

Characterization and delineation of oil-in-water at the Scott Inlet seeps through robotic autonomous underwater vehicle technology

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There has been an increase in offshore oil and gas as well as shipping operations in the northern Atlantic and Arctic Oceans. Hence, there is an urgent need to enhance state-of-the-art technologies to strengthen our readiness in case of emergencies. The primary objectives of this multi-year project are to develop and test autonomous underwater technology to enhance marine robotics capability for oil spill response in the ocean.

Our focus is on the research questions: What level of artificial intelligence is needed on autonomous underwater vehicles (AUVs) to effectively delineate an oil spill; and how does adaptive sensing and sampling advance oil spill delineation?

We plan a period of about 14 days of field trials during August – September 2023. The field trials will be done from a ship, likely the ex-CCG (ice breaker) MV Polar Prince, ex-Canada C3. The operating site will be close to the natural oil seeps in Baffin Bay (approximately 50km offshore from Scott Inlet) as shown in Figure 1. The survey class AUV, *Memorial Explorer* (5.5m) will be deployed and recovered daily from the ship, while an underwater glider (1.5m) will be stationed continuously offshore during the period of the trials. Both vehicles will be equipped with a variety of hydrocarbon sensors selected from a methane sniffer, acoustic scanning sonars and fluorimeters. They will be launched from a known position to search and survey the dissolved and undissolved oil in the water column near the source of the natural seep in this region. A water sampling unit installed on *Explorer* will be triggered by our developed algorithms to collect oil-in-water samples.

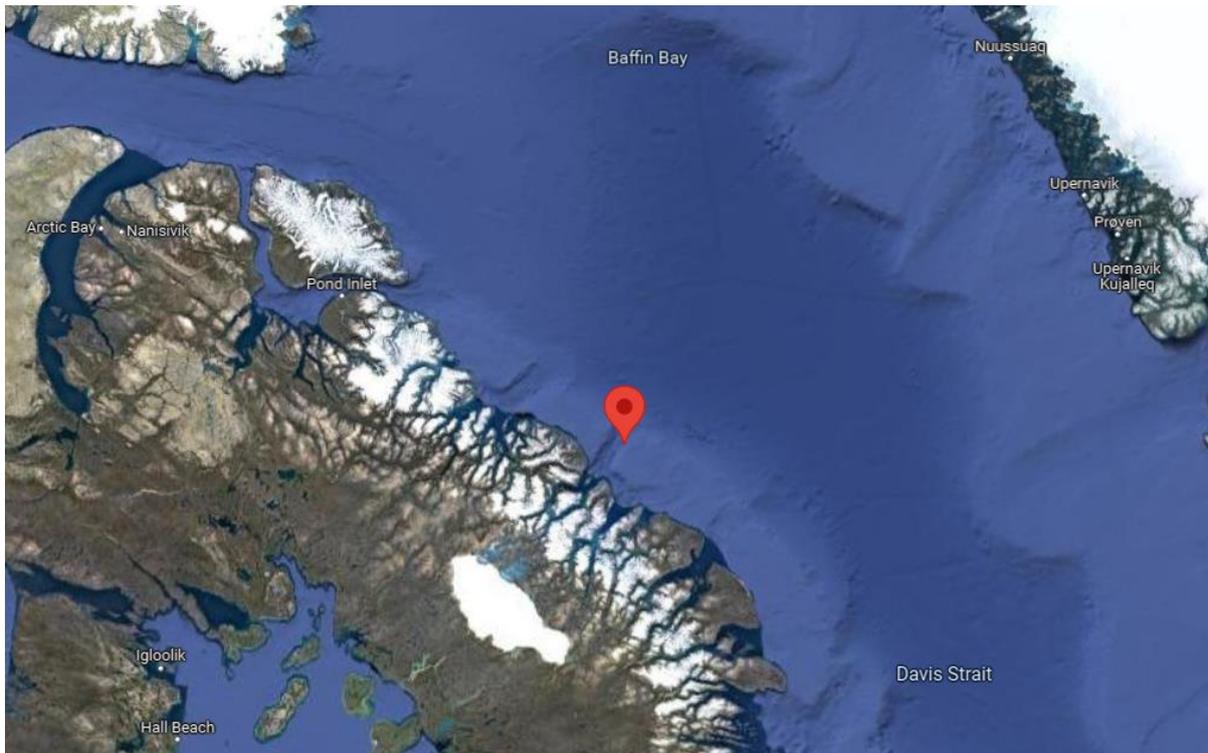


Figure 1. Proposed AUV operating site of the field trial.

Our research aims to produce significant improvements in the use of AUVs to respond to a potential accidental oil spill. It will also reveal information on levels of oil concentration below the surface adjacent to Scott Inlet and our understanding of behaviour of crude oil and gas in the ocean will be enhanced.

We aim that the impacts on the environment, wildlife, and hunting in the area of operation will be minimal as our AUV field missions will be done primarily in open waters offshore from Scott Inlet. It is possible that the ship might require to shelter in the inlet in periods of adverse weather. We will invite 1-2 additional Ittaq staff and/or Clyde River community members to participate in the field trials and engage in familiarization with our underwater robotics equipment.

We will store data generated on Memorial University's computer systems. Memorial is putting in place centralized data management processes in line with Tri-Agency policy. We also plan to meet with the Municipality of Clyde River and the Ittaq Heritage and Research Centre during 2022, at the time of the field trials in 2023 and also in 2024, towards the end of our project, to present and discuss the outcomes from the research.