## 2026 MATE ROV COMPETITION: PRODUCT DEMONSTRATION AND SPECS BRIEFING

***MATE Competition Philosophy***

The MATE ROV competition is about **student learning**.

It is designed to be an event that challenges **students** to apply the physics, math, electronics, and engineering skills they are learning in the classroom to solving problems from the workplace.

Mentors (teachers, parents, working professionals) are expected to limit their input to educational and inspirational roles and encouraged to focus on the benefits of the **learning process** and not simply on "winning" the competition.

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

## 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.

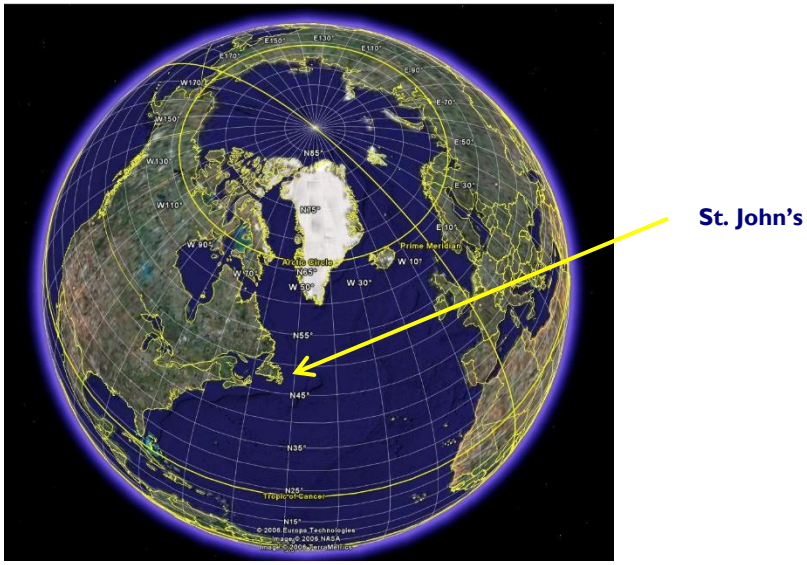
The cryosphere includes polar ice sheets and sea ice, mountain glaciers, snowpacks, ice on lakes and rivers, and permafrost (soils that stay below 0°C for years). Although it may seem remote, the cryosphere covers a huge area, around 10% of the Earth's land, and stores most of the planet's freshwater. 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.

## And this is where you come in – and where your mission begins.

**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**

***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**

***Task #2: Smart Atlantic 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**

***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**

***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**

## REFERENCES


- 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


***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


***Task #2: Smart Atlantic 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
- Seeing, hearing and testing underwater
- Marine biodiversity assessment using eDNA sequencing


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

- 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)

***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

## DESIGN BRIEF

Below is a summary of the product demonstrations organized by competition class – EXPLORER, PIONEER, RANGER, NAVIGATOR, and SCOUT. At regional competitions, all product demonstration tasks will be attempted in one product demonstration run.

At World Championships, tasks will be staged in an ice tank, an offshore engineering basin (wind and waves), in a flume tank (current) and in saltwater (bonus collaborative mission). The opportunity to showcase the companies' vehicles' capabilities in these unique environments is balanced by the fact that companies will only have one chance to undertake each mission task. The competition manuals will contain additional information on the details, including location, of the specific.

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

**EXPLORER, PIONEER, RANGER, NAVIGATOR and SCOUT class tasks:**

**Collect species from the coral garden (ALL CLASSES)**

- Collect species from the coral garden
    - Collect basket stars
    - Collect coral species

**Coral garden ridge modelling (EXPLORER, PIONEER, RANGER, NAVIGATOR)**

- Via photogrammetry, autonomously create a scaled 3D model of the coral garden **(EX/PN/RN only)**
    - Create a 3D model
    - Measure the length of the coral garden
    - Scale the model to determine the height of the coral garden

  OR
- Manually (CAD) create a scaled 3D model of the coral garden
    - Measure the length and height of the coral garden
    - Create a scaled 3D model

  OR
- Manually (paper) create a 3-view technical model of the coral garden **(PN/RN/NV only)**
    - Measure the length and height of the coral garden
    - Create a technical drawing

**Fly a transect (EXPLORER, PIONEER, RANGER, SCOUT)**

- At a regional competition
    - Fly a transect to create a video of the coral garden
- At World Championships **(EX/PN/RN only)**
    - Maintain position in a current to create a video of the coral garden

***Task #2: Smart Atlantic Alliance: Better Information, Better Decisions***

**EXPLORER, PIONEER, RANGER, NAVIGATOR and SCOUT class tasks:**

**Mitigate invasive species (ALL CLASSES)**

- Determine the number of invasive European Green crabs in the sample using image recognition **(EX/PN/RN only)** or manually **(EX/PN/RN/NV only)**
- Upload data to the Invasive Species Form **(EX/PN/RN/NV only)**
- Recover two European Green Crabs **(SC only)**

**Iceberg Tracking (ALL CLASSES)**

- Track icebergs headed towards offshore oil platforms
    - Survey the iceberg at multiple points around its perimeter
    - Measure the keel depth of the iceberg **(EX/PN/RN only)**
    - Use the location, heading and keel depth to determine the threat level of the iceberg to the four area oil platforms

**Deploy whale safe fishing gear (ALL CLASSES)**

- Turn handle on the whale safe lobster pot to simulate the acoustic release of the retrieval buoy
- Recover the lobster pot

**Recover the buoy anchor (EX/PN/RN/NV only)**

- Connect an attachment to the buoy anchor
- Return the line to the surface, side of the pool

**Service the Holyrood subsea observatory (ALL CLASSES)**

- Replace an eDNA biodiversity sensor
    - Recover the old sensor to the surface, side of the pool
    - Analyze data to determine frequency seen
- Install a new eDNA biodiversity sensor
    - Place sensor in designated area
    - Connect sensor to the Holyrood subsea observatory
- Remove biofouling from the observatory's camera **(EX/PN/RN only)**

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

**EXPLORER, PIONEER, RANGER, NAVIGATOR and SCOUT class tasks:**

**Micro-pile installation (EX/PN/RN only)**

- Install a micro-pile to the sea floor to secure the wind turbine
    - Place a bubble curtain device around the micro-pile
    - Guide the micro-pile to the designated location
    - Pull a pin to release the micro-pile

**Powering an oil platform from a wind turbine (ALL CLASSES)**

- Connect the wind farm power connector to the oil platform
    - Retrieve the power connector from the wind farm subsea station

- Lay power connector cable through a waypoint away from the micro-pile
- Remove the cover from the oil platform port **(EX/PN/RN only)**
- Install the power connector into the oil platform port

***Task #4: MATE Floats Under the Ice***

**EXPLORER, PIONEER, and RANGER class tasks:**

Design and construct an operational profiling float

- Prior to the competition, design and construct an operational vertical profiling float
- Float communicates with the mission station prior to descending
- Float completes two vertical profiles -
  - Vertical profile 1
    - Float completes first vertical profile
    - Data verifies that the float maintains a depth of 2.5 meters
    - Data verifies that the float maintains a depth of 0.4 meters
    - Float does not impact the ice sheet or breach the surface
  - Vertical profile 2
    - Float completes second vertical profile
    - Data verifies that the float maintains a depth of 2.5 meters
    - Data verifies that the float maintains a depth of 0.4 meters
    - Float does not impact the ice sheet or breach the surface
- Float communicates with the station after being recovered to open water
  - Float communicates data
  - Profile is graphed as depth over time

**NAVIGATOR and SCOUT tasks:**

- Prior to the competition, design and construct an operational vertical profiling float
- Deploy the float in the designated location
- Float completes two vertical profiles
  - Float is not tethered and is independent from surface control **(NAVIGATOR only)**
    OR
  - Float is tethered to and powered from the surface, operated autonomously
    OR
  - Float is tethered to and powered from the surface, operated manually

## SPECS

What follows is a summary of the electrical and fluid power requirements for each competition class. The complete design and building specifications will be included within the competition manual.

**NOTE:** Watch for new safety requirements and additional, detailed electrical specifications within the competition manuals (look for the ***New in 2026!!!*** label).

**EXPLORER**

- 48 volts, 30 amps DC. Conversion to lower voltages must be done on the ROV, not topside.
- SBS50 Anderson Powerpoles, Littelfuse (30-amp or less) and Littelfuse fuse holders required on all vehicles. These specific components are REQUIRED.
- Pneumatics and hydraulics are permitted provided that the company follows the specifications included within the competition manual.
- Lasers are permitted provided that the team follows the specifications included within the competition manual.
- Camera is required.
- Depth requirement at the world championship: up to 5 meters.
- Maximum size: None. However, certain tasks may limit an ROV's size to under 1 meter.
- Maximum weight: 35 kg.

**PIONEER**

- 48 volts, 30 amps DC or 12 volts, 25 amps DC. If 48 volts is used, conversion to lower voltages must be done on the ROV, not topside.
- 48 volt systems must use SBS50 Anderson Powerpoles and Littelfuse (30-amp or less) and Littlefuse fuse holders on all vehicles. 12 volt systems must use ATO type blade fuses or MINI blade fuses for any fusing. These specific components are REQUIRED for vehicles using 48 volts or 12 volts.
- Pneumatics and hydraulics are permitted provided that the company follows the specifications included within the competition manual.
- Lasers are permitted provided that the team follows the specifications included within the competition manual.
- Camera is required.
- Depth requirement at the world championship: up to 5 meters.
- Maximum size: None. However, certain tasks may limit an ROV's size to under 1 meter.
- Maximum weight: 35 kg.

**RANGER**

- 12 volts, 25 amps DC. Conversion to lower voltages is permitted topside and on the ROV.
- 12 volt systems must use ATO type blade fuses or MINI blade fuses for any fusing. These fuses are REQUIRED for all vehicles.
- Pneumatics and hydraulics are permitted provided that the company follows the specifications included within the competition manual.
- Lasers are permitted provided that the team follows the specifications included within the competition manual.
- Camera is required.
- Depth requirement at the international competition: up to 5 meters. Depth requirement may vary at regional competitions. Contact your regional coordinator or check your

regional competition information document.

- Maximum size: None. However, certain tasks may limit an ROV's size to under 1 meter.
- Maximum weight: 25 kg.

### NAVIGATOR

- 12 volts, 15 amps DC. Conversion to lower voltages is permitted topside and on the ROV. Onboard electrical power source is not permitted for the ROV but is permitted for the float.
- Anderson Powerpole connectors are required on all vehicles. ATO type blade fuses or MINI blade fuses are required.
- Pneumatics and hydraulics are permitted provided that the company follows the specifications included within the competition manual.
- Lasers are permitted provided that the team follows the specifications included within the competition manual.
- Camera is required.
- Depth requirement: Varies depending on the regional event. Contact your regional coordinator or check your regional competition information document.
- Maximum size & weight limit: None.

### SCOUT

- 12 volts, 15 amps DC. Conversion to lower voltages is permitted topside and on the ROV. Any onboard electrical power source is not permitted.
- Anderson Powerpole connectors are required on all vehicles. ATO type blade fuses or MINI blade fuses are required.
- Manually powered hydraulics and pneumatics are permitted. Pneumatic systems cannot exceed ambient pool pressure and must follow the fluid power specifications included within the competition manual.
- Lasers are NOT permitted.
- Depth requirement: Varies depending on the regional event. Contact your regional coordinator or check your regional competition information document.
- Maximum size & weight limit: None.

## RESOURCES

Companies are permitted to use the materials of their choice provided that they are safe, will not damage or otherwise mar the competition environment, and are within the defined design and building specifications.

Companies are encouraged to focus on engineering a vehicle to complete the product demonstration tasks. When considering design choices, teams should ask themselves which one

most efficiently and effectively allows them to solve the problem. Re-using components built by previous team members is permitted provided that the current team members evaluate, understand, and can explain their engineering and operational principles. Using or re-using commercial components is also permitted, provided that team members evaluate, understand, and can explain their engineering and operational principles. Teams will be questioned extensively on their overall design and component selections during their engineering presentations.

## TIME

The complete competition manual will be released in November 2025; teams have from that date until the regional events in the spring of 2026 to construct their vehicles and prepare the engineering and communication components (technical documentation, engineering presentations, and marketing displays). Visit www.materovcompetition.org for more information or join the MATE competition listserv to ensure a timely delivery of important information.