may hand-launch the float at the side of the pool. Once deployed, the float must communicate with the mission station to receive points for communication. Deploying the float is defined as the float no longer in contact with any station personnel and floating on the surface. Once the float has been deployed, it must communicate to the receiver located on the surface at the shore station. Companies are responsible for constructing both the transmitter on the float and the receiver at the shore station.

The float must communicate (i.e., transmit) the following information to the mission station, referred to as the defined data packet:

- Company number (provided by MATE a few weeks prior to the competition)
- Time data (UTC or local or float time [float time would be time since float starts recording])
- Pressure data and/or depth data
- Any additional data as required by the company to complete this task

Pressure data must be displayed in pascals (pa) or kilopascals (kpa).
Depth data must be displayed in meters (m) or centimeters (cm).

Pressure/depth data must correlate to a set time transmitted from the float. For example, a defined data packet from PIONEER 01 could be:

PN01 1:51:42 UTC 9.8 kpa 1.00 meters

NOTE: MATE is requiring WHAT data is transmitted (i.e., company number, time, pressure/depth). Companies must determine HOW to transmit that data and should consider that there will be other companies transmitting data at same time.

Companies will receive 5 points when their float is deployed into the water and successfully transmits the defined data packet to the receiver at the mission station upon deployment. Successfully transmitting the information is defined as the station judge seeing at least ONE defined data packet from the float on a screen or display at the mission station. The float only needs to transmit ONE defined data package prior to descending, but companies will not be penalized for sending additional defined data packets. The receiver should not receive transmissions from any source other than the float. The float must transmit the defined data packet before starting its first vertical profile. If the float does not transmit and has not started its first vertical profile, companies may recover the float and attempt repairs. If the float descends before transmitting, companies can continue with the remaining float tasks but will not receive points for transmitting before the first vertical profile.

The float should attempt to complete two vertical profiles.

The float will be considered to be under the ice. For teams at a regional competition, ice will be assumed to be on the surface. At the World Championship, this task will be conducted in the

NRC's tank with an ice sheet between 1 cm and 5 cm thick at the surface. Companies will hand-launch their floats through a 1 meter x 1 meter hole cut into the ice sheet. The water in the tank will be comprised of an EGADS (ethylene glycol, aliphatic detergent, and sugar) solution. The EGADS water solution has a specific gravity of approximately 1.025 but can vary slightly. Companies should consider bringing warm clothing, especially gloves that may become wet when deploying the float, for working in the cold environment and water of the ice tank.

A vertical profile under the ice is defined as the float on the surface and descending to and maintaining a depth of 2.5 meters (+/- 33 cm) for 30 seconds. After maintaining depth at 2.5 meters, the float must ascend to a depth of 40 centimeters (+/- 33 cm) but should not break the surface or contact the ice. The float must maintain a depth at 40 cm for 30 seconds. A float that breaks the surface at any time after descending, or contacts the ice sheet, will be penalized 5 points on that vertical profile.

Companies will receive 10 points for successfully completing their first vertical profile using a buoyancy engine, or 5 points if they use a different mechanism. Successfully completing a vertical profile is defined as the float descending to 2.5 meters (+/- 33 cm) then ascending to 40 cm (+/- 33 cm). For example, a float that descends to the bottom of the pool, then ascends to the surface would be considered to have completed a vertical profile. In this example the float did descend to 2.5 meters (and went beyond that), and then ascended to 40 cm (and went beyond that as well) This float would not receive points for maintaining depth at either 2.5 meters or 40 cm and would also be penalized for breaking the surface / contacting the ice sheet, but the float would be considered to have completed a vertical profile.

During the vertical profile, the float must maintain a depth of 2.5 meters for 30 seconds. Companies will receive 5 points for successfully maintaining a depth of 2.5 meters for 30 seconds. This is defined as the bottom of the float at 2.5 meters of depth (+/- 33 cm) for 30 seconds. The bottom of the float should be used for calculating this depth, i.e., the bottom of the float should be at 2.5 meters (+/- 33 cm). After recovery and transmission, the data packets should show seven (7) sequential data packets where the depth is 2.27 meters to 2.83 meters. Companies must display all data packets on a screen for the station judge; the company should point out the seven sequential data packets at the proper depth. If the float drifts outside of this range at any time during the 30 seconds, the float must return to the designated range for an entirely new 30 second period. For example, if the float maintains depth at 2.76 meters for 20 seconds but then descends to 2.91 meters (outside of the given range), the float must ascend back into the range for an entire 30 seconds, not just the remaining 10 seconds from the first attempt at maintaining of depth. If the float's depth/pressure sensor is not at the bottom of the float, communicate the offset to the station judge. For example, if the float's depth/pressure sensor is 25 cm above the bottom of the float, when the bottom of the float is at 2.5 meters, the pressure sensor would be at 2.25 meters. Thus, the proper range for the depth/pressure sensor would be 2.58 meters to 1.92 meters. Communicate that adjusted range to the judge prior to deployment.

After maintaining a depth of 2.5 meters, the float should ascend to 40 cm (+/- 33 cm), just beneath the surface of the ice sheet. Companies will receive 5 points for successfully maintaining a depth

of 40 cm for 30 seconds. This is defined as the top of the float at 40 cm of depth (+/- 33 cm) for 30 seconds. The top of the float should be used for calculating this depth, i.e. the top of the float should be at 40 cm (+/- 33 cm). After recovery and transmission, the data packets should show seven (7) sequential data packets where the depth is 0.07 meters to 0.73 meters. Companies must display all data packets on a screen for the station judge; the company should point out the seven sequential data packets at the proper depth. If the float drifts outside of this range at any time during the 30 seconds, the float must return to the designated range for an entirely new 30 second period. For example, if the float maintains a depth at 52 cm for 20 seconds but then descends to 75 cm (outside the given range), the float must ascend back into range for an entire 30 seconds, not just the remaining 10 seconds from the first maintaining of depth. If the float's depth/pressure sensor is not at the top of the float, communicate the offset to the station judge. Communicate that adjusted range to the judge prior to deployment.

As noted, if at any time during a vertical profile the float breaks the surface or contacts the ice sheet, companies will be penalized 5 points for that vertical profile.

Companies must show the station judge data packets confirming the proper depth range. There must be seven sequential data packets spanning 30 seconds (0, 5, 10, 15, 20, 25 and 30) for each depth. If the float is not recovered, or if the float does not transmit data packets to the receiver, companies will not be awarded points for maintaining depth.

The float should then attempt to complete a second vertical profile. Companies will receive 10 points for successfully completing a second vertical profile using a buoyancy engine, or 5 points if they use a different mechanism. Successfully completing a vertical profile is defined as the float descending to 2.5 meters (+/- 33 cm) then ascending to 40 cm (+/- 33 cm).

During the second vertical profile, companies will receive 5 points for successfully maintaining a depth of 2.5 meters for 30 seconds. This is defined as the bottom of the float at 2.5 meters of depth (+/- 33 cm) for 30 seconds. Data packets should show seven (7) sequential data packets where the depth is 2.27 meters to 2.83 meters, offset for the position of the sensor. Companies should indicate to the station judge the seven data packets at the proper depth for the second vertical profile.

Companies will receive 5 points for successfully maintaining a depth of 40 cm for 30 seconds. This is defined as the top of the float at 40 cm of depth (+/- 33 cm) for 30 seconds. When the float is recovered to the surface and data packets received, the data packets should show seven (7) sequential data packets where the depth is 0.07 meters to 0.73 meters, offset for the position of the sensor. Companies should indicate to the station judge the seven data packets at the proper depth for the second vertical profile

After successfully completing the second vertical profile, the in-water portion of the float task is complete. The float can be recovered. Recovery is defined as the float being returned to the surface, side of the pool. At regional competitions, the company's ROV should recover the float to the surface, side of the pool. At the World Championship, an ROV piloted by MATE staff will recover

the float to the surface side of the pool. In the ice tank at the World Championship, companies should inform the station judge that they are ready to recover their vehicle. The station judge will stop their mission time and allow the MATE ROV to recover their float.

If a penalty occurs, or if the float does not maintain the proper depth for 30 seconds, companies will not receive full points for that vertical profile. It is up to the company to decide when they are ready to recover the float and therefore when the in-water portion of the float task is complete.

If upon recovery and transmission it is discovered that the float did not maintain the proper depth, companies will not receive points for that portion of the task. Companies are not permitted to return their float to the water to attempt to complete additional profiles. If prior to recovery the company believes their float may not have maintained depth, or if the company knows their float contacted the ice or breached the surface, companies may have the float complete additional vertical profiles in an attempt to increase their score. If the float completes an additional vertical profile that would receive a higher score, companies may use that score instead of the penalized profile score.

Companies may not mix and match portions of a vertical profile, the entire vertical profile must be considered. For example, if during the first vertical profile, the float does not maintain depth at 2.5 meters but does maintain depth at 40 cm (and does not break the surface), companies would receive 15 points for that vertical profile. If during a subsequent profile (beyond the two profiles required), the float maintains depth at 2.5 meters, maintains depth at 40 cm, but breaks the surface, companies would still only receive 15 points for that vertical profile; companies are not permitted to pair not breaking the surface in the first profile with maintaining the proper depth in the subsequent profile.

Companies are permitted to include visual cues (e.g., colored LEDs or other devices) that can be detected from the surface to signify a successful profile. For example, a company could have a blue LED signal when their float is within the 2.5 meter range, and a green LED signal for when their float is within the 0.4 meter range. A company member on the surface could track the timing of these visual cues in order to determine if the float needs to continue profiling or whether it can be recovered. Visual cues are optional and will not influence scoring but may help the company to determine when to recover their float.

Once recovered onto the pool deck, the float should communicate data by transmitting data packets wirelessly to the receiver. Companies will receive 10 points when the float successfully communicates all of its data packets to the shore station. Successfully communicating all data packets is defined as showing the station judge one data packet from every 5 seconds of both vertical profiles. If the float does not communicate all data packets but successfully communicates at least one data packet from the vertical profiles, the company will receive 5 points. Successfully communicating at least one data packet, but not all data packets, is defined as at least one data packet from the vertical profiles being shown to the station judge. This data packet must be from after the float descends; it cannot be a data packet from before the float began vertical profiles.

Companies will use the data packets received from the float to graph depth over time. Companies will receive 10 points for successfully graphing depth over time. Successfully graphing depth over time is defined as showing the station judge a graph with time on the X axis and depth on the Y axis. Companies must graph the data received from their vertical profiles, and there must be at least 20 data packets included on the graph. If the float did not collect and transmit 20 data packets, the company will not be able to graph its data and may instead elect to graph the data provided by MATE. Companies must use a computer or device to graph the data; companies may not draw a graph by hand. Data points may be entered (or cut and pasted) to a device by hand.

At a regional competition, recovery of the float and data transmission, as well as graphing of that data must occur within the 15-minute product demonstration time. At the World Championship, companies will have 15 minutes for the task, but the time will stop for the MATE ROV to recover their float. Once the float is recovered and in possession of a member of the company, the station judge will restart the product demonstration time and the company will have the remaining time to receive communication from the float and graph the data. Data transmission and graphing may happen at a data station away from mission station. If that is the case, time will not restart until the company arrives at the data station.

Data will be available from MATE if the company does not build a float or if the float fails to communicate after it is recovered from the water. Likewise, if the float does not communicate at least 20 data packets from the profile, data will be available from MATE. Graphing MATE data replaces graphing profile data AND the float communicating all data packets to the shore station. Companies that graph MATE data may still earn points for completing vertical profiles and transmitting at least one data packet.

Companies that choose to use MATE data should inform the station judge that they require this data. The judge will then provide a set of time and depth data to the company. Once a company requests data from MATE, they can no longer receive points for communicating all data packets to the station or for graphing data from their own float.

Companies will receive 10 points for successfully graphing depth over time. Successfully graphing depth over time is defined as showing the station judge a graph with time on the X axis and depth on the Y axis. Companies must use a computer or device to graph the data; companies may not draw a graph by hand. Data points may be entered (or cut and pasted) to a device by hand.

*Regional competitions may take place in pools that are shallower than 2.5 meters +/- 33 cm. If that is the case, contact your regional coordinator or visit your regional contest's website to determine what depth the float should maintain depth at and what depth you must reach before you start your ascent for collecting sensor data.

Float Specifications:
The float must be less than 1 meter in overall height.
The float must be less than 18 cm in diameter/length/width.

The float may not have an airline to the surface or a rope/line to the surface or the bottom. The entire float must be less than 1 meter in length, including an antenna for broadcasting data. The float must be less than 1 meter in length for the entire mission, it cannot have multiple compartments that separate, nor may it raise or lower any objects beyond the 1-meter limit.

New for 2026!!!

Companies are **REQUIRED** to incorporate a feature to aid recovery of their floats by the MATE Competition ROV under the ice. Potential examples include a loop of rope or wire, a U-bolt (#310 U-bolt or one of larger diameter), or any other means that is at least 5 cm in width, protrudes 5 cm from the float, and by which the MATE ROV can grasp and return the float to the surface.

The feature must be easily accessible and can protrude beyond the 18 cm maximum diameter of the float. MATE recommends incorporating redundant features to help ensure a quick and easy recovery; the more quickly and easily the float is to recover, the more time a company will have to evaluate the data.

The float must operate independently; it cannot be connected to the shore by a tether, and the ROV cannot interact with the float other than during recovery.

Any air used on the float must be stored on the float. Floats may not have an airline to the surface. All electrical power to the float MUST go through a single fuse. The float will operate as a non-ROV device (see 3.3.1 Non-ROV Device Power Specifications for additional rules on powering a non-ROV device). Small button batteries are allowed to power timing devices on the float. All other batteries must adhere to the non-ROV device battery rules.

New in 2026!!!

PREVIEW OF THE COLLABORATIVE BONUS MISSION @ THE WORLD CHAMPIONSHIP

This is the FIRST time in history that the MATE ROV Competition is challenging companies to tackle a task – collaborative bonus or otherwise! – staged in SALTWATER *and* involving SONAR (the real thing, not simulated!). This is made possible because of the unique facilities of our host institution, the Marine Institute of Memorial University, and the generous support of Cerulean Sonar, manufacturer of the Omniscan 450 FS Imaging Sonar.

Omniscan 450FS - Cerulean Sonar

Companies will have the opportunity to integrate and test the sonar as part of their check-in and safety and workmanship inspection. And on Saturday, June 26, the MATE ROV Competition will transport competitors to The Launch where they will be challenged to operate in SALTWATER.

Details on the collaborative bonus mission will be provided once companies submit their documentation (see SUBMISSION GUIDELINES AND KEY DEADLINES). What follows are the technical specifications for preparing your vehicle to integrate the sonar both mechanically and electrically.

NOTE for 2026!!!

Companies do not need to purchase this sonar; Cerulean Sonar will be providing this sonar to all companies at the MATE ROV Competition to integrate into their vehicles and use for the bonus mission on site in St. John's.

Specifications

The Omniscan 450 FS Imaging Sonar will be:

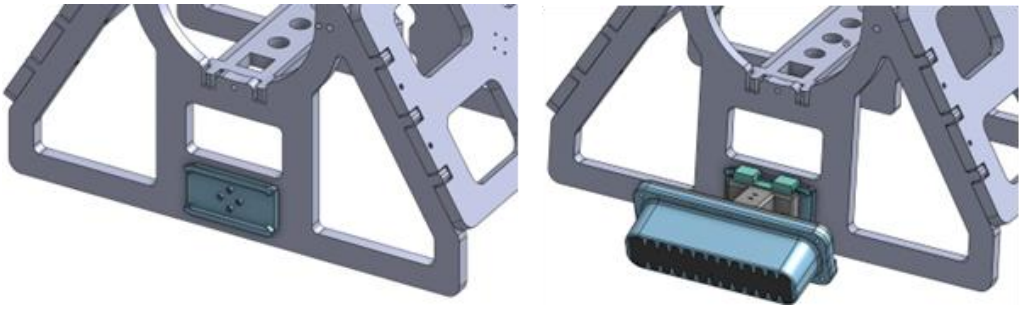
- Neutrally buoyant in seawater*.
- Independently powered from the surface; companies do not need to incorporate power links into their ROV.

*The Omniscan sonar is approximately 60 g positively buoyant. Prior to the collaborative bonus mission, weight will be added to the sonar to achieve near neutral buoyancy.

Companies will be required to attach the sonar to their ROV. The dimensions of the sonar can be found here: CAD Drawing of Omniscan sonar; companies should have room on the front of their ROV to attach this device. The sonar comes with a quick release mount. Companies will need to install a quick release plate to their ROV; the mount on the sonar can quickly connect to this release plate.

- Quick Release Plate Only (Amazon US): https://a.co/d/2zXv5pB
- Quick Release Plate and Mount(Amazon US): https://a.co/d/5krr
- 3D Model of the Plate for modification and 3D printing: STEP File STL File

Note that only the quick release plate is needed on the ROV, the mount is included on the provided Cerulean sonar. Companies may wish to purchase the quick release plate with the mount to practice and test attaching the sonar to their vehicle.



CAD image of the mounting plate (left) and sonar (right) installed on an ROV frame.

Prior to the collaborative bonus mission, companies will have approximately 20 minutes to integrate the sonar into their vehicle. This will include mounting the sonar to their vehicle and securing its tether cable to the ROV tether (MATE will provide cable ties to all companies in the collaborative bonus mission staging area). After completing the bonus mission, companies will have approximately 10 minutes to remove the sonar from their vehicle and detach its tether cable.

The sonar will connect to a laptop or other device on the surface via an Ethernet port. Companies must provide a computer or other device with this port that can receive the sonar signal. Companies should download SonarView onto their device prior to the World Championship. An overview of the system and SonarView installation directions can be found here: Cerulean website. Companies can familiarize themselves with SonarView by downloading a few example logs and the view from this website.

NOTE for 2026!!!
Companies must arrive on site with SonarView installed on their system. MATE will not provide additional time to download and install the necessary.

Questions concerning the specifications and integration of the Cerulean sonar system will be answered on the MATE ROV Competition Forum Board. Questions regarding the bonus collaborative mission itself will not be answered until that mission document has been provided to companies.

PRODUCT DEMONSTRATION RESOURCES

Product Demonstration resources can be found on the Competition Class page.
These resources include:

- Videos showing the successful and unsuccessful flying of the transect and maintaining position over the coral garden.
- European Green crab, native Rock crab, and native Jonah crab species images.
- Crab counting sample practice examples.
- Link to the 2026 MATE ROV Competition – Invasive Species Reporting Form.
- Offshore oil platform map in color and in black and white. The oil are platform information table.
- Iceberg track practice examples.
- eDNA sensor frequency seen practice examples.
- MATE Floats data practice examples.

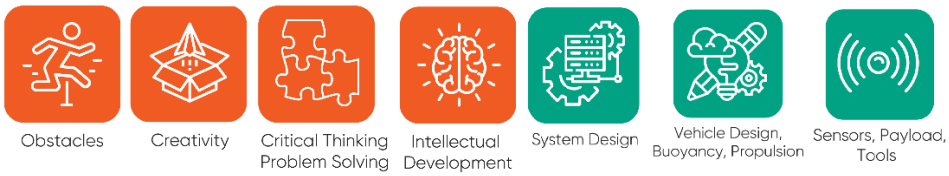
PRODUCT DEMONSTRATION RESPONSIBILITIES

Companies are responsible for designing, building, and bringing their own operational vertical profiling float. Companies must also design and bring any tools or devices to complete the required MATE product demonstration tasks.

Companies are permitted to create a basket to collect multiple product demonstration items. Any collection basket MUST be included in weight measurements. A collection basket is considered debris if still in the pool and not under control of the ROV when product demonstration time ends. Any collection basket must be deployed and returned by the ROV; it may not be pulled to the surface by hand or a surface device.

The MATE ROV Competition will provide all of the remaining product demonstration items.

PRODUCT DEMONSTRATION PROP BUILDING INSTRUCTIONS & PHOTOS



The [Product Demonstration Prop Building Instructions & Photos] will be released separate from the competition manual.

PART 2: VEHICLE DESIGN & BUILDING SPECIFICATIONS

1.0 GENERAL

IMPORTANT NOTE: Questions about the competition, including the production demonstrations and design and building specifications, should be posted to the [MATE ROV Competition Forum Board]. Questions will be answered by MATE ROV Competition staff so that all companies can see the questions and answers. This will also help to avoid duplicate questions. That said, please make sure that your question(s) has not already been asked – and answered – before posting. It is up to you and your company to read, comprehend, and comply with ALL rulings posted on the site. All pertinent rulings will be posted to the [2026 Official Rulings] thread, which will be pinned to the top of the forum board.

When emailing their question, companies should reference:

- Any specific specification or rule (e.g. ELEC-002P)

- Competition class

Conventions: All values contained in this document are threshold values unless specifically stated otherwise. All water depths are given in meters (m). All dimensions and measurements utilize SI units.

PIONEER class companies competing at a regional event should contact their regional coordinator or visit their regional contest's website to find out any specific requirements for your regional.

2.0 SAFETY

Safety is the competition's primary concern and guiding principle. Any system that is deemed unsafe by competition officials will not be permitted to compete. If a safety concern is identified during the initial inspection, companies are permitted to modify their system and have it re-inspected. Companies are permitted to have their vehicle re-inspected twice. If a company fails to pass its third and final safety inspection, it is disqualified from the underwater competition portion of the event. There are NO APPEALS once an ROV has been disqualified.

NEW for 2026!!!
This year the MATE ROV Competition will reinforce the competition's emphasis on safety *and* workmanship. This year vehicle inspections will include both a safety *and* a workmanship inspection. **Companies that do not meet the safety standards will not be permitted to compete in the in-water events until issues are corrected. Companies that do not meet workmanship standards will have points deducted from their workmanship score sheet but can still compete in the product demonstration.** Safety and workmanship examples will be included in the MATE ROV Competition Safety Inspection Tutorial.

See the Onsite Safety Inspection Score Sheet and the Onsite Workmanship Sheet for specific information. The Technical Bulletin – MATE Expected Work Practices has additional information on workmanship and minimum industry standards. `

Examples of safety violations from previous ROV competitions include:

- Companies used equipment that did not participate in and/or pass safety inspection.
- The electrical SID included in the technical documentation did not show a main fuse.
- The ROV used pneumatics, but the technical documentation did not include a pneumatics diagram or pneumatic specifications.
- The ROV used pneumatics, but the company had not passed the fluid power quiz.
- Motors were not shrouded to IP-20 standards

Examples of workmanship violations from previous ROV competition include:

- Circuit boards and components were not securely fastened.
- There was insufficient strain relief topside or ROV-side.
- Wiring in the control box is messy; a "rat's nest".
- Wires in the control box were not properly labeled

- Wires in the control system have improper termination
- Jumper pins were used to make connections in final control box

2.1 Jobsite Safety and Environment Analysis

Each member of the company is encouraged to read Oceaneering Americas Region HSE Employee Handbook, with emphasis placed on the following chapters.

Chapter 1 - Housekeeping
Chapter 9 - Hand Safety
Chapter 11 - Lifting and back safety
Chapter 12 - PPE
Chapter 17 - Tool Safety
Chapter 24 - Electrical Safety
Chapter 29 - Employee Observation Program
Chapter 33 - JSEA
Chapter 37 - Working at Other sights

Jobsite Safety and Environment Analysis (JSEAs)
Note for 2026!!!
Companies advancing to the World Championship are required to create a JSEA and submit it along with (but as a separate document from) the Technical Documentation. Companies are also required to bring their JSEA to the onsite safety inspection; companies will not pass their inspection without this document. Companies must also bring a copy of their JSEA with them to the mission station and present it to the mission station judges prior to setting up for each of the product demonstration attempts. Companies will receive 5 points on their product demonstration score sheet for presenting the product demonstration judges with their JSEA prior to setup. **Companies without a JSEA will not be allowed to compete in the product demonstration run.**

JSEAs may or may not be required for PIONEER class companies attending a regional. Contact your regional coordinator or visit their regional contest's website to find out whether a JSEA is required for an PIONEER regional competition.

A **JSEA** describes job tasks in step-by-step fashion, identifies associated hazards at each step, and outlines proper hazard controls that minimize the risk of injury or illness to the individual(s) performing that task. JSEAs are used extensively by the offshore industry.

The JSEA process follows a structured approach that comprises three (3) processes

In addition to these three processes, JSEAs should include the following information:

- The scope of the work.
- Space for specific names to be entered as responsible for implementing safeguards.
- Names and positions of all members involved in the JSEA discussion or Toolbox Talk.

- Describe Job Steps
  - Breakdown the task into basic steps. Each step should briefly describe what is done and in what order. Avoid making the breakdown so detailed that it has too many steps or making the job breakdown so general that basic steps are omitted.
- Identify the Hazards
  - Examine each step for hazards – either caused by the task to be conducted or by the work environment – or for any situation that might deviate from expected circumstances. The main activity in the JSEA procedure is to determine the hazards or potential hazardous exposures at each step of the task. Companies should strive to recognize all potential risks and plan to eliminate or reduce the hazards identified.
- Implement and Assign Safeguards
  - Safeguards must be implemented to defend against the identified hazards. Remember that Oceaneering maintains the following Safeguard Hierarchy for implementation:
    - **Eliminate** the risk by avoiding it altogether, eliminating the source of risk, or substituting the source of risk with something that poses no risk or a much lesser risk.
    - **Engineer** solutions that reduce the risk or eliminate exposure to it.
    - Provide necessary Personal Protective Equipment (**PPE**) to protect from residual risk.
  - Assign responsibility for safeguards

    For safeguard implementation, it is extremely important to assign direct responsibility for each safeguard developed during the JSEA process. For example, if a task requires the replacement of a hydraulic pump, a safeguard would be to isolate the energy source feeding the pump's drive motor. The ideal method to describe this safeguard implementation on the JSEA would be: "*Tech II Bob* will apply lock-out /tag-out to *the energy source.*"

    These responsibilities should be communicated to the appropriate personnel when the JSEA is reviewed by the company.

For more information and examples, companies can visit the following web sites:

- Shops and Trades | Office of Environment, Health & Safety (berkeley.edu) https://ehs.berkeley.edu/shops-and-trades
- SafetyWorks!: Job Hazard Analysis (safetyworksmaine.gov) https://www.safetyworksmaine.gov/safe_workplace/safety_management/hazard_analysis.shtml

POTENTIAL HAZARDS

DESCRIBE JOB STEP (List the natural steps of the job. Do not make the steps too broad or too fine)	POTENTIAL HAZARDS (What are the potential hazards identified at this part of the job steps)	RECOMMEND RISK CONTROL MEASURES (describe how the identified hazards can be eliminated or reduced)	RESPONSIBLE PERSON (S) (Implementing control)	INITIAL (Of the responsible person/s)
Toolbox Talk	Miscommunication	**ANYONE can call ALL STOP at any point if an unsafe condition /act is perceived/observed.** **Cell phone use is PROHIBITED in test area while testing!** Ensure all participants are aware of procedures and roles within the procedure and sign JSEA acknowledging thusly. Ensure that all participants are wearing correct PPE (safety glasses, safety shoes, gloves, and hard hats if crane ops are being performed) Ensure participants/witnesses are wearing adequate clothing for weather conditions and to take breaks whenever necessary.		
Hydraulic Function Testing	Stored/Trapped Energy: Up to **12,000 PSI** Environmental Discharge Tubing/Hose Failure Line of Fire	Ensure all functions have pressure/flow reduced to 0 PSI when not being actively function tested. Ensure each circuit is setup correctly before increasing pressure. Ensure Vent hoses are properly connected to fluid containment reservoir. Ensure all hoses are whip checked before coming up on pressure. Ensure valves and actuators are in proper configuration before testing. Ensure relief valves are set to relieve at the proper setting.		

Example JSEA task items courtesy of Oceaneering International

NOTE for 2026!!!

Companies **MUST** focus their JSEA on their deck/dive operations only. **Shop safety and tool safety for building the ROV is extremely important but does not belong in this JSEA**. The submitted JSEA should focus information on potential hazards and recommended risk control measures of a company's pool side operations. This JSEA should cover topics such as:

Deck Ops/Launch and Recovery:

- Entering/exiting the pool deck area
- System set up
- Power up checks
- Pool side operations
- System breakdown

Examples of JSEAs:

- **2025 Overflow Robotics**
- **2025 Alcona RAFT Robotics**

2.2 Safety Pre-Inspection

A safety pre-inspection will be completed before competition day. Companies will submit the following documentation to the MATE ROV Competition. PIONEER teams competing at a regional event should submit their required documentation to their regional coordinator. Regionals may not require all of these documents. Contact your regional coordinator or visit your regional contest's website to determine the required documents as well as the date and proper format for submission. Safety pre-inspection document submissions will include the following:

- Technical documentation
- Company spec sheet
- SID [Electrical, Pneumatic & Hydraulic as utilized]
- Non-ROV device design document (if used)
- Non-ROV device SID (if used)
- Company safety review
- JSEA

See 2.2.1 Safety documentation requirements below for more information.

Once received, safety inspectors will conduct an initial safety inspection to identify potential safety and workmanship violations. This inspection will be worth 20 points. Companies with violations will be notified via email. Once notified, companies must:

1. Respond acknowledging receipt
2. Layout a plan to address this violation
3. Submit new documentation if required

Onsite safety inspectors will also be informed of any potential safety violations identified during the initial safety inspection. This will allow safety inspectors to verify that any issues have been resolved.

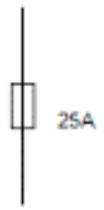
2.2.1 Safety documentation requirements

Unless stated otherwise, each document MUST be submitted separately. In addition to the SID included in the technical documentation, an individual SID must be submitted for the initial safety inspection. The company safety review should NOT refer to systems shown in a submission video or detailed in the technical documentation.

DOC-001: SID Electrical: This must be an electrical diagram for all ROV systems. One section should focus on the systems above the waterline, and one section should focus on systems on the ROV (below the waterline). The SID:

- Should not exceed one 8.5” x 11” page in length (both above and below water sections, as well as any other information, should be on one page). Printed documents must be sized to fit on one side of the printed paper.
- Must be drawn with a CAD (computer assisted drawing) program. Hand drawn figures are not permitted.
- All symbols used should be standard symbols as specified by ANSI, NEMA or IEC.
- The SID must include a FUSE SYMBOL using an ANSI, NEMA or IEC symbol.
- ***Note for 2026!!!***: The SID does not require fuse calculations; instead, companies must determine their full load amps (FLA) in water value and include that on the SID (see 3.3.3 Current for more information).
- The SID must not be component level schematics, but a higher-level interconnection block type diagram. Do not include individual pins on a board; the SID is a higher-level diagram.

The following ANSI and IEC fuse symbols are all acceptable for MATE documentation:

Item	ANSI	IEC
FUSE		

An example of an acceptable SID can be found here:

- **2025 Fukien Secondary School Over-Defined SID – 12 volt**
- **2025 Jesuit High School Rovotics SID – 48 volt**

DOC-002: SID Fluid Power: Companies using fluid power **MUST** include a fluid power diagram using industry standard symbols, showing all items, including regulators, and control valves. The diagram must document the components on the surface and the components located onboard the ROV. Fluid power diagrams must use ANSI, NEMA or IEC symbols. The fluid power diagram must also be drawn with a CAD program and should be a one 8.5” x 11” page diagram. The fluid power diagram may be included on the main electrical SID or as a separate one-page document.

DOC-003: SID Non-ROV Device: Companies utilizing an independent sensor or other electrically powered, non-ROV device to complete a product demonstration task must submit a SID for this device. The *MATE Floats!* vertical profiling float, if designed and used at the competition, is considered a non-ROV device. This diagram must be completed to the specifications listed in DOC-001. The non-ROV device SID may be included on the main electrical SID or as a separate one 8.5” x 11” page document. Two (or more) separate pages may be used for two (or more) different non-ROV devices. Companies must include the full load amps in water value and the selected fuse size on their non-ROV device SID. Companies not designing and building a vertical profiling float or powered release container should state so in their Company Safety Review.

DOC-004: Non-ROV device design: Companies will be required to submit a written and photographic description of their non-ROV device. For 2026, this only includes Task 4's vertical profiling float. This document is limited to 2 pages in length. Companies must measure the full load current of the float and select their fuse size from their full load amps value. This non-ROV device design document must contain:

- A photo or diagram of the non-ROV device.
- The type of battery used.
- A photo of the battery pack.
- A photo of the fuse(s) used on the non-ROV device.
- A table of the measurements showing full load current.
- A description of the buoyancy engine used to complete vertical profiles.
- A description of how the float communicates with the shore side receiver. If any commands are given to the float after deployment, those communications must be described too.
- A description of how the battery pack was designed to safely fulfill the full load current needs and the voltage requirements of the float device.

A SID of the non-ROV device document must be included with the non-ROV device design document. This SID must be one page in length and is in addition to the 2 pages for the non-ROV device design document (i.e. DOC-004 can be a total of 3 pages, 2 pages for a description, 1 page for a SID). The SID must include:

- A fuse using a standard fuse symbol.
- Full load amps in water value and fuse size selected.

NOTE for 2026!!!

Any electrical or fluid powered device on the ROV MUST be documented on a SID. Depending on the type of device, it may be on the main ROV SID, an independent sensor SID, a Non-ROV device SID, or a Fluid SID. Any such device not represented on a SID cannot be used in the competition.

Examples of Non-ROV device documents:

Coral Crusaders Non-ROV device document 2025

St. Francis Genesea Non-ROV device document 2025

Additional Non-ROV device documents can be found in the 2025 Archives under the Technical Reports, Spec Sheets, Float Documentation tab.

DOC-005: Company safety review: PIONEER companies submitting a company safety review MUST show compliance with the following specifications:

- If using 48-volts, an SBS50 Anderson Powerpole connector is the main point of connection to the MATE supply. If using 12-volts, a red-black Anderson powerpole connection is the main point of connection to the MATE supply (ELEC-011P).
- A properly sized fuse is within 30 cm of the main point of connection to power. If the company is using 48-volts, a properly sized Littelfuse must be used. If the company is using 12-volts, a properly sized ATO blade or Mini blade fuse must be used. The company must use a ruler to show this distance (ELEC-010P).

- Full load amps value and fuse size selected (ELEC-009P).
- The inside of the control box does not have exposed wiring (ELEC-018P), the control box is neatly laid out with attention to workmanship (ELEC-023P), a separation and identification of 120VAC wiring from DC and control voltages (ELEC-024P). If AC wiring is not used in the control box, include a statement saying no AC is used. Note: Companies using a computer or laptop should state that they are using a laptop and include the type of controller (Joystick, Xbox controller, etc.).
- The tether leading to control system has adequate strain relief (ELEC-025).
- The tether leading to the ROV has adequate strain relief (ELEC-025).
- If used, hydraulic / pneumatic systems include a pressure release valve, shut-off valve and regulator in the system (FLUID-004, FLUID-008), and that any pressurized cylinder, pressure storage device meets the MATE specifications.
- ***Note for 2026!!!*** If used, the specifications and details of the hydraulic / pneumatic components, including pressure ratings of hoses and components.
- Any watertight housing on the vehicle can withstand pressure at 5 meters (MECH-001).
- All propellers are shrouded and have propeller guards (MECH-006).
- The ROV has no sharp edges or elements of the ROV that could cause damage (MECH-006, ELEC-018P).

The following photos **MUST** be included within the company safety review:

- SBS50 Anderson powerpole within 30 cm of the fuse (show fuse, ruler and connectors).
- Inside of the control box with wires labeled or control system (and controller) for those using a computer or laptop.
- Strain relief where the tether connects to the control system.
- Strain relief where the tether connects to ROV.
- Compressor or pump (if pneumatics/hydraulics are used) including release valve, shut-off valve and regulator.
- Propeller shrouds (front and back of one propeller).
- The entire vehicle

The company safety review should include an explanation of how each system meets the safety specifications and include photographs of the relevant systems for review by the MATE ROV Competition officials.

Examples of Company Safety Reviews:

- **Labrador Straits Shark Tech Company Safety Review_2025**
  This company includes all components in their company safety review
- **East Tennessee State University Company Safety Review_2025**
  This company does not use fluid power or a non-ROV device and clearly state that fact in the company safety review.

Initial Safety and Documentation Review points

Penalty points will be deducted from the initial safety and documentation review if:

- Companies do NOT submit ALL the required documentation by the given date. See KEY DEADLINES.
- Submissions are not within the given file size or page limit, submissions do not use the proper naming convention, or documents are not submitted as PDFs. See DOCUMENTATION for more information.
- The SID does not show a fuse, or the fuse does not use an ANSI, NEMA or IEC symbol.
- Full load amps value and fuse selected are not shown on the SID.
- Fuse calculations were used instead of full load amps values.
- The vehicle uses fluid power, but a fluid power diagram is not included.
- A non-ROV device is used but is not shown on any SID.
- A non-ROV device is used but not properly documented (including all required photos and descriptions).
- Companies not using fluid power or not attempting a task requiring a non-ROV device, do not state this fact in the company safety review.
- The company safety review does not show compliance with all of the specifications.

The initial safety and documentation review rubric can be found here.

Documentation notes: The MATE ROV Competition recommends that companies keep a folder with specification sheets for all commercially purchased components, as well as testing procedures and results for any home-made components. This can be a physical copy in an actual folder, a digital copy in an electronic folder, or both. If a safety inspector has a question about a specific component, companies will then have all the necessary documentation on hand. For example, if a company is using a Blue Robotics T200 thruster, companies should print out the Technical Details - Specification section and include these specifications in their folder along with any software limitations they have incorporated to maintain the proper current restrictions of the MATE ROV Competition.

2.3 Onsite Safety Inspection

Companies must complete their onsite safety inspection before their vehicle enters the water.

Companies advancing to the World Championship must complete their first onsite safety inspection immediately after checking in. A sign-up form with specific dates and time frames will be circulated in advance of the World Championship. Companies should review this form carefully and select the date and time frame that aligns with their travel plans. Companies that ship their ROV should also consider the expected delivery date and time when making their selection; without a vehicle present, the company will fail their first onsite safety inspection. Companies are required to check in and undergo their first safety inspection on Tuesday, June 23rd or Wednesday, June 24th, prior to the MATE World Championship competition. Accommodations will be made for companies that experience travel delays beyond their control (i.e., a cancelled flight or flight delay), but these will be the exceptions and not the norm.

NOTE for 2026!!! All items used on the ROV MUST participate in and pass safety inspection. Companies that use a device that did not participate in and pass the safety inspection will be disqualified. Companies should prepare for their safety inspection as if they are headed to a product demonstration run. All equipment being used for a run should be available for inspection. A power supply will be available; companies may be required to power up their control system and vehicle during the safety inspection. The inspector(s) will reference the list of violations as he/she conducts the safety inspection of the vehicle using the onsite safety inspection and workmanship rubrics.

At the World Championship, companies MUST pass their safety inspection by the end of the first day of the competition. Companies that do not pass their safety inspection by the end of the first day will be disqualified from the underwater product demonstration component.

What follows is the safety inspection protocol used at the World Championship. For PIONEER class teams competing at a regional event, consult your regional coordinator or visit your regional contest's website for more information about the safety inspection process used at your regional.

2.4 Safety Inspection Protocol

New for 2026!!!

The inspection will be divided into two parts, safety and workmanship.

Safety Inspection Protocol

1. Before entering the water for practice or a product demonstration run, the ROV system must go through a safety inspection. Once a company successfully passes inspection, they will turn in their safety inspection sheet to the safety inspector and receive a Blue PASSED Card with their company number on it. Companies must present the Blue PASSED Card to the pool practice/product demonstration coordinator before their vehicles are permitted to enter the water.
2. Competition staff will conduct a safety inspection of the vehicle using the safety inspection rubric.
3. If the safety inspector(s) identify a safety violation, companies will have the opportunity to address it. The pool practice or product demonstration run schedule will NOT change to allow companies more time.
4. If during the second safety review the
    a. violation has not been properly addressed or
    b. another violation is revealed

    companies will have ONE additional opportunity to address the issue.
5. If during the third safety inspection a violation still exists, safety inspectors will request that the Chief Judge(s) review the violation. If the Chief Judge(s) confirms the violation, companies will not be permitted to participate in the underwater product demonstration component of the competition. However, companies can still participate in the engineering and communication (technical documentation, engineering presentation, and marketing display) component.

6. Reminder: All companies must present the Blue PASSED Card to the pool practice or product demonstration judge before placing their vehicles in the water. In addition, product demonstration station judges and competition officials can pause or stop a product demonstration run at any time if they feel that there is a potential safety concern.

Workmanship Inspection Protocol

1. Competition staff will conduct a workmanship inspection of the vehicle using the workmanship inspection rubric.
2. If the safety inspector(s) identify a workmanship violation, points will be deducted from the workmanship inspection rubric.
3. Companies that have a workmanship issue will still receive their blue PASSED safety card and can compete in the product demonstration.

2.5 Safety Inspection Points

The safety inspection is worth 30 points. Each time a company fails its safety inspection it loses 10 points. After a company fails its second inspection, it must meet with the chief safety inspector to discuss a plan of action prior to returning to its workstation. THREE STRIKES and a company

a. Receives 0 points for the safety inspections and
b. Is disqualified from the underwater product demonstration component

The workmanship inspection is worth 20 points total. Companies that do not meet the workmanship requirements will lose 5 points per issue identified.

Additional information on workmanship can be found in the MATE ROV Competition Tech Bulletin - MATE Expected Work Practices Updated.pdf.

Note for 2026!!!

MATE highly recommends using transparent, see-through electronic enclosures onboard the ROV and float. Safety inspectors MUST be able to see the contents inside any enclosure. Companies not using transparent enclosures will be REQUIRED to open the enclosure and display the contents for the safety inspectors.

3.0 SPECIFICATIONS

The ROV system (or "system") must meet the following requirements:

3.1 Operational

3.1.1 Multiple Vehicles

OPER-001: PIONEER class companies are required to design and build ONE ROV that can complete the necessary product demonstration tasks. "Floating eyeballs" or other vehicles that are not hard connected to the frame of the main vehicle are NOT permitted. Cameras designed to provide a

"birds-eye view" are permitted provided that these cameras are hard connected to the frame of the main vehicle. "Hard connection" does not include the wiring between the camera and the ROV.

3.1.2 Environmental

OPER-002: The ROV system must be able to function in fresh, chlorinated water with temperatures between -2°C and 30°C. The water should be considered conductive of electrical currents.

At the World Championship, companies will operate in an ice tank. The tank is water mixed with an EGADS (Ethylene Glycol/Aliphatic Detergent/Sugar) at a 0.39% concentration. The ice tank operates at 0°C to 0.5°C during testing, but companies should assume a temperature as low as -2°C. The specific gravity of the EGADS ice tank is approximately 1.025.

OPER-003: The pool will not be covered or purposefully darkened in any way, although the specific product demonstration tasks may require that your ROV operates in low-light. Surface ice or waves may cause low light conditions.

OPER-004: Depending on the venue, pressurized pool filtration system outlets may cause unexpected currents. At the World Championship, companies will be operating in a flume tank with a current.

OPER-005: The pool venues at the World Championship have a flat, smooth bottom.

OPER-006: At the World Championship, the water level may be up to 30 cm below the level of the deck. Companies may need to lift their ROV or float over a rail 30 cm high to reach the tank. Companies should plan accordingly.

Note: PIONEER companies attending regional competitions should note that regional events may be held in pool venues with different environmental conditions than those listed here. If you are unfamiliar with the regional pool, contact the regional coordinator or visit your regional contest's website for additional information.

3.1.3 Service Requirements

OPER-007: Companies shall provide a crew of at least 3 but not more than 6 people on the pool deck to operate the ROV System. Companies can send a larger crew complement, but no more than six can be on the deck at any time. More information about this "product demonstration team" is provided in the COMPETITION RULES.

3.1.4 Maintenance and Calibration Requirement

OPER-008: All measurement devices shall be calibrated according to manufacturer recommended calibration procedure and performed by company members only. Company mentors or advisors are not permitted to perform calibration procedures. More information about mentor restrictions is provided in the COMPETITION RULES.

OPER-009: System maintenance during field operations shall be conducted by ROV personnel at their workstations. Work of any kind must not be done by company mentors or advisors. All maintenance parts and equipment necessary to meet the operational requirements shall be provided by the company. More information about these regulations is provided in the COMPETITION RULES.

3.2 Mechanical/Physical

This section of the document provides specifications for the mechanical properties of the ROV system.

3.2.1 Materials

MECH-001: At the World Championship, any electronics housings on the ROV shall be capable of operating to depths of 5 meters.

3.2.2 Size and Weight

MECH-002: ROVs are limited to a maximum weight, in air, of 35 kg. Vehicles over this weight will not be allowed to compete. Product demonstration tasks will limit the size of the vehicle. Companies must be able to personally transport the vehicle and associated equipment to the product demonstration station and to the engineering presentation room. ROV systems must be capable of being safely hand launched. Additional points will be given to lighter vehicles (see WEIGHT RESTRICTIONS).

Note for 2026!!!

At the World Championship, companies should not rely on carts to transport their equipment to and from the station. Carts will not be able to reach all mission station areas.

3.2.3 Tether Length

Note for 2026!!!

MECH-003P: At the World Championship, ROVs must be capable of operating in a maximum pool depth of 4 meters (13.2 feet). All underwater product demonstrations will take place within 8 meters from the side of the pool. The product demonstration station will be no more than 3 meters from the side of the pool. Tether length should be calculated accordingly. PIONEER companies attending regional competitions should note that regionals may be held in pool venues with different maximum depths than those listed here. If you are unfamiliar with the regional pool, contact your regional coordinator or visit your regional contest's website.

3.2.4 Vehicle Deployment and Recovery

MECH-004: The ROV system must be launched and recovered manually; no powered winches or portable cranes can be used. Hand-powered lifts and levers may be used to launch and recover the vehicle. The vehicle and any associated equipment must not damage any part of the pool or pool deck.

MECH-005: Any hand-powered lift or levers that are used as a launch and recovery system (LARS) must be detailed in the technical documentation and must be part of the safety inspection procedure. Any LARS equipment that is deemed unsafe at the safety inspection will not be allowed. Ladders, tripods, or other bracing equipment are not permitted as part of a LARS.

3.2.5 Propellers

MECH-006: Propellers must be shrouded and have thruster guards. ROVs that have propellers exposed without thruster guards will not pass the safety inspection and will not be allowed to compete. A shroud must completely encircle the propeller and extend at least 2 mm in front of and behind the propeller. Thruster guards must completely cover any openings on the thruster and should have a mesh size that meets IP-20 standards (solid particulate protection level 2). This IP code equates to a mesh size <12.5 mm. To pass safety inspection, the shroud and propeller guard should meet this standard. If your finger can touch the propeller, then it is not properly guarded.

Teams may construct thruster guards, 3D print thruster guards, or may purchase commercially available thruster guards. All motors on the ROV must be protected with shrouds and thruster guards on all sides.

See https://www.thingiverse.com/thing:1498338 for an example of an acceptable thruster guard.

3.2.6 Sharp Edges and Pinch Points

New for 2026!!!

MECH-007: No "sharps" are allowed on the ROV or other related systems. "Sharps" are defined as sharp edges or points that could cause harm to people or the environment. This includes cable ties cut leaving sharp edges, glass, cutting blades of any type, and the like. No glass will be allowed on the pool deck; glass can break and create sharp edges. The no glass rule includes video monitors with glass faceplates. Monitors with glass faceplates may not be used. For cable ties, MATE recommends using flush cutters with wire catcher to snip off the remaining tie leaving a smooth edge.

If a mission task requires a sharp device, that device should be marked with cautionary colors, such as yellow/black caution tape. This sharp device should be noted in the technical documentation, the engineering presentation, to the safety inspectors, and to the product demonstration judges, with the safety precautions taken by the company noted to those judges.

MECH-008: Any gear assemblies must be fully shrouded. Turning gears create pinch points that can cause injury. Geared systems are allowed, but the gears should be shrouded and protected to IP-20 standards (solid particulate protection level 2). This IP code equates to a mesh size <12.5 mm, but companies may use a solid covering as well. If a finger can touch the gear assembly, then it is not properly shrouded.

3.3 Electrical

PIONEER class companies may design their ROV to run off 48-volts or 12-volts. Depending on which option is chosen, by PIONEER class companies, certain rules will apply. Companies must choose to power their ROV from 48-volts **OR** 12-volts. Companies may not use both sources of power.

ELEC-001P: All power provided to the ROV system through an external connection for any purpose during the competition must be obtained from the MATE competition power supply. This includes dedicated lines for cameras, manipulators, and any other devices. This is a singular point of connection; all power to the ROV must pass through the MATE-provided fuse AND the single in-line fuse as specified in this section.

NOTE for 2026!!!

If a company is using 48-volts, that company must use one of the following inline fuses that are rated for the amperage used on a 48-volt ROV.

30-amp fuse or 30-amp fuse
25-amp fuse
20-amp fuse or 20-amp fuse
Fuse holder

COMPANIES ARE REQUIRED TO USE ONE OF THE LITTELFUSES AND THE LITTEL FUSE HOLDER LINKED TO ABOVE.

These specific components are required. Companies without these components will not pass any of the following:

- video qualification
- initial safety inspection
- onsite safety inspection

If companies cannot purchase these components from the above sources, companies may purchase fuses and fuse holders from the SeaMATE Store. The SeaMATE store will ship these components anywhere in the world (Contact Us – SeaMATE).

If a company is using 12-volts, that company MUST use ATO type blade fuses or MINI blade fuses. These fuses provide easy visual inspection for amperage using industry standard color codes.

Fuse Reference: ATO fuse MINI fuse

These fuses are all rated for 32VDC and are color coded for amperage. All blade fuses MUST correspond to the standardized color codes listed on the fuse links above.

COMPANIES USING 12 VOLTS WITHOUT A PROPER BLADE FUSE WILL NOT PASS SAFETY INSPECTION!

ELEC-002P: The ROV system must be capable of operating off the power provided by a MATE supply. Two options will be available to PIONEER class companies. One MATE supply will provide a nominal voltage of 48-VDC. This voltage may be as high as 56 volts. The other MATE supply will provide a nominal voltage of 12-VDC. This voltage may be as high as 14.8 volts. Companies may use either, but not both, power supplies. Power supplies will be a fixed output voltage and will not be "turned down" to accommodate other than the specified voltage for the class. All references to 48-VDC and 12-VDC in this document are the nominal voltage of 12-VDC or 48-VDC, which must be within the ranges specified in this paragraph. At the World Championship, power for the PIONEER class will be provided by isolated power supplies. At regional competitions, power may be provided by isolated power supplies or batteries. Contact your regional coordinator or visit your regional contest's web site if you have questions about the type of power source being used.

ELEC-003P: If using 48-VDC, the ROV system must deliver the supply voltage to the ROV as provided and without modification. No conversion of this voltage is allowed prior to it arriving at the ROV system bus. Methods on the surface such as DC/DC converters, voltage drop resistors, and Pulse Width Modulation (PWM) are not allowed to be used between the ROV and the power source. ESCs and H-bridges are not allowed on the surface. Power supplies and conversion devices are not allowed on the surface if they operate the ROV.

ELEC-004P: Power over Ethernet (PoE) types 1 through 4 are permitted on 48V vehicles. Note that PoE is intended for low-current/low-power applications. Companies using PoE should evaluate, document, and be able to explain the justification for using PoE in their specific application.

MATE strongly urges companies to refrain from sending reduced voltage signals from the ROV back up the tether to power devices on the surface. This is not done by ROVs in industry and therefore discouraged by the MATE ROV Competition.

If using 12-VDC, the ROV system may deliver any voltage to the ROV at or below the nominal voltage provided. Conversion of this voltage is allowed prior to it arriving at the ROV.

ELEC-005P: If using a 12-volt supply, ROV systems may use any voltage desired up to 12 volts. If using a 48-volt supply, ROV systems may use any voltage desired up to 48 Volts, but any conversion to a lower voltage must be made on board the ROV. Companies will not be permitted to operate a 48-volt ROV that reduces the voltage on the shore-side/top-side end of the ROV tether.

ELEC-006P: Voltage may not be increased above the nominal 12-volts or 48-volts anywhere in the ROV system.

ELEC-007P: Sonar or other systems that may have DC/DC conversion resulting in voltages above 12V or 48V nominal are not permitted.

ELEC-008P: Voltages in excess of the class parameters set forth in this specification are not allowed on the ROV system at any time other than any inductive spikes that are caused by the switching on/off of motors, solenoids and other inductive devices. Companies should design their

systems to handle these voltage spikes but will not be penalized for the presence of these in a system. For additional information on this, companies can research back electromotive forces (back EMF), collapsing magnetic motor fields, and transient suppression.

3.3.1 Non-ROV Device Power Specifications

NOTE for 2026!!!

Systems that qualify as a non-ROV device in 2026:

- vertical profiling float

No other devices qualify as non-ROV devices.

ELEC-NRD-001: The vertical profiling float cannot be powered from the surface. If the float is powered, it must use onboard batteries. Voltage is limited to **12 VDC maximum**; amperage is limited to **5 amps maximum**. All power for the non-ROV device must go through a single fuse (see ELEC-NRD-005).

ELEC-NRD-002: The vertical profiling float non-ROV device may utilize thrusters but may not include any cameras. Vertical profiling floats cannot use a camera onboard to take images or video of sensor data and transmit those images/videos to the surface station.

NEW for 2026!!! New battery limitations are in place. Read the following information carefully!

ELEC-NRD-003: Onboard power is allowed for non-ROV devices. If onboard batteries are used, the following specifications must be met.

- NiMH (Nickel Metal Hydride) and AGM (Absorbed Glass-Mat) batteries only. **Alkaline batteries are not allowed**.
- NiMH battery packs consisting of 9-volt, AA, C or D cell batteries are allowed. See table below for maximum amperage allowed for each battery type.
- Larger NiMH and AGM (Absorbed Glass-Mat) 12-volt batteries are also allowed. This includes large (brick sized) batteries.
- No other size or chemical composition is allowed. 12-volt outdoor, re-chargeable batteries are not allowed. **High discharge LiPo batteries are not allowed**.
- Batteries are mounted in a manner that they are not loose inside the container.

All batteries are limited to the maximum allowed current shown in this table. Above this current, batteries will overheat.

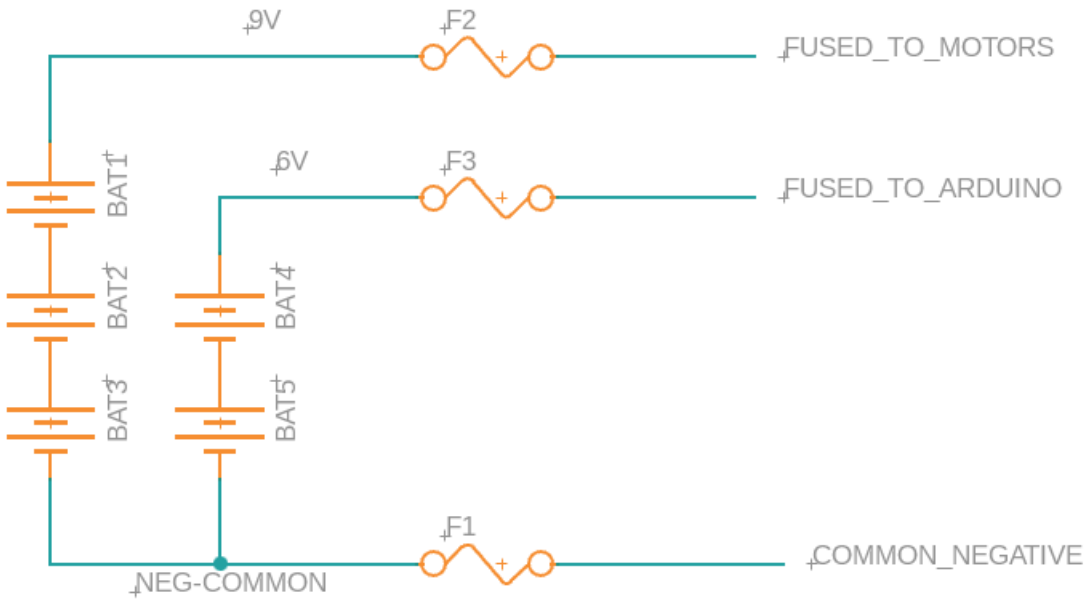
Battery Type	Maximum Fuse Size
NiMH AA	2.0 A
NiMH C or D	5.0 A
NiMH 9-volt	200mA
NiMH* / AGM 12V	5.0 A

*The 5.0 amp maximum fuse size for NiMH 12 volt batteries refers only to the larger, brick sized batteries. 12-volt battery packs, consisting of multiple AA or 9-volt batteries, require the smaller fuse size for those batteries.

Technical note: To determine a NiMH battery's maximum fuse size, see the individual battery's mAH (milliamp hours) rating. Divide that number by 1000. For example, if a NiMH AA battery has a rating of 2300 mAH, its maximum current would be 2.3 amps, requiring a 2-amp fuse. If a NiMH battery has a rating of only 1900 mAH, its maximum current would be 1.9 amps, requiring a 1-amp fuse.

ELEC-NRD-004: Battery fusing for non-ROV devices is an important consideration and the following rules must be adhered to.

- A single fuse must be utilized that will shut down all power sources in the non-ROV device if the fuse blows.
- A fuse (5 amps max) must be installed within 5 cm of the battery positive terminal.
- All fuses, when installed, must be able to be visibly inspected for amperage through a clear housing or immediately after an opaque NRD device housing is removed without the need to uncover the fuse.
- ***Note for 2026!!!*** Cartridge, ATO type blade fuses or MINI blade fuses CAN be used for fusing NiMH and AGM batteries. The fuses to select from are 1A, 2A, 3A, 4A and 5A fuses. These fuses provide easy visual inspection for amperage using industry standard color codes.
  Fuse Reference: ATO fuse MINI fuse
  These fuses are all rated for 32VDC and are color coded for amperage.
- All blade fuses MUST correspond to the standardized color codes listed on the fuse links above. All cartridge fuses must be readily accessible and have the current stamped on the end of the fuse. Minimum DC voltage for the fuse must be 32 volts.
- The maximum distance from a battery pack to any fuse is 5 cm.
- Batteries in Series: No voltage over a nominal 12V is allowed. This means no more than eight 1.5V alkaline batteries in series.
- Batteries in Parallel: Batteries may be placed in parallel to increase the current available to the system within the following limits:
  - In no case shall the current from the pack exceed 5A.
  - The number of series strings in parallel is used as a multiplier to determine the fuse size. For example, using NiMH AA batteries, the maximum fuse size is 2.0 amps. If two battery strings are placed in parallel, the maximum fuse size is 2 amps (2 * 2.0A = 4.0 Amps).
- ***Note for 2026!!!*** For systems with multiple battery packs, the battery packs should be connected on the negative terminals with the fuse (5 amps max) located off of the common negative terminal connection. Each individual battery pack should also be fused with the properly sized fuse for that battery pack. Note that a single battery wired in parallel is considered a battery pack. For example, five NiMH 9-volt batteries wired in parallel, the maximum fuse size is 1 amp (5 * 0.2A = 1.0 A). Each 9-volt battery would need to be individually fused at 0.2A as well.



ELEC-NRD-005: Full Load Amps Value. Companies MUST measure the full load amps (FLA) of their device during waiting mode (motors off) AND during buoyancy change mode (motors on). The type of battery pack allowed for their system can be determined using the full load amps measurement (See ELEC-009P for more information).

Using the non-ROV device full load amps values, companies should select the standard fuse closest to their FLA.

ELEC-NRD-006: The enclosure housing must be designed so that it will open if the pressure inside the housing is greater than the outside pressure.

There are two allowable methods for pressure relief:

1. A pressure relief hole of a minimum of at least 2.5 cm in diameter. This hole can be plugged up with a rubber stopper but must be friction fit. Threads or other fastening methods are not allowed. Holes less than 2.5 cm in diameter will not pass safety inspection.
2. The enclosure is built in a manner that an end cap will pop off if under pressure. This can be an internal or external cap with O-rings to provide sealing. The sealing diameter of the end cap must be 2.5 cm in diameter or greater (this limits the smallest ID of an enclosure to 2.5 cm).

Additional notes:

- Under no condition should the housing be built with fasteners to hold the housing together. There must be at least one 2.5 cm or larger opening that serves as a pressure release.

Note for 2026!!!

- Utilization of pressure release valves are not acceptable as they cannot be tested at the competition site.
- Pop-off end caps that utilize a tightening mechanism (hose clamp, Twist-Tite) are not allowed.

ELEC-NRD-007: A SID must be submitted for any non-ROV device that uses electrical power

3.3.2 Independent Sensors

Certain product demonstration tasks may require a sensor that is independent of the vehicle. These electrically powered sensors will operate under the following independent sensor rules.

ELEC-IS-001: Independent sensors must be powered from the surface; no onboard batteries are allowed. Independent sensors are limited to 12 volts, 3 amps.

ELEC-IS-002: Companies may use USB to connect their sensors to a computer. Companies may also use surface battery packs (limited to 12 volts maximum) or the MATE 12-volt power supply to provide power for their independent sensor.

ELEC-IS-003: The independent sensor may only contain the intended sensor; thrusters, cameras, or other systems MAY NOT be attached unless specified in the PRODUCT DEMONSTRATION section.

ELEC-IS-004: Companies that use an independent sensor must provide a 3 amp (or less) fast blow fuse on the positive side of their connection. Companies using USB only to power an independent sensor may utilize the built-in current limiting of USB and do not need to add an additional fuse.

ELEC-IS-005: A SID must be submitted for any independent sensor that uses electrical power.

3.3.3 Current

ELEC-009P: ROVs utilizing the 48-volt supply will be limited to 30-amps at 48-volts. ROVs utilizing the 12-volt supply will be limited to 25-amps at 12-volts.

How to select the proper fuse size for your ROV

MATE is modifying its specifications on how fuse size is selected for the ROVs. Past methods allowed currents well beyond the class maximum fuse due to the time delay of the fuses. For 2026, companies must measure the full load amperage (FLA) of the ROV while in water and then select the next standard size fuse that is both above the FLA and equal to or below the class maximum fuse size. To measure the full load amperage, companies should:

- Submerge your ROV in water and apply full down and full forward on all motors (this should be your highest current draw)
- Measure the Full Load Amperage (FLA) with an ammeter
- Select the fuse size from the table below

Companies should not itemize individual device currents; only report the actual measurement of the FLA. Do not multiply by 150% as in past years.

For companies using 48-volts:

48V Full Load Amps	Fuse Size	JCASE Color
< 20.5 A	20 A	Blue
20.6 A to 26.3 A	25 A	White
26.4 A to 33.2 A	30 A	Pink

For companies using 12-volts:

12V Full Load Amps	Fuse Size	Fuse Color
< 10.5 A	10 A	Red
10.6 A to 15.5 A	15 A	Blue
15.6 A to 20.5 A	20 A	Yellow
20.6 A to 26.3 A	25 A	Clear

If the ROV FLA exceeds the maximum current, companies should limit their ROV current to prevent blowing the fuse during the competition. An example of this would be limiting the maximum PWM applied to the thrusters.

New for 2026!!!

Full load amps values must be included on any SID and in the Company Safety Review. Full load amps and fuse selection should be reported as follows:

ROV Full Load Amps (FLA) in water = _____

Fuse size selected based upon FLA = _____

SIDs without FLA values or without fuse size selections will have points deducted from their initial safety inspection. Also, SIDs without FLA values will not pass the safety inspection. All FLA values must be measured with the motors in water.

The MATE power supply will be protected by a 30-amp fuse; however, the ROV system must also have its own properly selected fuse.

Note for 2026!!!

The power supplies used by the MATE ROV Competition have integrated circuit protection. Under most conditions, this protection will activate before a company's fuse blows. If a company

experiences a power supply circuit protection event during a product demonstration run, it will be assumed that there is an electrical fault within the ROV system. It will be at the discretion of the lead safety inspector or their designate whether the company may continue the product demonstration, and whether the ROV will need to be reinspected by a safety inspector.

ELEC-010P: ROV systems are allowed one replacement fuse during the product demonstration. In the event that the ROV system blows the second fuse during the demonstration, the demonstration will be over, and no additional points will be earned. Companies should have adequate replacement fuses on hand, MATE will not provide replacements. Standard sizes for fuses are 15, 20 and 25 amps. Additional standard fuse sizes for 12-volt vehicles are 1, 3, 7.5, and 10 amps.

Note for 2026!!!
The required Littelfuse (48-volt systems) or ATO or mini fuse (12-volt systems) **MUST** be within 30 cm of the connection to the MATE power supply. There should be no other components between the Anderson powerpole connections that connect to the MATE supply and the fuse. Companies choosing to use E-stops or control boxes must locate their fuse before any of these components. **Companies should consider using a power cable that is at least 2 meters long. This will allow companies to more easily connect to the MATE power supply.**

3.3.4 Power Connections

IF CONNECTING TO A 12-VOLT SUPPLY

ELEC-011P(12V): Power supply connections will be red/black Anderson Powerpole Connectors. Companies' ROV system power wires must have proper connectors to obtain power. The Anderson Powerpole Connectors must be connected to the ROV power wires securely; use of a proper mechanical crimper is required. Hand crimp tools do not have the force necessary to ensure proper and safe connections. MATE will not provide companies with connectors or adapters at the 2026 World Championship.

NOTE for 2026!!!
The red and black pole pieces must be attached. Loose Powerpoles (those not attached) will not pass safety inspection.

30 Amp Permanently Bonded Red/Black Anderson Powerpole Connectors | Powerwerx
or
30 Amp Unassembled Red/Black Anderson Powerpole Connectors | Powerwerx
or
ASMPP30-1X2-RK Anderson Power Products, Inc. | Connectors, Interconnects | DigiKey

These are two-piece connectors as shown in the picture below.

ELEC-012P(12V): The power supply may be located up to 1 meter from the station table and may be located on either side of the table. MATE recommends a power cable long enough to reach the power supply up to 3 meters from your control system.

IF CONNECTING TO A 48-VOLT POWER SUPPLY

ELEC-011P(48V): Power supply connections will be Anderson Power Connectors. Companies' ROV system power wires must have proper connectors to obtain power. The Anderson Power Connectors must be connected to the ROV power wires securely; use of proper (hydraulic) tooling is required. Hand crimp tools do not have the force necessary to ensure proper and safe connections. MATE will not provide companies with connectors or adapters at the 2026 World Championship.

NOTE for 2026!!!
COMPANIES ARE REQUIRED TO USE THE ANDERSON SBS50BLU LINKED TO BELOW.

This specific component is required. Companies without an Anderson SBS50BLU connector will not pass their video qualification, will not pass their initial safety inspection, nor will they pass their onsite safety inspection.
Housing: Anderson SBS50BLU-BK
DigiKey: SBS50BLU-BK Anderson Power Products, Inc. | Connectors, Interconnects | DigiKey
Mouser: SBS50BLU Anderson Power Products | Mouser
Newark: SBS50BLU-BK ANDERSON POWER PRODUCTS, Connector Housing, SBS50 Series, Plug, Receptacle, 2 Positions | Newark Electronics
RS: Anderson Power Products SBS50BLU-BK Power Connector Housing Blue SBS Connector SBS, SBS 50 Series
Grainger: ANDERSON POWER PRODUCTS, SBS 50, Blue, Housing - 820RD2|SBS50BLU - Grainger

Additional online sources for the Anderson SBS50BLU connector:
Blue SBS50 Standard Housings Up to 110 amps Bulk (andersonpower.com)

Pins: The proper pin for your tether conductors
12 or 10 AWG: Anderson 1339G3-BK
8 AWG: Anderson 1339G5-BK

http://leeselectronic.com

MATE strongly discourages the use of Anderson Powerpole "knock-offs." These connectors do not meet electrical specifications and have the potential to melt under load.

NOTE for 2026!!!
If companies cannot purchase an Anderson SBS50BLU from the above online sources, companies may purchase a kit with these connectors (and the proper Littelfuses/fuse holder) from the SeaMATE store. The SeaMATE store will ship anywhere in the world (Contact Us – SeaMATE).

ELEC-012P(48 volts): The power supply may be located up to 1 meter from the station table and may be located on either side of the table. MATE recommends a power cable long enough to reach the power supply up to 3 meters from your control system.

3.3.5 Tether Voltages

The signals in the tether must meet the following specifications:

ELEC-013P: If using a 12-volt system, DC main-supply at a nominal voltage of 12 VDC as provided by the MATE power supply. If using a 48-volt system, DC main-supply at a nominal 48VDC as provided by the MATE power supply.

ELEC-014P: Low voltage, low current AC or DC control or sensor signals. Low voltage is defined as a voltage equal to or less than the maximum supply voltage per class specification. Low current is defined as being less than 500mA. Examples include video signals, control signals for electrically powered manipulators, sensor signals, etc.

Note: Companies concerned about how voltage loss will affect their camera(s) should consider adding a separate line in the tether to supply the camera from the main power source. This dedicated line for cameras is permitted, provided it runs through the single fuse.

ELEC-015P: Ethernet, USB, or other ANSI or IEC accepted serial protocol signals.

ELEC-016P: NTSC or PAL Video signals

ELEC-017P: Fiber optic cabling of any type may be used.

NOTE for 2026!!!
At the World Championships, PIONEER class companies should include a video splitter in their line at the surface control station so that their ROV camera view can be incorporated into the livestream. MATE ROV competition officials will connect to this splitter and broadcast the ROV camera view on the livestream. Optionally, companies may also provide a split view of their GUI and/or non-video displays to be broadcast over the livestream.

An HDMI connection box will be available at the product demonstration station. During the 5-minute setup, companies should connect their split video connector to this connection box. Companies should prepare their system to ensure that their video feed is not interrupted by splitting it out to the livestream feed.

MATE HDMI Connection Box:

The following are examples of video splitters. Companies may choose devices other than those provided below to split their video. Companies with analog or other non-HDMI cameras should consult with the livestream group prior to their mission runs. Contact the livestream coordinator if you have questions or require a converter to HDMI.

- OREI HDMI Splitter 1 input 2 output 1080p with EDID (HD-102)
- OREI 4K 1x2 HDMI Splitter: 1-in 2-out, EDID (HDS-102)
- Amazon Basics HDMI Splitter 1 In 2 Out
- GAOZHOU Capture Card with 4K Pass-Through, USB3.0 1080P 60FPS
- NZXT Signal HD60 Full HD USB Capture Card with Zero-Lag Passthrough
- Elgato HD60 X – Capture Card

3.3.6 Exposed Connections and Disposable Motors

ELEC-018P: ROVs with electrical connections that are exposed to water and not sealed are not permitted to enter the water. Taping a connection with electrical tape only does not constitute a sealed connection. The process of sealing electrical connections must include methodologies such as, but not limited to, Silicone RTV, hot melt glue, epoxy, self-vulcanizing tape, and enclosure of the connections in a housing.

ELEC-019P: "Disposable motors" are not permitted, these are exposed motors with no waterproofing.

Brushless motors must be properly waterproofed. Companies must show manufacturer documentation showing their brushless motors are waterproof, or companies must properly waterproof their motor and provide documentation showing their methodology. Non-sealed brushless motors will not pass safety inspection.

See the MATE Technical Bulletin for proper methods to waterproof a brushless motor.

3.4 Onboard Electrical Power

ELEC-020P: Onboard electrical power (i.e., power not provided by the tether) is not allowed on the primary ROV. See the Non-ROV Device Power Specifications regarding onboard power for other devices.

NOTE: Water leaking into a closed battery container can result in the generation of hydrogen gas. This gas can build up inside the pressure housing and create an unsafe situation. Any battery housing must be designed to open if the pressure inside the housing is greater than the outside pressure to meet the MATE safety standards. See the non-ROV device onboard battery rules (Non-ROV Device Power Specifications) for more information.

3.5 Power Shutdown

ELEC-021P: For safety purposes, any ROV system that is disconnected from the surface supply must stop functioning in less than 5 seconds. This applies to electrical, pneumatic, and hydraulic power sources. Any filters, capacitors or accumulators must be sized accordingly to meet this specification.

3.6 Fluid Power

Any vehicle using fluid power must provide a fluid power diagram. Fluid power is defined as hydraulic pumps (water) or pneumatic pumps (air) on the vehicle or on the surface.

3.6.1 Hydraulic Power

Note for 2026!!!

FLUID-001: Hydraulic fluid: Water only.

FLUID-002: Maximum Hydraulic pressure allowed: 10.33 bars (150 psig).

Note for 2026!!!

FLUID-003: Hydraulic system: All lines, fittings, and hydraulic devices must be rated for a minimum pressure of two (2) times the maximum supply pressure. Hydraulic component specifications must be included in the Company Safety Review.

FLUID-004: Hydraulic pumps must be part of the safety inspection.

- They must have a pressure relief valve with a maximum setting of 300 psig or less installed before the pressure regulator.
- The pump must have a regulator in place and set to 150 psig or less.
- Pumps with any sign of external rust or deterioration will not be accepted.
- All wiring must be secure.
- All guards must be in place.
- Hydraulic pumps may run off of the 15 A 115 VAC outlet provided for command and control as long as the hydraulic fluid is not used to propel the ROV. The hydraulic fluid is to be used for grippers and actuators only.

Companies using hand/manually powered hydraulic systems do not need a pressure relief valve or regulator in their system. The hand/manually powered hydraulic system must be included on a SID.

3.6.2 Pneumatic Power

FLUID-005: Pneumatic fluid: Compressed air or inert gas only

FLUID-006: Maximum pressure allowed: 2.75 bars (40 psig)

Note for 2026!!!

FLUID-007: Pneumatic system: All lines, fittings, and pneumatic devices must be rated for a minimum pressure of two and a half (2.5) times the maximum supply pressure. For example, if an 83 bar (1200 psig) tank is regulated to 2 bars (30 psig), then all system components must have a minimum rating of 5.17 bars (75 psig). Pneumatic component specifications **MUST** be included in the Company Safety Review. Note: Aquarium tubing is not generally rated for the pressures associated with compressed gas systems and should not be used in a pressurized pneumatic system.

FLUID-008: Air compressors must be part of the safety inspection.

1. The company's system must have a pressure regulator, shut-off valve and manual pressure release. See Compressed Air at the MATE ROV Competition for more information.
2. The regulator must be set to 40 psig for less.
3. Compressors with any sign of external rust will not be accepted.
4. The tank drain valve must open.

5. If more than 5 ml of water exits upon opening the drain valve, the compressor will not be accepted.
6. All wiring must be secure.
7. All guards must be in place.
8. Air compressors may run off of the 15A 115VAC outlet provided for command and control as long as the air is not used for motor thrust. The air is to be used for buoyancy/ballast, grippers and actuators only.

At the World Championship competition, MATE ROV will provide compressed air at each station. Companies using compressed air MUST attach to the compressed air source provided by the MATE ROV Competition; companies may not use their own compressor. See 3.9 MATE Provided Equipment for more information.

3.6.3 Pressurized Cylinders

Note for 2026!!!

FLUID-009: Pressurized cylinders (SCUBA tanks) are not allowed.

Note for 2026!!!

FLUID-010: Electronic housings and other enclosures on the ROV must operate at surface pressures. Companies may not pressurize their electronics housing.

3.6.4 Pressure Operated Devices (PSO)

MATE will allow the use of soft-walled pressure operated devices in the competition provided they meet the following specifications:

- Device uses a pressure release valve of 12 psi maximum.
- Company provides specifications and factory cut sheets of the valve used and a description of the device to the Competition Technical Manager no later than May 15th, 2026 for review by the MATE safety committee.

The intent of the exception to the pressure specifications is to allow the use of bladder type devices and flexible grippers that operate a few psi above ambient and would be destroyed if tested at full MATE pressure specifications. This exception does not apply to cylinders, pressure vessels or other pressure containment devices. If the device is tested to the 40 psi (pneumatic) or 150 psi (hydraulic) MATE specifications, a pressure release valve is not required.

3.6.5 Unpressurized Cylinders

FLUID-011: Companies may fill containers on the ROV with air provided those containers never exceed ambient pressure. Any such container is required to have at least one ¼-inch (6.35 mm) hole drilled into the bottom of the container to allow excess air to escape.

3.6.6 Pressure Storage Devices (Pressure Accumulators)

FLUID-012: Pressure storage devices are allowed on the ROV if they do not exceed 1.25L in total storage and do not store pressure higher than the allowed pressure for air or hydraulics. It is recognized that a company may not be able to purchase a pressure accumulator that has the proper rating and fits in the space needed. In that case, the company must show that their designed accumulator is capable of withstanding the specified pressures without rupture.

3.6.7 Chemical Creation of Gases

The chemical creation of gases is not allowed.

3.6.8 Fluid Power Quiz

FLUID-013: PIONEER class companies planning to use hydraulics and/or pneumatics (i.e., fluid power) are required to take and pass an online quiz with a score of 100%. Companies ONLY using manual pumps and unpressurized containers are not required to take the Fluid Power Quiz but must still submit documentation regarding their fluid power system.

NOTE: The quiz was developed by MATE ROV Competition technical support staff and competition judges and is designed to ensure that companies understand basic information on these topics and can apply that knowledge to safe practices. The intention is not to add yet another "requirement," but rather to provide a safe and successful learning experience and competition environment.

The quiz should be completed by the STUDENT company members. Each member of the company does NOT have to take the quiz; students can work together and make it a group effort. **ONLY ONE TEST PER COMPANY.** The company's instructor or mentor can provide guidance and advice, but the questions should be answered by the students participating on the company. The quiz will be scored, and the results provided instantaneously. A score of 100% is considered a passing grade. Companies can take the quiz as many as 5 times to achieve this score.

The quiz must be completed with a passing grade by April 30th, 2026. NO EXCEPTIONS OR EXTENSIONS! Companies with regional competition prior to April 30th due date should plan to take the fluid power quiz at least 2 weeks prior to their competition. If registration for your regional competition opens after the fluid power closing date, you must still take the quiz before April 30th. Companies failing to complete this quiz within the given time frame will NOT be permitted to use fluid power during their competition event. **NO EXCEPTIONS OR EXTENSIONS! See KEY DEADLINES.**

To purchase and take the fluid power quiz, click here.

The following are sources of information on hydraulics and pneumatics. This is not intended to be an exhaustive list, but rather a starting point to encourage companies to seek out additional information and resources:

- Underwater Robotics: Science, Design, and Fabrication (Revised Edition – SeaMATE, published by the MATE Center and MATE Inspiration for Innovation

- What is Fluid Power? (nfpa.com)
- Full Guide to Air Compressor Safety | Quincy Compressor

3.7 Control Systems

ELEC-022P: PIONEER class ROVs are expected to utilize computer- (or electronic-) based control methodologies and H-Bridge or BLDC controllers for the thrusters. Systems using surface switch box controllers are not permitted.

ELEC-023P: Surface control stations must be built in a neat and workmanship-like manner. Loose components and unsecured wires will not pass safety inspection.

New for 2026!!!
When the ROV is in use, all connections in the control box must be shielded or covered to **IP-30 standards**. IP-30 standards equate to <2.5 mm and should protect against tools, thick wires, and the like. Any guards / shields must be in place when the control system is connected to power.

ELEC-024P: Surface control stations by nature may combine 120VAC and 48VDC/12VDC wiring. The surface control stations must be wired in a manner such that the 120VAC wiring is physically separated from the DC wiring, the 120VAC wiring is clearly identified from the DC and control voltages, and every conductor is insulated in a manner that no conductor is exposed. Identification can be through signage and/or wire color schemes. All 120VAC wiring colors must use ANSI, NEMA or IEC standard wiring colors appropriate to each voltage. There must be a sign inside the surface control station indicating which wiring standard is being utilized. Companies that do not have adequate separation of AC wires and components and DC wires and components will NOT pass safety inspection. It is recommended that separation be designed into the control system to keep power systems separate. Wiring should be clear, neat and easy to follow by inspectors. Wiring "rat's nests" or "spaghetti wiring" will not pass safety inspection.

ELEC-025P: Companies must use proper strain relief and abrasion protection where wires and the tether enter the vehicle. The ROV should be capable of being lifted by the tether without damaging the tether connection to the ROV. Tape, glue, zip ties, and other quick methods of strain relief are not acceptable. The intent is to see the wires pass through a connector specifically designed to provide strain relief.

Companies must use proper strain relief at the surface where wires and the tether enter the control system. Pulling on the tether should not strain the wires entering the control system or computer/laptop.

Examples of some acceptable strain reliefs for the ROV side include:

Hubbell Strain Relief
Strain relief grip

Kellums strain relief cord grip

NOTE for 2026!!!

Additional information on expected and accepted practices for design and wiring of your system, including proper strain relief, can be found in the following MATE ROV Competition Tech Bulletin:

- **MATE ROV Competition Tech Bulletin – MATE Expected Work Practices**

New for 2026!!!

See the strain relief section in the MATE Expected Work Practices document for the required 2026 top-side strain relief.

ELEC-026P: Any connectors utilized in the surface control station and elsewhere in the ROV system must be properly type rated for their application. AC rated connectors must not be used for DC. The connectors must also be rated at or above the voltage and current used in their application.

3.8 Command, Control, & Communications (C3)

3.8.1 Power Provided

CCC-001: Surface power: MATE will provide one GFI-protected outlet with a nominal 115 Volts AC (60 Hertz) and 15 amps maximum. This outlet is intended to provide power for pumps and other surface support equipment (e.g. video displays & control boxes). This AC power source CANNOT be used to directly or indirectly power the vehicle.

CCC-002: If hydraulic or pneumatic power is used for vehicle thrust, the power for the pump must come from the MATE supplied DC power supply.

CCC-003: In addition to electric pumps, hydraulic, and pneumatic systems can be powered by manual pumps (e.g. bicycle tire pump) or supplied from a pre-pressurized cylinder. Companies that are only using manual pumps must still comply with all hydraulic and pneumatic specifications, including the creation of a fluid power SID.

3.8.2 Cameras

NOTE for 2026!!!

CCC-004: Cameras are required to pilot the ROV. ROV pilots will be penalized for looking into the pool when piloting their ROV.

All cameras, including USB cameras, must be powered by the MATE supply. Powering a USB camera from the MATE supply can be accomplished by using a USB repeater / extender that has a separate power input at the far (ROV) end. The ROV would then provide the power to the device from the MATE supply. USB cameras plugged directly into laptops are not allowed. Be sure to denote camera power on your SID.

3.8.3 Displays

CCC-005P: Companies are not limited to the number of display screens used for video feeds or ROV status information. Display devices may be made up of any combination of TVs, monitors, laptops, and/or computer displays.

CCC-006P: These display devices may be powered by the MATE provided GFI-protected 115-Volt AC (60-cycle) and 15-amp AC power source described in CCC-001, Surface power.

CCC-007P: A company's C3 station may include devices like video recorders. All C3 devices must be able to run on the single AC power outlet provided or on its own internal battery power. Any device plugged into this AC power outlet can only provide C3 functions and cannot provide power to the ROV.

CCC-008P: A company's C3 station should have all items stable or secured to the station. Large monitors not secured to and stable in the product demonstration station are not permitted. Monitors and other C3 devices with glass faceplates are not permitted.

3.9 MATE Provided Equipment

For companies advancing to the World Championship, the MATE ROV Competition will **NOT** provide video monitors at the product demonstration stations. Contact your regional coordinator or visit your regional contest's website as to whether video monitors will be provided at your regional competition.

In 2026, the MATE ROV Competition will supply compressed air at each station during the World Championship. Companies may connect to this compressed air via a standard ¼-inch NPT male fitting. See the Compressed Air Guidelines for more information on what MATE ROV provides and what companies are required to provide for their compressed air systems. For companies at a regional event, contact your regional coordinator or visit your regional contest's website as to whether compressed air will be provided at your regional competition.

3.9.1 Companies Sharing Equipment

Companies may share the following equipment during the competition event: monitors and joysticks/controllers.

Companies may NOT share the following equipment during the competition event: control systems and payload tools (e.g. grippers, manipulators).

For companies competing at a regional event, contact your regional coordinator or visit your regional contest's website to determine if equipment can be shared.

Companies that plan to share equipment during the World Championship event must notify the

Competition Technical Manager at least 4 weeks prior to the event so that this can be considered when creating the schedule. MATE will do its best to accommodate companies sharing equipment.

3.10 Laser Safety Rules

LASR-001: **Companies must forward the specifications of their laser to the Competition Technical Manager by May 15th, 2026. For PIONEER class companies attending a regional, laser specifications should be forwarded at least three weeks prior to the regional competition.** Specifications **MUST** include a link to the laser being used. The link should include a photo of the laser and the laser specifications. A notification will be sent to the company when the laser is approved. Companies must also bring a copy of their laser specifications to their safety checks. If the laser is being used at a regional event or pool practice, notification will also be sent to the regional competition coordinator.

LASR-002: All lasers must operate in the visible range at either the 630-680 nm (red) or near the 532 nm (green) wavelength. All lasers must fall into the Class I, Class II, or Class IIIa category. Red lasers must operate at 5mW or less. Green lasers must operate at 1 mW or less.

LASR-003: Companies should include detailed specifications of their laser in their technical documentation as well as have that information ready and available during their safety inspection and engineering presentations.

LASR-004: Lasers must have an on/off switch. This switch must be on the surface controller.

LASR-005: All lasers must be powered by the MATE surface power supply. Batteries, including batteries for powering lasers, are not permitted on the vehicle.

LASR-006: Companies using lasers cannot increase the voltage or the current to increase the power of their lasers. Lasers must use the voltage and current set in their specifications.

LASR-007: When out of the water, the laser should have a shield or enclosed beam stop attachment within 30 cm of the laser. This means that the laser beam should not travel more than 30 cm before reaching the shield. This is a requirement at all times when the laser is out of the water. ***NOTE for 2026!!!*** The beam stop must be attached to the ROV at all times. Companies may not remove the beam stop by hand when the ROV enters the pool. The beam stop should be designed so it floats or moves out of the way of the beam when the ROV is in the water. The shield must be painted with FLAT BLACK paint.

LASR-008: At no time should the laser be focused or deviate from a collimated beam.

LASR-009: When testing the laser at a workstation, companies must display a sign telling others that a laser is being operated.

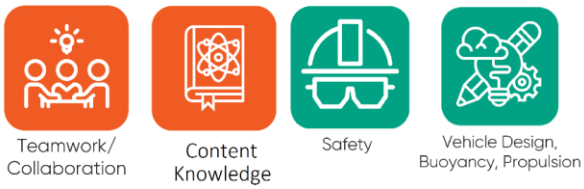
LASR-010: Operators working with the laser while the ROV is out of the water should wear appropriate laser safety glasses at all times. This requirement is for all laser types. Search online to find laser safety glasses appropriate for the wavelength being used.

Companies must forward the specifications of their laser safety glasses to the Competition Technical Manager by May 15th, 2026. For PIONEER class companies attending a regional, glasses specifications should be forwarded at least three weeks prior to the regional competition. Specifications MUST include a link to the laser safety glasses being used. The link should include a photo of the laser glasses and the laser glasses specifications. A notification will be sent to the company when the laser safety glasses are approved. Companies must also bring a copy of their laser safety glasses specifications to their safety checks. If more than one brand of glasses is used, a copy of each specification sheet should be provided.

The following lasers are acceptable to use in the MATE ROV Competition, although companies may choose to use alternate lasers. NOTE: **ALL COMPANIES MUST FORWARD SPECIFICATIONS TO THE COMPETITION TECHNICAL MANAGER, EVEN IF ONE OF THE FOLLOWING ACCEPTABLE LASERS IS USED:**

- Amazon.com: HiLetgo 10pcs 5V 650nm 5mW Red Dot Laser Head Red Laser Diode Laser Tube with Leads Head Outer Diameter 6mm : Industrial & Scientific
- Amazon.com: Quluxe 650nm 5mw Laser Head Laser Tube Adjustable Focus 3~5V Red Laser Tube, Laser Head Industrial Laser (Pack of 3) : Industrial & Scientific

PART 3: COMPETITION RULES



3.1 GENERAL

- All members of the company and their supporters must follow the safety regulations of the ROV competition, pool facility, and event venue.

- All company members and their supporters are expected to conduct themselves in a professional and responsible manner during the competition. Disrespectful behavior towards the judges, officials, pool staff, audience, or other companies will lead to penalty points or disqualification.

- Sabotaging, stealing, or pilfering equipment of other companies will lead to disqualification. Companies found cheating will also be disqualified.

- The MATE ROV competition is, at its core, designed to be an educational and inspirational event for **STUDENTS**. It is designed to challenge them to apply the physics, math, electronics, and engineering skills they are learning in the classroom to solving practical problems from the marine workplace. (See the MATE Competition Philosophy.)

  It is expected that all "adults" (non-students; e.g. teachers, mentors, parents) involved in the competition limit their input to educational and inspirational roles. Actual construction of the ROV (particularly in the complex electrical and software areas) must be completed by the students. Adults should teach and advise students about design, electronics, software, and construction, but not complete the work for the students. Throughout the process adults are encouraged to focus on benefits to the students from the process and not simply winning. If it becomes apparent that adults exercised more than an advisory role, judges reserve the right to deduct points or, in extreme cases, disqualify companies from the competition.

  ALL work done on the vehicle must be conducted by company members. This includes any work done at home, at school, or during the MATE ROV competition (World Championship and regional). Teachers, mentors, parents, and non-competing students are not permitted to work on the ROVs. They may provide advisory input, but they may not work on the ROV directly. This includes writing or editing software code. All mechanical, electrical, and software modifications and/or repairs to the ROV must be completed by students.

  With learning at its core, the MATE competition encourages students to utilize and build upon their skill sets to find creative solutions to designing and building their ROV. Students gain valuable skills and knowledge when creating a component from "scratch," which is apparent to judges as they review the technical documentation and engineering presentation. However, as they move through the process of analyzing their designs and identifying building materials, students may decide to either build a component from "scratch" or purchase it from a commercial vendor.*** So, while original solutions are encouraged, the use of commercial components is acceptable, provided 1) that the components adhere to the design and building as well as safety specifications for the particular competition class and 2) more importantly, that the students can provide a reasonable, logical explanation for buying versus building.

  The competition scoring rubrics are designed to reflect this; points are awarded based on students' abilities to explain and justify how all of the components and systems work together as an integrated ROV, regardless if they purchased them, pulled them from public libraries, or made them themselves.

  ***Note "commercial vendor" includes the SeaMATE store and other competition programs that sell educational robotics kits. SeaMATE kits were created to remove barriers to participation for teachers and schools unable to easily 1) find parts and materials and 2) set up accounts with multiple vendors. The kits are part of a larger educational package that includes

curriculum materials, videos, and other resources to support and enhance learning. And learning is what students who use SeaMATE (or other) kits will be expected to demonstrate during and through the ENGINEERING & COMMUNICATION components.

It should be noted that purchasing and competing with complete, assembled, commercial ROVs is not permitted.

3.2 PROCEDURAL

- Companies must compete during their assigned time slots. Your company is **NOT** permitted to switch time slots with another company. Failure to show for your scheduled product demonstration or for your company's engineering presentation will result in "no score" for that particular competition category. **No exceptions.** Assigned time slots will be sent out in advance so that any scheduling concerns can be addressed prior to the event.

- At the World Championship, companies will complete their ROV weight measurements during their onsite safety inspection. See WEIGHT RESTRICTIONS.

  Note: Regional competitions may handle size and weight measurements differently. Regional competitions that combine all the tasks into one product demonstration run may weigh vehicles prior to each run. For PIONEER class companies competing at a regional event, contact your regional coordinator or visit your regional contest's website for more information.

- While there is no limit to the number of students who can compete as part of a company, **the product demonstration team (aka demo team) is limited to six students**. The demo team is defined as the team of students who operate the vehicle and its associated equipment during the product demonstration. Only six students will be allowed to enter the product demonstration station, launch, pilot, and perform the tasks. Instructors, mentors, and/or non-student members cannot participate as part of the demo team. **Companies may alternate students on the demo team for the different product demonstration attempts.** (All members of the company should participate in the ENGINEERING & COMMUNICATION components.)

- Only the demo team members and judges are allowed at the product demonstration station during the product demonstration, which includes the set-up and demobilization periods. Other members of the company, instructors, mentors, audience members, and observers (press or special invited guests) must remain outside the product demonstration station or in designated viewing areas.

- Instructors, mentors, parents, and "fans" are **NOT** permitted at the safety inspection stations or repair tables. Two warnings will be issued before individuals not heeding this rule will be asked to leave the venue.

- In addition, instructors, mentors, parents, and fans are **NOT** permitted to work on the ROV. Individuals who are not student company members and are seen working on the ROV will be issued a warning. Two warnings will be issued before individuals not heeding this rule will be asked to leave the venue. If companies choose to take their ROVs off the competition grounds for maintenance and repair, they are expected to observe this rule in the interests of the spirit of the competition.

- To help enforce this, teachers, mentors, parents, and non-competing students MAY have limited access to the workstation areas. Contact the MATE ROV Competition officials for more information.

- Video devices may be used to record the underwater activities for entertainment and learning purposes **only**. Video will not be used as an instant replay to review judges' decisions or to challenge product demonstration timing.

- Product demonstration stations will be roped off and marked. Product demonstration stations will contain 2-3 chairs and one 6-foot table long table for companies to use. This table will be within 3 meters of the pool edge. Product demonstration stations will be set up to prevent the pilot(s) from looking at the ROV in or under the water except through the ROV cameras.

- The product demonstration time consists of a 5-minute set-up period, the performance period, and a 5-minute demobilization period. If the demo team and all of their equipment are not out of the product demonstration station at the end of the 5-minute demobilization period, the company will be **penalized 1 point for each additional minute**.

  Note: Regional competitions may group all four tasks into one product demonstration run, and may offer two attempts at the product demonstration. Regional competitions may allow more time (15 minutes) to complete the product demonstration. For PIONEER class companies competing at a regional event, contact your regional coordinator or visit your regional contest's website for more information.

- Manipulating the tether to free it from underwater obstacles is permitted. Pulling on the tether to speed up the recovery of items or to return your vehicle more quickly to the surface is not permitted and will result in penalty points. Judges will issue one warning if tether pulling occurs. Each future infraction will result in **5** points deducted from the final product demonstration score.

- At the World Championship, SCUBA diver assistance will only be available at the Offshore Engineering Basin. If assistance is required, the company CEO or pilot must ask a station judge and divers. The product demonstration clock will not stop, and each diver assist will incur a 5-point penalty. Diver assistance will not be available at the Flume Tank or Ice Tank.

  Diver assistance may not be available at your regional competition. For PIONEER class companies competing at a regional event, contact your regional coordinator or visit your regional contest's website to determine if diver assistance will be available at your regional competition.

- Pilots can only leave the product demonstration station and move poolside to repair, adjust, or alter a vehicle if the ROV is surfaced and at the side of the pool.

- Companies are not permitted to leave debris in the pool. Any debris must be recovered by the ROV before time has expired or the company will be penalized. Debris is defined as pieces of the ROVs, weights, floats, or other items created by the company. Task props are not considered debris unless noted in the Product Demonstration section. The product demonstration notes section may cover special items that can be left in the pool after time has expired.

- No demo team member shall enter the water to complete an object recovery. Only arms and hands are allowed into the pool to retrieve an object or to retrieve the vehicle. Companies will be disqualified or penalized depending on the severity of the infraction.

- Communication between demo team members at the pool edge and demo team members piloting the vehicle will be limited. Only tether management issues (e.g. how much tether is out, how much is remaining on the pool deck) can be discussed. Those team members at the pool edge cannot give any directional or product demonstration task information to the pilot. Judges will issue one warning regarding illegal communication. Each future infraction will result in **5** points deducted from the final product demonstration score.

  Pilots may communicate freely with the company members at pool edge. For example, Task 3.1 requires pilots to communicate with pool side members to direct a micro-pile into its designated location.

- Communication using cell phones, text messaging, and online social media tools such as Teams, Zoom, Skype, Facebook, Twitter, instant messaging, etc. is NOT permitted during the product demonstration, either between the demo team members at poolside or between any demo team member and anyone outside of the product demonstration station. The ROV and/or the ROV control system is not allowed to broadcast video or other information to anyone outside of the product demonstration area. No exceptions. Companies found broadcasting

any data to those outside of the product demonstration area will be disqualified.

- **Product demonstration judges and other competition officials will only communicate with students.** Judges and officials will NOT communicate with mentors, parents, or other non-student members regarding product demonstration information, challenges, or other issues except during pre- and post-competition briefing sessions.

  Companies that wish to issue a challenge during the product demonstration run should immediately communicate this challenge to the product demonstration judges. The judges will discuss and attempt to resolve the issue. If a decision cannot be made, the product demonstration judges will consult with the head judges and competition technical manager to resolve the issue.

  NOTE for 2026!!!

- Once a chief judge rules on a challenge, that ruling is final. NO EXCEPTIONS, including appeals to other competition officials. Penalty points may be given if companies continue to pursue the challenge beyond the chief judge's final ruling.

3.3 DESIGN & SAFETY CONSIDERATIONS

- The competition coordinators and host venues stress the importance of safety practices and procedures to all companies. The score sheets and rubrics will reflect the MATE ROV Competition's efforts to encourage and reward companies that demonstrate exceptional safety practices and procedures.

- **ALL ROVS MUST PASS A SAFETY INSPECTION CONDUCTED BY COMPETITION OFFICIALS PRIOR TO ENTERING THE POOL.** These inspections will be conducted topside to ensure that ROV systems meet the design and building specifications and do not pose a risk to the integrity of the event venue. See VEHICLE DESIGN & BUILDING SPECIFICATIONS for additional information.

- Radio transmitters that operate on a separate battery are permitted. No batteries are permitted to be in or on the water, other than those allowed for non-ROV devices. No other exceptions are allowed.

  Companies should be aware of all the implications of these wireless devices. There is no assurance that an adjacent company's wireless controller will not interfere with your control systems. Adjacent wireless controllers with a battery that has a higher charge than the nearby controller have demonstrated the ability to "hijack" the nearby control signals. In addition, all wireless controllers are susceptible to external sources of electronic interference. Your system may work fine in your home environment, but not in the industrial environment of the

competition. MATE will not stop the clock to resolve wireless control issues. Companies deciding to utilize wireless controllers do so at their own risk.

- Keep an eye out for tripping hazards in the product demonstration station and at your company's workstation. Make sure power cords are not laying in pools of water on the deck.

- During your product demonstration, be sure to secure any equipment so that it does not fall off the product demonstration station table, damage the deck, or cause injury.

- Loose fitting clothing, jewelry, and long hair could all become safety issues. Consider securing long shirts or baggy pants, removing jewelry, and tying back long hair when working on or operating your ROV.

- ROVs may be constructed out of materials of your company's choice, provided they meet the design and building specifications and safety regulations. Warning labels should be posted on potentially hazardous components of your ROV system.

- Close-toed shoes are required on the pool deck. Safety glasses are required when working on the vehicle.

- Personal flotation devices (PFDs) will be required at the World Championship at each venue for those company members at poolside. Personal flotation devices will be provided by MATE or the host venue. Regional events may not require PFDs. For PIONEER companies competing at a regional event, contact your regional coordinator or visit your regional contest's website to determine if PFDs will be necessary.

PART 4: ENGINEERING & COMMUNICATION

NOTE for 2026!!!

MATE has created an ROV Competition Marketing Kit that includes logos and guidelines for their use.

The ability to communicate information about your vehicle and the design and building process is equally as important as how well your vehicle performs. Strong communication skills are an essential part of good business practices and one of the most in-demand skills in the constantly evolving, ever-changing workplace.

To emphasize this point, the competition requires the following five engineering and communication components:

- Company spec sheet
- Technical (written) documentation
- Engineering (oral) presentation
- Marketing display
- Corporate Responsibility (OPTIONAL)

NOTE: Regional contests may not require all of the Engineering & Communication components. Contact your regional coordinator or visit your regional contest's website for more information.

See TIPS FOR EFFECTIVE WRITTEN AND ORAL COMMUNICATION for additional information.

Notes on the use of AI

The MATE ROV Competition recognizes the expanding use of AI and how it can be used as a tool to overcome challenges, enhance productivity, and fill in knowledge gaps, technical or otherwise, that may occur during the development and build of vehicles and floats. If applicable, how you used AI as a tool (but not as a crutch) to help with your build, increase efficiency, and/or fill in gaps in understanding (but not replace knowledge and skills) should be described within your technical documentation and engineering presentation. It should be understood that you should not use AI to write or prepare your technical documentation or engineering presentation.

NOTE for 2026!!!

Your company should refer directly to the scoring rubrics posted under Scoring for details on what is required for your company spec sheet, technical documentation, engineering presentation, marketing display, and corporate responsibility. The judges will use the rubrics to evaluate and score these engineering and communication components.

4.1 COMPANY SPEC SHEET

The purpose of the company spec sheet is to provide the judges with a "snapshot" of your company. It includes basic information about your company and vehicle.

Company spec sheets will be reviewed by MATE competition coordinators. Companies will receive up to 20 points for submitting a spec sheet that is **one page** in length, follows the file size and naming specifications, and contains **all** of the following information:

COMPANY SPECS

- **Team ID**
- **Company and school, club, or community organization name**
- **Home state and/or country**
- **Distance required to travel to the World Championship**
- **History of MATE ROV competition participation.** Be sure to specify if your company and/or the members of your company are "new" or "returning."
- **Company photo and caption indicating members' names and roles (e.g. CEO, CFO, Design Engineer, Pilot, etc.).** This photo should include all of the members of your company.
- **Range of grade/college levels represented by the members of your company**

ROV SPECS

- **ROV name**
- **Total cost.** You must include the approximate cost of any donated items.
- **Size and weight measurements**
- **Total student-hours to design and build.** This should include the number of hours that each and every member of the company worked on the vehicle.
- **Safety features**
- **Special features**
- **Photo of the vehicle**

REMINDER!!! If all of the above information is included, the specifications for length, size, and naming conventions are followed carefully, and the document is submitted on time, this is an "easy" 20 points! You can find the company spec sheet scoring rubric posted here.

Examples of spec sheets from previous competitions can be found in the MATE ROV Competition Archives.

4.2 TECHNICAL DOCUMENTATION

The purpose of the technical documentation is to challenge you to effectively and efficiently communicate information using clear and concise text along with graphics, illustrations, and data that add to and complement (and not distract from) the information. Your company must organize and present the information in a way that is logical and complete. The document should focus on the technical and safety aspects of your ROV/ROV systems, the design rationale behind your engineering decisions, and a critical analysis of testing and troubleshooting done on the vehicle. The design rationale should include information on why a specific design or component is appropriate for this year's theme and mission. You should consider this document a reference for both judges and future team members (part of the company's institutional knowledge).

NOTE for 2026!!!
Companies should create original content for their technical documentation and should not reuse portions of previous technical documents. If a company's solution to a problem or design choice is similar to the previous year, it should be presented that way within the technical documentation.

For example, if a company is reusing Blue Robotics thrusters the company could include a note like this within their technical documentation: "We used Blue Robotics thrusters again this year. Like last year (2025), we found that they were the best fit for our ROV. In last year's technical documentation, we stated that [cut and paste information from previous document], and our reasons have not changed for this year."

Your company's technical documentation will be reviewed and evaluated by a panel of working professionals – individuals who represent science, exploration, government, and industry. (Don't assume that these same individuals will evaluate your company's engineering presentation!)

Each judge on the panel will award a score (100 points max). Judges' scores and comments will be returned to you shortly after the event.

NOTE: The judges will not review and rescore revised versions of your technical documentation during the competition.

Use the technical documentation scoring rubric posted here as the guideline for the required components for the technical documentation. This rubric will be posted by March 1, 2026. In the meantime, companies may refer to the previous year's rubrics for a general idea of the categories and points.

Examples of technical documentation from previous competitions can be found in the MATE ROV Competition Archives.

4.3 ENGINEERING PRESENTATION

The purpose of the engineering presentation is to challenge you to effectively and efficiently communicate information with words and "props" (i.e., the ROV). Your company must organize and present the information in a way that is logical and covers the development and testing of your ROVs and the formation and development of your team. The presentation should be delivered as a "technical brief," with references to the technical documentation for additional details. The presentation is THE opportunity your company has to 1) communicate directly and in person your critical thinking, creativity, and engineering reasoning (including build vs. buy) and 2) demonstrate your individual and collaborative contributions to the creation of the vehicle.

During the competition, your company will have 15 minutes to deliver your presentation to a panel of working professionals – individuals who represent science, exploration, government, and

industry. (Don't assume that these same individuals will evaluate your company's technical documentation!) The presentation will be scored as a stand-alone requirement; no points will be awarded in the presentation for information included in the Technical Documentation that is not included in your presentation. After the presentation, the judges will take up to 15 minutes to ask the members of your company questions about your ROV. The judges will evaluate both your presentation and responses to their questions. Each judge on the panel will award a score (100 points max). Judges' scores and comments will be returned to you shortly after the event.

All student members of your company must be prepared to participate in this presentation and the question and answer (Q&A) period. You are required to have your ROV with you, but will not be allowed to power up your vehicle. For larger companies, the main presentation may be done by a subset of the overall company. During the Q&A, all members of the company should be prepared to answer. However, if one student is better suited to answer a specific question, the others may defer the question to that student to answer. For example, if a judge calls on the pilot to answer a question about the tether, the pilot can respond by informing the judge that the tether manager was the lead on that system and allow the tether manager to answer without penalty or loss of points.

NOTE: The engineering presentation is designed to be a face-to-face interaction where students and representatives from industry become engaged in conversation. MATE will not provide audio visual aids, such as slide projectors, computer projection screens, whiteboards, etc.; however, you are welcome to distribute handouts to help judges better understand the information that you are presenting. Electronic forms of presentation (e.g. PowerPoint or Keynote slides) **are NOT permitted.**

NOTE for 2026!!!

Companies are permitted to bring a maximum of **two** videos, each no more than 30 seconds long, to demonstrate a design or component that cannot easily be demonstrated without powering the ROV. These videos **cannot** be pre-recorded portions of the presentation; while they may show a design or complex component in action, they should not include an explanation of that design or component. The company is expected to provide any electronic device needed to present these videos; MATE will not provide a device or access to a projector. Note that the time taken to present these videos is part of your allotted time.

Instructors, mentors, family members, friends, and members of other companies are permitted to attend. However, we ask that those in attendance be respectful and courteous throughout the presentation and follow-up question and answer period. Be mindful that this presentation may be a stressful time for the students. If the room becomes crowded or the spectators become distracting, it is up to the judges' discretion to request that some or all spectators leave the presentation. **While they are permitted to attend, instructors and mentors are not allowed to participate.**

Use the engineering presentation scoring rubric posted here as the guideline for the required components for the engineering presentation. This rubric will be posted by March 1, 2026. In the meantime, companies may refer to the previous year's rubrics for a general idea of the categories and points.

Videos of engineering presentations can be found on the MATE Vimeo site: Univ. of Washington (EXPLORER 2025, full presentation and Q&A, best engineering presentation award 2025), Jesuit High School (EXPLORER 2019), 404 Engineering (EXPLORER 2021), Hawks Engineering (RANGER 2021), Deep Ocean Robotics (RANGER 2021) and Sea Life Technologies (RANGER 2021.)

Judges may ask questions regarding any of these topics not covered in the presentation as well as other questions about the vehicle, the mission theme, or the company.

Preparing for your engineering presentation and Q&A

- Make sure that every member of your company has a good, general working knowledge of your vehicle, even though they may have specialized in one specific aspect of its design and construction.
- Make sure that all the members of your company are familiar with your technical documentation. Ask every member to read it over to catch any errors or omissions. This exercise will help to familiarize everyone with all aspects of the project.
- Generally, you will have more to say about your ROV than can be presented in 15 minutes. That is why it is critical to organize your material and practice communicating it. However, avoid coming across as having memorized your presentation verbatim. Judges want to see that you are prepared and understand the information, not that you can simply regurgitate a rehearsed speech from memory. Ask your instructors or mentors to give you feedback.

Other important items

- If during the engineering presentation it becomes apparent that instructors, mentors, and other adults associated with your company exercised more than an advisory role, judges reserve the right to deduct points or, in extreme cases, disqualify companies.

4.4 MARKETING DISPLAY

The purpose of the marketing display is to challenge you to present technical information in a way that appeals to and is understood by a non-technical audience. It is the promotional piece – you must not only present information about your ROV and your company, but you must also use graphics and design to publicize and "sell" (convince viewers, including the general public, of their value and excellence) your products and people.

Note: The marketing display should be tailored for this audience and not a cut-and-paste of the technical documentation.

During the competition, your company's display will be evaluated and scored by a completely different group of working professionals – individuals who will represent science, business, government, industry, and education/outreach.

While some judges will have a technical background, others will have a communications, marketing, or public relations background. In addition, there will be visitors to the competition who may not completely understand what an ROV is or how it is used. Think of these visitors as potential future clients who may authorize funding for your work but have a limited understanding of the technology (i.e., you need to explain your technology, the tasks at hand, and "sell" them on YOUR products and services). Design your display to communicate to this type of audience.

Each judge will award a score (50 points max). Judges' scores and comments will be returned to you shortly after the event.

New for 2026 World Championship teams!!!

This year companies competing at the World Championship must submit a digital copy of their marketing display on May 21st with other submitted documentation. Judges will evaluate the content of the marketing display prior to the competition. See SUBMISSION GUIDELINES AND KEY DEADLINES for more information.

Onsite Setup (Required)

In addition to submitting a digital copy, companies are required to bring a printed copy of their marketing display (the same version that they submitted), along with other marketing materials. The displays will be further evaluated on site for content as well as overall aesthetics before a final score is awarded.

NOTE FOR WORLD CHAMPIONSHIP COMPETITION ONLY!

The MATE ROV Competition will NOT supply display boards.

You must provide your own display board. The space that the text and photographs/graphics occupy CANNOT exceed 36" tall by 48" wide. For example, company names CANNOT be mounted above the display board. NO EXCEPTIONS!

At the World Championship, tables will be provided for the displays. Two companies will share a six-foot table. Contact your regional coordinator to see if tables (easels or other) will be provided at your regional event. Companies should create their marketing displays so that they can be exhibited on either a table or an easel.

MATE will continue to provide scissors, tape, glue sticks, adhesives, and other means of attaching display items to the presentation board, although you are also welcome to bring your own.

Use the marketing display scoring rubric posted here as the guideline for the required components for the marketing display. This rubric will be posted by March 1, 2026. In the

meantime, companies may refer to the previous year's rubrics for a general idea of the categories and points. Look for updates in the 2026 rubric.

Examples of top marketing displays from 2025: Jesuit High Poster (EXPLORER), Miramar Poster (PIONEER), Coral Crusader Poster (RANGER.)

Creating an effective marketing display:

- Address the overall theme and make real-world connections (how could your company and ROV solve these real-world problems?).
- Address the UN Sustainable Development Goals and ESG.
- Reflect your company's personality and mindset.
- Make key points and be concise.
- Keep the general public in mind.
- Make sure to label any and all figures, graphs, diagrams, and photographs and credit the source.
- Maximize the use of the 36" by 48" display space.
- Make sure that it is both informational and aesthetically pleasing.

Note: "Accessories" such as video footage, PowerPoint slide presentations running on laptop computers, video projections, etc. are permitted but should be used with discretion. Remember that the judges will have a limited amount of time to evaluate your marketing display and may find excessive use of audio or video presentations distracting.

However, if you do make a video of your ROV building or competition experience, please submit information about it to the MATE ROV Competition officials so that it can be shared via MATE's YouTube and Vimeo channels.

4.5 CORPORATE RESPONSIBILITY

The MATE ROV Competition uses underwater robotics to inspire and encourage students' interest in STEM (science, technology, engineering, and math) education and careers. Recognizing that the students who participate in MATE competitions are powerful ambassadors for the program as well as effective leaders in raising awareness of important issues and bringing about positive change, companies have the opportunity to earn up to 20 points for "corporate responsibility."

Corporate responsibility includes, but is not limited to, the following:

- **Education focused initiatives** consists of, for example, providing guidance to other students in your area who are designing and building an ROV for the competition or a science or other project.

  This follows the industry trends of engaging in educational partnerships and STEM outreach to students. Specific examples of education-focused initiatives include:

- Mentor newer/less experienced MATE ROV Competition teams
- Support local schools/organizations
- One-time / short-term educational activities
    - MATE regional competition volunteer
    - Science fair judging
- Structured presentations or exhibits that specifically showcase marine technology
    - Career day presentation/talk

Education-focused initiatives will be scored on the number of events, with continual interactions preferred over one-time events, and the reporting of measurable impacts on the participants of the initiatives. Measurable impacts include how many students were mentored, whether mentored students participated at a regional competition or other event, etc.

- **Engaging the community** includes demonstrating your ROV and sharing information about your company at festivities and other community-wide events. Presenting to a Rotary Club or your school district's board of directors are examples.

  This follows the industry trends of participating in STEM outreach to the community and media engagement. Specific examples of engaging the community include:
  - One time / short-term outreach activities such as a STEM activity booth at community events
  - Media engagement
    - Press release distribution
    - Media coverage secured

  Engaging the community will be scored on the number of events participated and the reporting of measurable impacts. Measurable impacts include how many people visited a booth or the amount of media coverage that resulted.

- **Environmental Impact** consists of conducting citizen science, environmental monitoring and organizing or participating in environmental cleanup activities.

  This follows the industry trends of focusing on environmental monitoring and ocean conservation, and the growing trend of citizen science. Specific examples of environmental impact outreach include:
  - Scientific data collection and monitoring projects
    - Water quality monitoring
    - Marine habitat assessment
  - Organize/participate in beach, waterway or environmental cleanups

  Environmental impact outreach will be scored on the number of events. Scientific data collection projects will emphasize an ongoing long-term data collection project with regular data collection and proper calibration of instruments. Public sharing of data will be emphasized as well. Environmental cleanup events will be scored on the number of events, with an emphasis on teams organizing over participating in an event. Additional emphasis will be placed on properly disposing of waste and of proper safety protocols being followed.

- **Knowledge sharing** consists of providing open-source data on your vehicles code and design specifications and engaging social media to follow your company's journey to the competition.
  This follows the industry trends of emphasizing open access to data and technology.
  Specific examples of knowledge sharing include:
    - Publishing document code on GitHub/GitLab/other public source
    - Technical resource creation, including tutorial videos and technical blog posts
    - Maintaining an active project website/blog
    - Social media engagement and video documentation
        - Regular updates on company progress
        - Educational content sharing
        - Industry/STEM news sharing
        - Project development videos
  Knowledge sharing will be scored on the number of activities, with emphasis on open-source documentation links, and activities being tagged as MATE ROV Competition.

Here are some general guidelines for working with the media. They are specific to the World Championship but can be easily modified for regional events.

Corporate responsibility efforts will be reviewed by competition coordinators and awarded 0 to 20 bonus points, depending on the number and scope of the outreach and awareness activity(s), i.e., the number of other students or members of the community engaged, the number of mentoring sessions, etc.

Make sure to include the following information in your write up:

- Type of activity (e.g. education-focused activity, engaging the community, environmental impact, knowledge sharing.)
- Locations, dates, and the amount of time spent on the activity.
- Number of students or community members (if a large event, this can be an approximate) involved.
- Description of your actions, outcomes, and other information that helps to demonstrate the quality of your time and efforts. Emphasis will be placed on the impacts and outcomes of the event.
- For media outreach, please submit a copy of your press release, a copy of your media contacts list, and a summary of news articles, TV or radio coverage, etc. that your company received. Include copies of articles and URLs, and list any television or radio coverage. Be sure to include name of outlet, date, and a summary of the coverage.

New for 2026!!!

MATE is emphasizing a deeper dive into two (or three) of the Corporate Responsibility categories instead of requiring companies to cover activities in all four categories. See the scoring rubric for additional information.

Use the Corporate Responsibility scoring rubric posted here as the guideline for your Corporate Responsibility submission. This rubric will be posted by March 1, 2026. In the meantime, companies may refer to the previous year's rubrics for a general idea of the categories.

TIPS FOR EFFECTIVE WRITTEN AND ORAL COMMUNICATION

Communicating ideas about how to solve a problem and evaluating those ideas against competing alternatives is a critical skill for anyone entering the workplace. It is a skill that is directly linked to decision making about whether or not to hire (or fund) us and our ability to influence the work that we do.

The key to a successful technical documentation and engineering presentation is the way that critical thinking and engineering reasoning are communicated. You can think of the process as technical "storytelling."

Technical storytelling includes the use of text, images, schematics, and data to effectively communicate the "story" of how your company brainstormed and evaluated ideas to come up with your solution (e.g. ROV, payload tools, and operational strategies) to the problem at hand (product demonstration tasks). It also involves organizing content to efficiently present your work and justify why you did what you did.

However, you should choose details with care. Each detail should help to answer the question "why is what you did the best solution for your company and for this competition?" Describe why a component in the system is critical and how you chose it. Include specifications or dimensions only if they help to explain the "why" and "how" you made choices. Keep in mind that a mechanical drawing with dimensions can replace a lot of text and in many cases do a better job telling details of the story than text.

That said, if something is hard to describe clearly and completely with two to three sentences, consider whether using an image may help. A good technical document balances text and images to provide lots of information concisely, which for a detailed understanding while being quick and easy to read. Remember that your reader is new to your design and needs to understand both what your design is and the process you used to get there. Present text and images in a logical order that helps readers follow your development process and results.

Maintaining a project notebook is a good business practice that will help to capture ideas and document your company's progress – including your research, designs, trade studies,

experiments, data, vehicle specifications, testing, expenditures, and donations. The notebook is also a place to keep track of your company member's contributions (time, support, etc.).

Along with your notebook, here are some items to consider as you prepare to tell your story:

- What was your company's "work breakdown structure" (tasks, time, and people)?
- What were the greatest constraints (schedule, budget, equipment, labor, logistics, etc.) on your design process?
- How did the product demonstration tasks and rules influence your design and decisions?
- What systematic process, such as a tradeoff matrix, did you use to evaluate competing design solutions?
- What were the most important design decisions you made and why?
- How did you arrive at your final power budget? What concessions, if any, did you have to make and why?
- How do you calibrate your sensors?
- If your vehicle uses software, where does the code execute? Describe the flow and format of the data.
- Did you have a noteworthy troubleshooting experience? Any problem or procedure that takes more than 20 minutes to figure out is worth understanding and writing down.
- How did the mission theme influence your choices across the ROV? What choices would have big impacts had this been in a less controlled environment?

Note for 2026!!!

The Engineering & Communications components are 40% of a company's overall score. Working on these components early and preparing thoroughly (practicing your engineering presentation, proofreading your technical documentation and marketing display) can increase your chances of achieving a higher score.

PART 5: SUBMISSION GUIDELINES AND KEY DEADLINES

5.1 DOCUMENTATION

Companies advancing to the World Championship are required to submit technical documentation, a company spec sheet, a SID, a fluid power diagram (if fluid power is used), a JSEA, a company safety review, and ***New for 2026***, a marketing display. In addition, companies may submit documents supporting their corporate responsibility efforts. If companies are using a non-

ROV device, they must submit a non-ROV device design document and a non-ROV device SID. Companies advancing to the World Championship MUST also include a photo of their sonar attachment device. See the PREVIEW OF THE COLLABORATIVE BONUS MISSION. This photo should be included with the Company Safety Review.

NOTE: By submitting your documentation, you are giving the MATE ROV Competition permission to publish these documents on its website and in other, competition-related media.

Regional competitions may not require all documentation. For PIONEER companies competing at a regional event, contact your regional coordinator or visit your regional contest's website to determine what documentation must be submitted for your regional and the date it is due.

NOTE for 2026!!!
The links provided in this section are for companies advancing to and submitting documentation for the World Championship. Regional coordinators will provide their own link for regional submissions. **Regional submissions sent to the MATE ROV Competition management team or to World Championship officials are NOT guaranteed to be forwarded to the regional coordinator.**

DOC-006: All required documentation sent to the MATE ROV Competition officials MUST be in searchable PDF format (see SearchablePDFs.pdf (rackcdn.com) for information about creating searchable PDFs).

DOC-007: The technical documentation may be up to **8 MB** in size, the other documents are restricted to a maximum file size of 2MB. Consider resizing the images in your documentation to lower the overall size of the document.

DOC-008: The marketing display must be submitted as a digital file. The file must be a single PDF, 300 dpi minimum resolution, sized for standard poster output (24 in x 36 in or A1), with all fonts embedded. Use RGB color, no crop marks or bleeds, and keep the file size under **25 MB**.

DOC-009:For corporate responsibility, companies can upload a variety of file types (pdfs, jpegs, etc.) and multiple files, but the size of each file should not exceed **2 MB**. Number each file to distinguish between them.

Combined files over 25MB may be automatically converted to a Google drive link during upload. That is acceptable; MATE will accept files submitted in this format.

DOC-010: All documents should use the following naming convention: Company ID_School or organization name_company name_DOCUMENT TYPE_2026.pdf, where DOCUMENT TYPE is technical documentation, spec sheet, SID [type – electrical or fluid], non-ROV device design, company safety review, JSEA, marketing display, or corporate responsibility.

New for 2026!!!

Companies will be assigned a company ID when they register for a MATE ROV event. Companies must include this ID into the names of their documents.

See Documentation Submissions Guidelines for information on submitting your documentation. **Submit all of your final documents** in one email. Revised documents submitted at a later date will not be accepted. The MATE competition will use the date-stamp on your form to determine your initial submission.

Before submitting documentation, check to verify that all the files have been attached. Once submitted, companies should verify that all the proper documents were uploaded. If there was an error while submitting your documents, contact the MATE ROV Competition and upload ALL documents again.

DOC-011: For the World Championship, due date for the required documentation is 11:59 PM, Hawaii Time Zone, on May 21, 2026.

NOTE for 2026!!!
DOC-012: Companies will lose points on their initial safety and documentation review if documents:

- Are submitted late
- Exceed the size limit or page limit
- Use improper naming conventions
- Are not submitted on ONE form

5.1.1 Video Demonstration Requirements

DOC-013: See Documentation Submissions Guidelines for information on submitting your demonstration videos.

DOC-014: For the World Championship, due date for the video demonstration submissions is 11:59 PM, Hawaii Time Zone, on May 15, 2026.

DOC-015: Videos must be submitted as links to a YouTube, Vimeo or Google Drive video. Make sure to properly share access to the video with anyone with the link. Companies may submit the specification and product demonstration as two separate videos. Note that the product demonstration portion must be a complete, uncut video.

The video MUST indicate the company ID, the school/organization and the company name, as well as the competition year, 2026.

MATE competition organizers will review the videos and respond by May 19th. Video submissions will NOT be accepted after May 15th – NO EXCEPTIONS. Video conferences will not be scheduled after May 15th. If the video does not clearly demonstrate that the company's vehicle meets the

specifications and accomplishes the tasks, the company is not eligible to participate in the World Championship. No extensions past the due date will be given for any reason.

MATE strongly encourages companies to submit their videos or arrange for a video conference with a MATE official well before May 15th. That way, if an issue is found, companies will have the opportunity to address the issue and submit an updated video, or schedule another video conference, before the May 15th deadline. **Note that it may take MATE up to 5 working days to evaluate a video submission or respond to a request to schedule a video conference.**

NOTE: By submitting your video demonstration links, you are giving the MATE ROV Competition permission to publish these videos links on its website and in other, competition-related media.

5.2 KEY DEADLINES

Below is an updated summary of key dates and deadlines for the 2026 MATE ROV competition season. Note that regional competitions will have their own set of key dates and deadlines. For companies competing at regional events, contact your regional coordinator or visit your regional contest's website for more information.

- December 1, 2025: Registration opens (note that registration for the World Championship and individual regional competitions will open as locations and dates are secured).
- April 30, 2026: Last day to register for the fluid power quiz. Last day to submit laser specifications. Companies with regional competitions earlier than April 30th should plan to take the fluid power quiz at least 2 weeks before their competition and submit specifications early to allow at least 1 week for approval.
- May 12, 2026: Last day to register a team for the World Championship
- May 15, 2026: PIONEER class video demonstration submission deadline.
- May 21, 2026:
    - Technical documentation
    - Company spec sheet
    - SIDs (including electrical, fluid, Non-ROV Device)
    - Non-ROV device design document
    - Company safety review
    - Job site safety analysis
    - Marketing display
    - Corporate responsibility documentation (optional)