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Engaging local students and aquarium visitors through ROV technology

Jessica Lotz
Highline College, United States, jlotz@highline.edu

Katy Kachmarik
Highline College, United States, kkachmarik@highline.edu

Rus Higley
Highline College, United States, rhigley@highline.edu

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Jessica Lotz[1,2] ; Katy Kachmarik[1]; Rus Higley[1]
[1]Marine Science and Technology Center Highline College, [2]Americorps

The MaST Center

The Highline Marine Science and Technology Center (MaST) is the marine biology and aquarium facility of Highline College in Des Moines, Washington, located on the south-central Puget Sound. Dedicated to expanding knowledge about Puget Sound, a central mission of the MaST Center is fostering a culture of marine stewardship by engaging the community through interactive learning, personal relations and exploration. The development of program curriculum designed around Remotely Operated Vehicles (ROV) targeted at elementary and middle school students, summer camp & aquarium guests exemplifies these aquarium efforts.

We have developed curriculum, linked to Next Generation Science Standards and Ocean Literacy Principals targeted at those interested in ocean exploration, underwater technology, and engineering. With more miles of the surface of Mars mapped than in our own ocean, scientists are diving into new technology to help us better understand our oceans ecosystems.

Our ROV program engages local students, campers, and aquarium visitors with hands-on experiences either building or utilizing the video capabilities of these underwater robots. Once engaged, these audience are able to deploy their robots off of our dock.

Next Generation Science Standards & Ocean Literacy Principals

The program is linked to Next Generation Science Standards and Ocean Literacy principals which enables students to become familiar with defining a design problem that can be solved through the development of an object, tool, process or system.

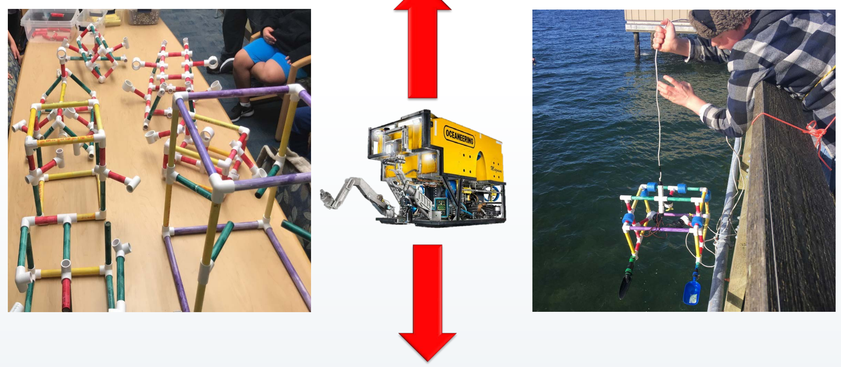
Students also practice using logic, reasoning, and creativity while building their vehicle.

(MS-ETSI1-1, MS-PS2-1, MS-LS4-2, MS-ESS3-4, MS-PS1-3, MS-PS1-2, MS-PS4-3)

On Site Curriculum

We aim to provide a one-of-a-kind, hands on experience for our students to learn about ROV technology and it's uses in the field.

- We discuss ocean exploration and the history of technological advances and how each has moved the other forward, including how this knowledge can be used to create whole ocean monitoring systems
- Another topic includes how ROVs are made for the purpose of exploring the ocean where humans cannot go safely or without life support systems.
- Students use forces diagrams to learn about buoyancy and make arguments for motor/payload/flotation placement.
- Students learn about how ROVs are made with specific missions in mind (e.g. collecting samples). The student's mission is to design their ROVs to bring a rock to the surface.



Students build a variety of models (left) and apply force diagrams to them taking into account buoyancy and gravity (middle) in order to test them beneath the water's surface (right).

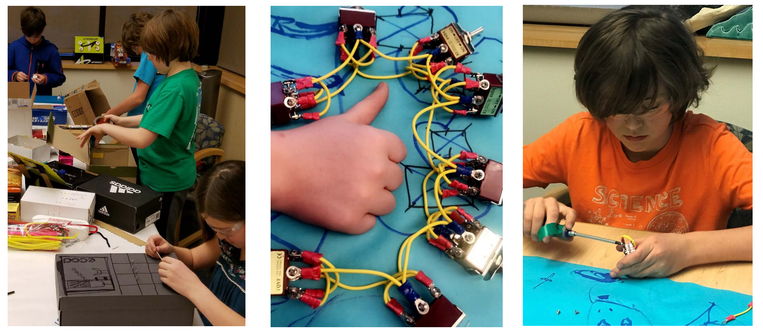
Summer Camp Curriculum

During the Summer of 2018, we will spotlight ROVs and underwater technology during our Sound Science Summer Camp. The theme of the camp will be "Science Beyond the Surface". This theme will create a cohesion not only through daily activities, but throughout the week in its entirety.

In previous years, counselors have constructed the ROVs and taught lessons about underwater exploration, then allowing the campers loose to test drive them in the Puget Sound. Campers had expressed a great interest in being able to construct their own. This year campers will be able to participate in a variety of hands-on educational experiences focused on engineering their own operational vehicle. Topics of interest will include buoyancy, Archimedes Principal, frame design, and electronics.

Acknowledgements

We would like to thank the MaST and Highline College for the financial support to further pursue our endeavors. We would like to thank Woodmont Elementary School and Nautilus Elementary school for piloting our on-site programs.



After-school students gain hands on experiences making and wiring control boxes.

After-School Underwater Robotics Club

We work alongside 5th grade students from Geiger Montessori Elementary School in Tacoma, WA to facilitate experiential learning of ROV technology and teach STEM and engineering concepts through team building.

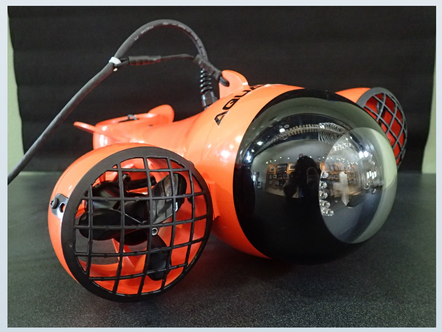
GOAL 1: The club has been designing, engineering, and testing ROVs in preparation for the 2018 Marine Advanced Technology Education (MATE) ROV competition.

GOAL 2: These young students are able to dive even deeper into the makings of these underwater robots, from building frames to even wiring the electronics and motors. In addition to these engineering feats, they gain further experience by preparing technical reports, poster displays, and engineering presentations which are delivered to professionals working in the field. All of these skills will be very useful to prepare the students for technical careers in the future.

Public involvement

We interact and educate the public about ROV technology in a number of ways including:

- Allowing aquarium volunteers and visitors the opportunity to build ROV frames and test them off our dock
- Explore the underwater habitats of Redondo Beach, WA with our $10,000 Aquabotix ROV, equipped with video streaming capabilities



Aquabotix Hydroview Remotely Operated Vehicle used at the MaST

Further Information & Questions: Contact Jessica Lotz, jlotz@highline.edu | mast.highline.edu