Flora Fauna UROV Sprint 1 Review

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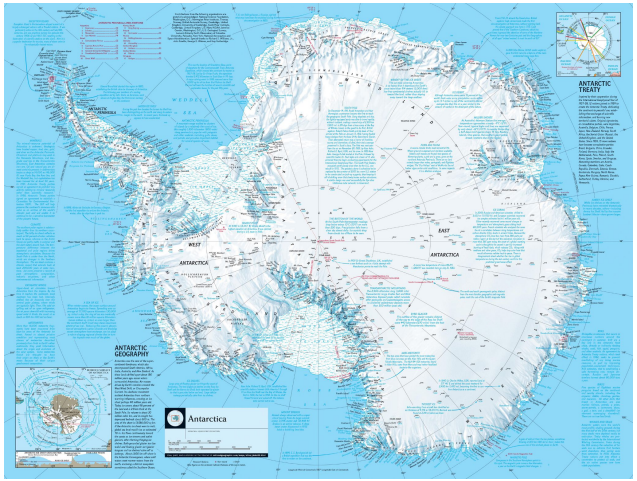
Stakeholders

The Queensland University of Technology / The Government

Australian Antarctic Division

- Researchers in environmental robotics, working on applying robotics technology for problem solving in different ecosystems.
- Underwater Remote Operated Vehicle (UROV) on a research expedition to the Antarctic.
- Researchers are aiming to collect samples of flora and fauna along the antarctic seafloor using the UROV. For this task, an attachment to the UROV is in need of being developed.

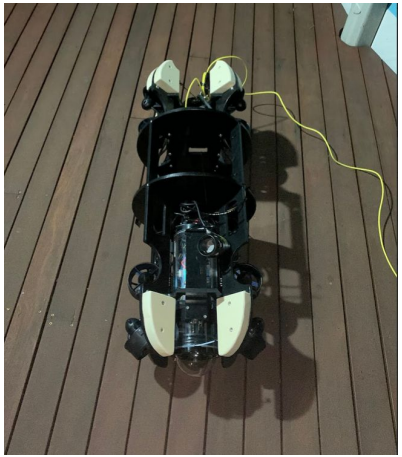


Sea life- dont heavily disturb populations/environments

Matt Dunbabin- CI who has been asked to use UROV for sample collection, the stakeholder we have direct contact with

Needs Statement & Significance

We need to design a way for Matt and his team to collect antarctic under-ice flora and/or fauna using the ROV provided so that they can expand the current capabilities of the sub-zero ROV



Our arm attachment will be used to further the research of Matt's team. Ideally our attachment will be used for a wide variety of sample collections.
One study Matt specifically mentioned wanting to do involves the DNA sampling of two different species of brittle stars.

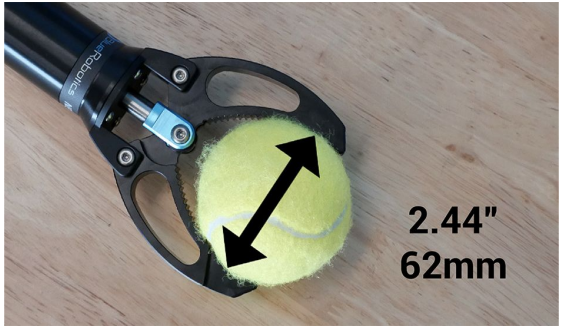
Primary requirements	Secondary requirements	Specification metric	Spec. units	Spec. target value	Spec. threshold value
Store samples	prevent damage to samples due to extraction	Identifiable and classifiable	NA		
	must house a variety of samples	size of samples (diameter/width)	cm	8	constrained by volume
Collect samples	Operate 20-30cm above seafloor	distance to seafloor	cm	20	30
	collect different kinds of species	can it be used for brittle stars, crabs, algae, and other plants			
Reach Seafloor	reach a specified depth of operation	Depth Range	m	100	up to 150
	withstand water pressure	water pressure	kPA	1003.81	1505.71 kPa
Maneuverable in cold water/under ice	attachment and electronics should be freeze-resistant when pulled out of water into subzero air	temperature rating of material	Deg C	0 (in water)	-40 (out of water)
Fit through 40 cm hole	diameter to get clearance through ice and fit into urov	Diameter	mm	350	
	length to fit into urov	Length	mm	850	
Effectiveness	Minimize time spent per sample	Time between sample sighting and retrieval	sec	20	120
	Fast response time	Delay between input and maneuver	sec	~0	3
	Precise controls	Precision	how many times successful pick / how many times try to pick	1/1	1/5
Maintain Buoyancy of subzero ROV	minimize density change	Mass	kg	(Need to determine)	(Need to determine)
Integration with existing UROV	Operate within Camera's line of sight	See CAD file	NA		
	Utilize available communication/connection ports	See CAD file	NA		
	Easily removable/detachable	Time	Min	5	10

Background Research- ROV & Attachment

- BlueROV2 Heavy Configuration

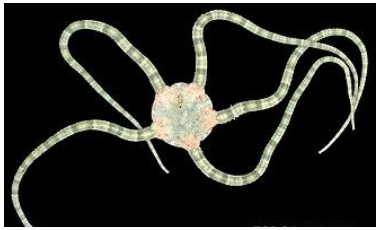
- SubZero configuration

- Newton Subsea Gripper



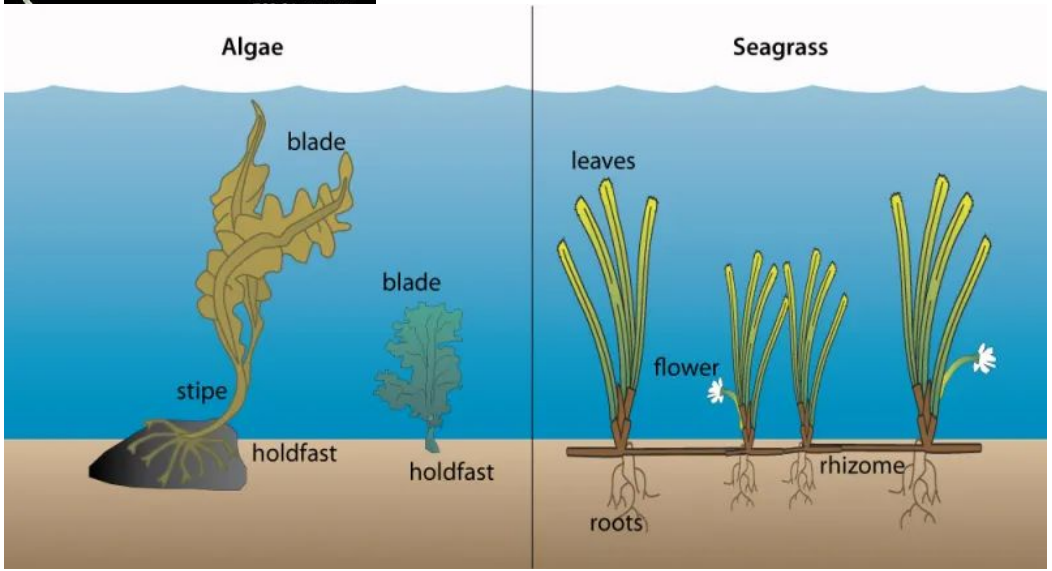
Environment Background Research

Brittle stars & Algae & Seagrass



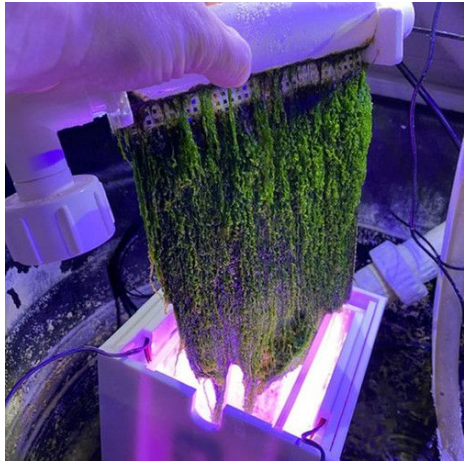
Potential environmental concerns for our attachment are:

- Antarctic ocean temperatures ranging from 10 C to -2 C
- Stringy algae and other plant life that could gum up machinery

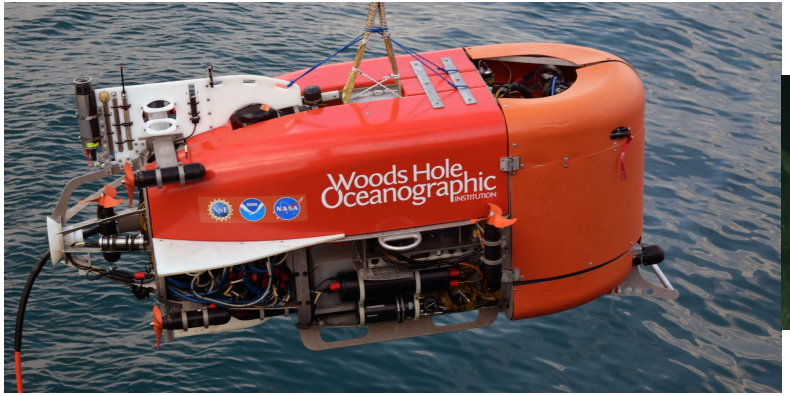


Existing Solutions

Algae scrubber: An algae scrubber is a water filtering device that employs light to cultivate algae, effectively removing undesirable chemicals from the water.



A remotely operated vehicle (ROV) developed by Woods Hole Oceanographic Institution (WHOI) achieved the first autonomous ocean sample using a robotic arm. The Nereid Under Ice (NUI), equipped with AI-based planning software, autonomously decided sampling sites and collected a sediment and flora/fauna sample from the mineral-rich seafloor.



Design Concepts

Low-Fi concept of the storage unit has been built

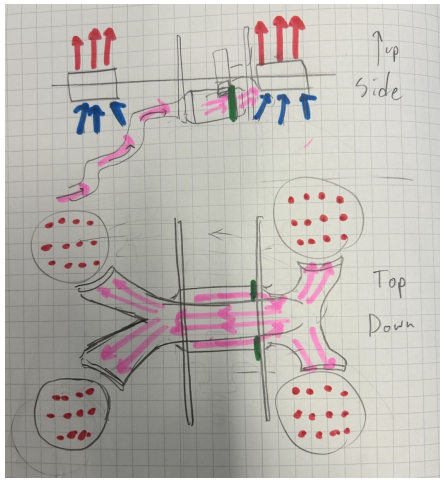
- Initial ideas included storing samples within the mechanism used to collect them, however this would limit us to one sample (eg clamps, pokeballs, pinchers, nets)
- Other initial ideas included solutions that would not fit in provided space (nets)

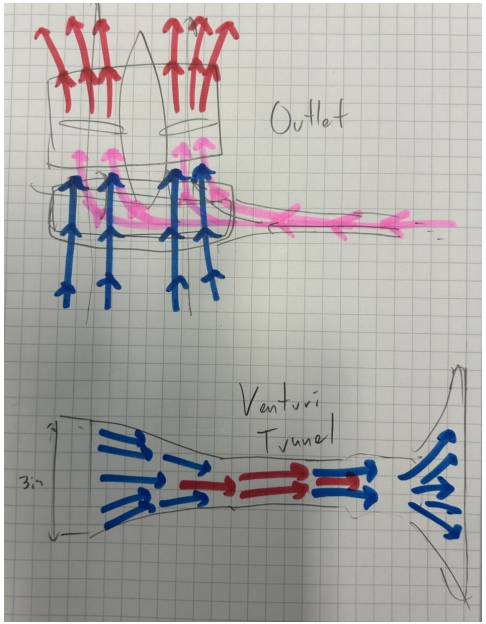
Sample collection concepts

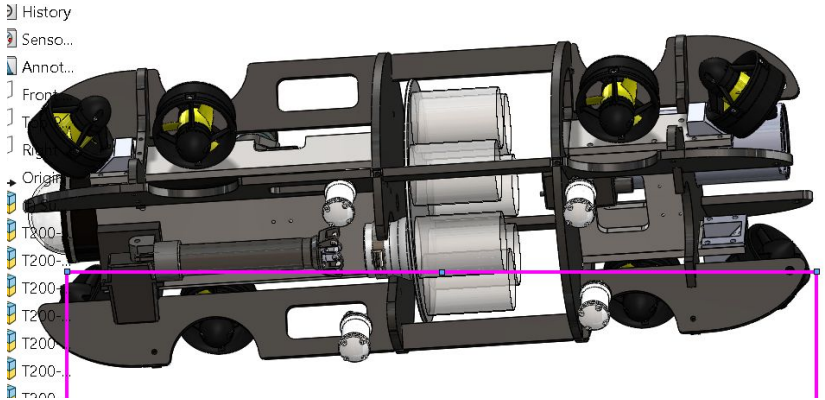
- Grab arms
- Nets
- Vacuum

Good	Bad
A net	Giant scope
Having a large store place	Vacuum tube
Organizing by size by filters	Tape them
Samples of flora and fauna	Don’t store it
A box that makes the gripper come in as well.	Attach a balloon
Big bin that can rotate the dividers	The second small ROV to hold

The design prototype result - rotating canister vacuum model







Next Sprint

Main goal: Implement a prototype for the current suction-based collection idea to test if it is even feasible.

Sub goals:

- Complete a version 1 design of the suction mechanism
- Manufacture the design
- Test if it even fits on the ROV
- Test if the suction produced is efficient/strong enough to be used to collect samples

Optional: Consider ways to collect flora (that presumably can’t just be vacuumed up)