



## **NIRB Application for Screening #125689**

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

**Application Type:** New

**Project Type:** Marine Based Activities

**Application Date:** 4/19/2022 11:08:08 AM

**Period of operation:** from 0001-01-01 to 0001-01-01

**Proposed Authorization:** from 0001-01-01 to 0001-01-01

**Project Proponent:** Neil Bose  
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## DETAILS

### Non-technical project proposal description

English: 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. 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 fluorometers. 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. 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.

French: Il y a eu une augmentation des activités pétrolières et gazières offshore ainsi que des opérations de transport maritime dans les océans Atlantique Nord et Arctique. Par conséquent, il est urgent d'améliorer les technologies de pointe pour renforcer notre préparation en cas d'urgence. Les principaux objectifs de ce projet pluriannuel sont de développer et de tester une technologie sous-marine autonome pour améliorer la capacité de la robotique marine pour la réponse aux déversements d'hydrocarbures dans l'océan. Nous nous concentrons sur les questions de recherche : quel niveau d'intelligence artificielle est nécessaire sur les véhicules sous-marins autonomes (AUV) pour délimiter efficacement un déversement de pétrole ; et comment la détection et l'échantillonnage adaptatifs font-ils progresser la délimitation des déversements d'hydrocarbures ? Nous prévoyons une période d'environ 14 jours d'essais sur le terrain d'août à septembre 2023. Les essais sur le terrain seront effectués à partir d'un navire. Le site d'exploitation sera proche des suintements de pétrole naturels dans la baie de Baffin (à environ 50 km au large de Scott Inlet), comme illustré à la figure 1. L'AUV de classe d'enquête, Memorial Explorer (5,5 m) sera déployé et récupéré quotidiennement du navire, tandis qu'un planeur sous-marin (1,5 m) sera stationné en permanence au large pendant la période des essais. Les deux véhicules seront équipés d'une variété de capteurs d'hydrocarbures choisis parmi un renifleur de méthane, des sonars à balayage acoustique et des fluoromètres. Ils seront lancés à partir d'une position connue pour rechercher et surveiller le pétrole dissous et non dissous dans la colonne d'eau près de la source du suintement naturel dans cette région. Une unité d'échantillonnage d'eau installée sur Explorer sera déclenchée par nos algorithmes développés pour collecter des échantillons d'huile dans l'eau. Notre recherche vise à produire des améliorations significatives dans l'utilisation des AUV pour répondre à un éventuel déversement accidentel de pétrole. Il révélera également des informations sur les niveaux de concentration de pétrole sous la surface adjacente à Scott Inlet et notre compréhension du comportement du pétrole brut et du gaz dans l'océan sera améliorée. Notre objectif est que les impacts sur l'environnement, la faune et la chasse dans la zone d'opération soient minimes, car nos missions de terrain AUV se feront principalement en eaux libres au large de Scott Inlet. Il est possible que le navire ait besoin de s'abriter dans le goulet en période de mauvais temps. Nous inviterons 1 à 2 membres supplémentaires du personnel d'Ittaq et/ou des membres de la communauté de Clyde River à participer aux essais sur le terrain et à se familiariser avec notre équipement de robotique sous-marine. Nous stockerons les données générées sur les systèmes informatiques de l'Université Memorial. Memorial met en place des processus centralisés de gestion des données conformément à la politique des trois organismes. Nous prévoyons également de rencontrer la municipalité de Clyde River et le Ittaq Heritage and Research Centre en 2022, au moment des essais sur le terrain en 2023 et également en 2024, vers la fin de notre projet, pour présenter et discuter des résultats de la recherche.

[illegible]

Closure Phase: from 2024-08-20 to 2024-09-14

## Activities

Location	Activity Type	Land Status	Site history	Site archaeological or paleontological value	Proximity to the nearest communities and any protected areas
Explorer AUV operation area (Depth range 0m-300m)	Marine Based Activities	Marine	N/A	N/A	The test area is 20 miles offshore and 60 nauticle miles of North of Clyde River.

## Community Involvement & Regional Benefits

Community	Name	Organization	Date Contacted
Clyde River	Mr. Jerry Natanine	Municipality of Clyde Rover	2022-03-07
Clyde River	Ms. Shari Fox	Ittaq Heritage and Research Centre	2022-04-11

## Authorizations

Indicate the areas in which the project is located:

Transboundary  
North Baffin

### Authorizations

Regulatory Authority	Authorization Description	Current Status	Date Issued / Applied	Expiry Date
Nunavut Research Institute	NPC File # 149723 [Characterization and delineation of oil-in-water at the Scott Inlet seeps through roboticautonomous underwater vehicle technology]The following works and activities have been proposed in the above-noted project proposal:1. Scientific research that will test the use of autonomous underwater vehicle (AUV) technology for betterunderstanding oil plume behavior and improving the efficiency of Canada's oil spill response.2. Location: Qikiqtani Region; [100 KM northwest of Clyde River]	Applied, Decision Pending	2022-04-14	

### Project transportation types

Transportation Type	Proposed Use	Length of Use
Water		

### Project accomodation types

Other,

## Material Use

Equipment to be used (including drills, pumps, aircraft, vehicles, etc)

Equipment Type	Quantity	Size - Dimensions	Proposed Use
Autonomous Underwater Vehicles	2	5.4m, 1.5m	Ocean use and underwater deployment of two autonomous underwater vehicles. 1: Explorer AUV (5.4m long)2: Glider (1.5m long)
Ship	1	22-60m	AUV support vessel

### Detail Fuel and Hazardous Material Use

Detail fuel material use:	Fuel Type	Number of containers	Container Capacity	Total Amount	Units	Proposed Use
Diesel	fuel	4	7110.5	28442	Liters	Ship is powered by diesel. AUVs are powered by electric batteries.

### Water Consumption

Daily amount (m3)	Proposed water retrieval methods	Proposed water retrieval location
0	All water used will be from the ship.	The ship's water will be replenished from port supply locations and town water as needed.

# Waste

## Waste Management

Project Activity	Type of Waste	Projected Amount Generated	Method of Disposal	Additional treatment procedures
Marine Based Activities	Greywater	Ship operations for two weeks	The work will be done from a ship and will comply with the Arctic Waters Pollution Prevention Act AWPPA.	As above
Marine Based Activities	Sewage (human waste)	10 people for two weeks	The work will be done from a ship and will comply with the Arctic Waters Pollution Prevention Act AWPPA.	As above.

### Environmental Impacts:

Underwater sound from the presence and operation of vessels generated from project operations may result in effects to fish and invertebrates. The sound produced by vessels, AUVs and other equipment during project activities can be carried through the water column and could disturb marine fish and mammals in the vicinity of the proposed project site. The effects may vary given the varying sensitivities of fish and invertebrates, and fish health (including changes to food availability and abundance). Responses include avoidance or attraction by individual fish, as well as possible physiological effects with continuously exposure to noise, which may in turn affect feeding, reproduction, and communication. The short-term, low-frequency sounds from vessel operations may elicit temporary avoidance due to startling effects and potentially longer-term avoidance with higher frequency or continuous emissions. These effects can be transient in nature and reversible once the sound source has been removed or reduced, decreasing the potential for long-term negative effects. Typically, most fish species are expected to avoid underwater sound at levels that are harmful to them. Therefore, physical harm associated with vessel sounds is unlikely, and the magnitude of potential effects is low.

# **Additional Information**

**SECTION A1: Project Info**

**SECTION A2: Allweather Road**

**SECTION A3: Winter Road**

**SECTION B1: Project Info**

**SECTION B2: Exploration Activity**

**SECTION B3: Geosciences**

**SECTION B4: Drilling**

**SECTION B5: Stripping**

**SECTION B6: Underground Activity**

**SECTION B7: Waste Rock**

**SECTION B8: Stockpiles**

**SECTION B9: Mine Development**

**SECTION B10: Geology**

**SECTION B11: Mine**

**SECTION B12: Mill**

**SECTION C1: Pits**

**SECTION D1: Facility**

**SECTION D2: Facility Construction**

**SECTION D3: Facility Operation**

**SECTION D4: Vessel Use**

**SECTION E1: Offshore Survey**

**SECTION E2: Nearshore Survey**

**SECTION E3: Vessel Use**



## **SECTION F1: Site Cleanup**

## **SECTION G1: Well Authorization**

## **SECTION G2: Onland Exploration**

## **SECTION G3: Offshore Exploration**

## **SECTION G4: Rig**

## **SECTION H1: Vessel Use**

We are working with several ship operators and have not yet finalized a choice of vessel.

## **SECTION H2: Disposal At Sea**

Once we have selected the vessel we will be able to confirm the exact disposal plans for the particular vessel. Operations will conform to the Arctic Waters Pollution Prevention Act AWPPA.

## **SECTION I1: Municipal Development**

### **Description of Existing Environment: Physical Environment**

The proposed area of activities is in Baffin bay (minimum of 5 miles from shore).

### **Description of Existing Environment: Biological Environment**

Potentially migration routes of marine mammals. Existing fish stocks.

### **Description of Existing Environment: Socio-economic Environment**

N/A

### **Miscellaneous Project Information**

We are conducting a comprehensive risk analysis of the AUV operations to minimise loss of our AUVs which could lead to equipment being lost on site. No human health risks are expected.

### **Identification of Impacts and Proposed Mitigation Measures**

The impacts are expected to be minimal consisting of ship operations and operation of our autonomous underwater vehicles. These vehicles will operate low battery powered sonars (Pingers/chirpers) during operation which will be for periods of upto 10hours/day during the period of trials. Ship operations will be done a reduced speeds to reduce ship based noise levels and disturbance to marine life.

### **Cumulative Effects**

No cumulative effects are expected.

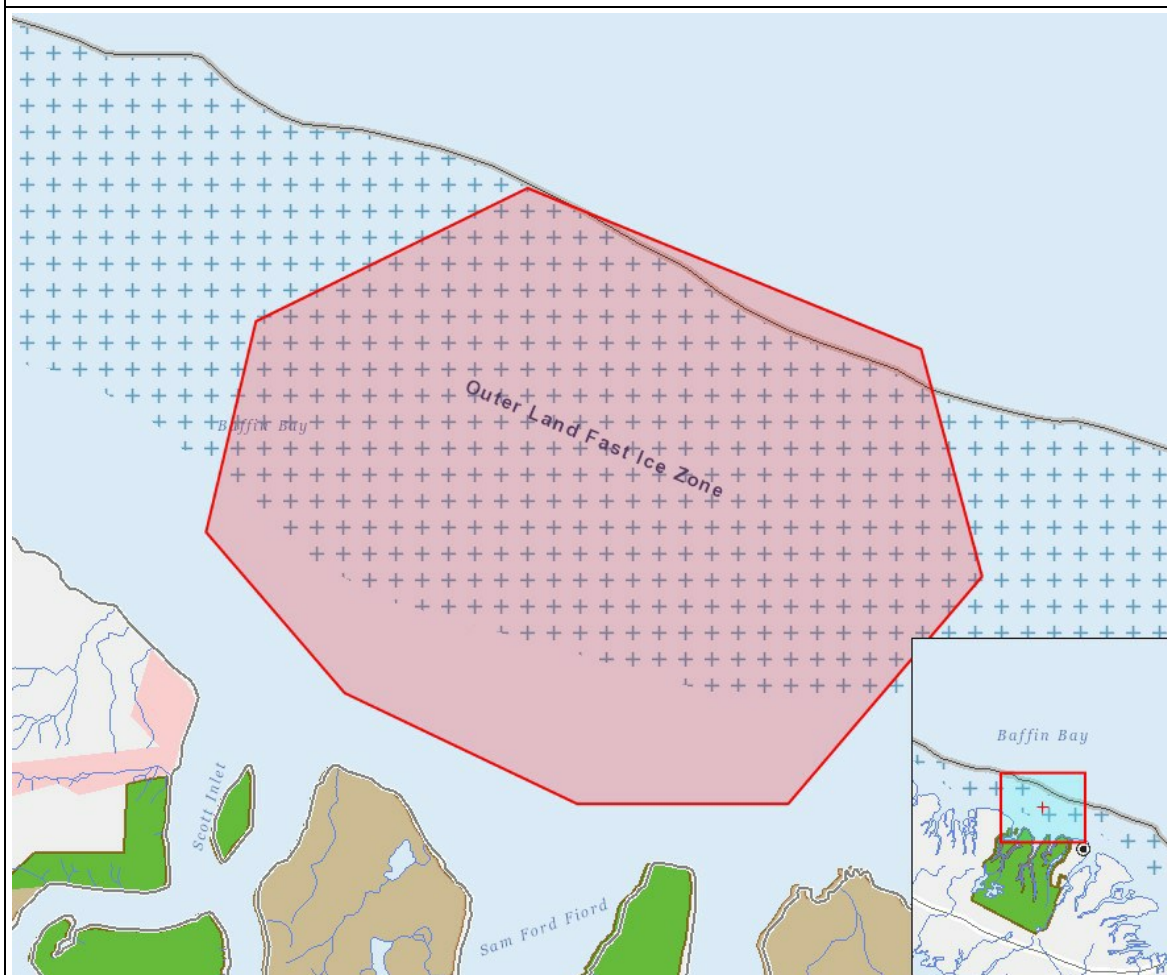
# Impacts

## Identification of Environmental Impacts

		PHYSICAL	Designated environmental areas	Ground stability	Permafrost	Hydrology / Limnology	Water quality	Climate conditions	Eskers and other unique or fragile landscapes	Surface and bedrock geology	Sediment and soil quality	Tidal processes and bathymetry	Air quality	Noise levels	BIOLOGICAL	Vegetation	Wildlife, including habitat and migration patterns	Birds, including habitat and migration patterns	Aquatic species, incl. habitat and migration/spawning	Wildlife protected areas	SOCIO-ECONOMIC	Archaeological and cultural historic sites	Employment	Community wellness	Community infrastructure	Human health
<b>Construction</b>																										
-		-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-		-	-	-	-	-
<b>Operation</b>																										
Marine Based Activities		-	-	-	-	-	-	-	-	-	-	-	-	N		-	-	-	-	-		-	-	-	-	-
<b>Decommissioning</b>																										
Marine Based Activities		-	-	-	-	-	-	-	-	-	-	-	-	N		-	-	-	-	-		-	-	-	-	-

(P = Positive, N = Negative and non-mitigatable, M = Negative and mitigatable, U = Unknown)

## Project Location



## List of Project Geometries

1	polygon	Explorer AUV operation area (Depth range 0m-300m)
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