Design of a Pedagogical ROV

Tristan Cowan — Mechanical/Electrical Engineering, University of New Haven
Dr. Cheryl Li — Mechanical Engineering, University of New Haven

Introduction

Remotely operated vehicles (ROVs) are invaluable tools for marine scientists. They grant the ability to observe environments and collect samples which would otherwise be out of reach. Traditionally, fielding an ROV has been a costly operation restricted to research and industrial applications. Recently, there has been increased interest in smaller ROVs with limited capabilities for hobbyists and K-12 educators.

The goal of this project is begin development of a small ROV with capabilities and price-point suitable for use as a pedagogical and research tool in university marine science curricula.

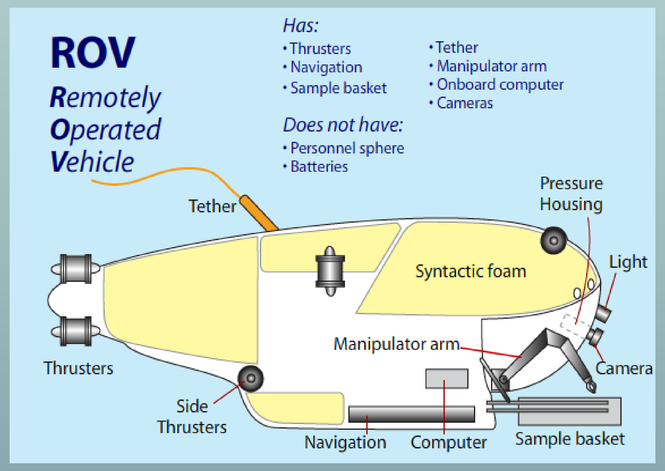

Figure 1. A schematic of a typical ROV. (Image credit http://www.divediscover.whoi.edu/robotics/vehicles.html)

Survey

In order to better understand the needs of the potential customers of an ROV of this type, a survey was sent to the marine science departments of major U.S. universities with marine science programs.

Survey responses indicated an ideal ROV as having the following characteristics:

•An ROV size of 2 ft x 2 ft x 2 ft or less
•A price point of $3000-$5000
•The ability to take HD video and temperature, salinity, and dissolved oxygen measurements
•The ability to take water, sediment, and biological samples
•Exact geolocation
•Flexible, modular vehicle

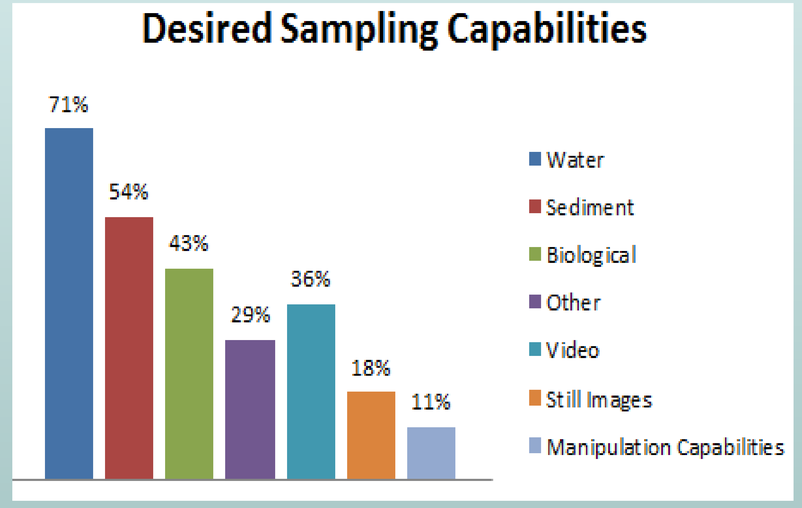

Figure 2. Survey data – Desired sampling capabilities

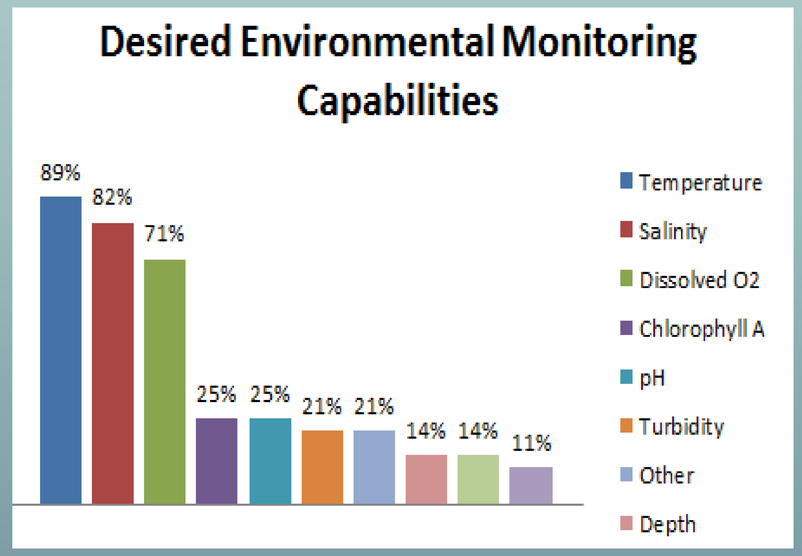

Figure 3. Survey data – Desired environmental monitoring capabilities

Design

It was decided to focus primarily on the basic structural design of the ROV for the duration of the SURF program. Elements examined include the frame, pressure vessel to house onboard electronics, buoyancy, and propulsion.

Fiberglass was selected as a frame construction material due to its low weight, rigidity, and low cost. Thrusters designed specifically for ROV use are selected to ensure good performance at depth, with a thrust vectoring system to reduce the number of thrusters required.

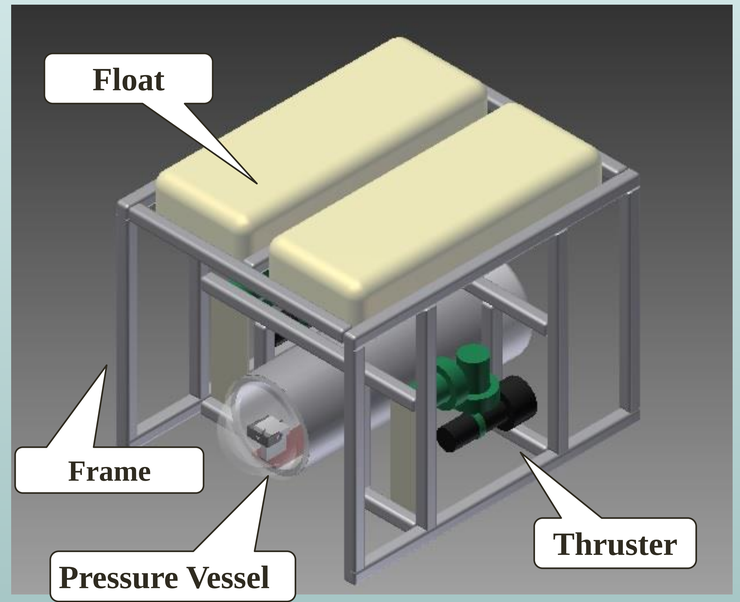

Figure 4. Basic mechanical design, showing frame, thrusters, pressure vessel, and floatation devices.

Future Work

This project is expected to continue development over the next several years as an engineering senior design project funded by New Dimension Technology, Inc. This work will focus on a more fully fleshed-out mechanical design, as well as the electrical design necessary to integrate sensors and navigational equipment into the ROV.

We anticipate a collaboration with Dr. Christopher Kitts and his robotics laboratory at the University of Santa Clara, and hope to eventually advance a University of New Haven team to compete in the Marine Advanced Technology Education (MATE) international ROV competition.

Literature Cited

http://www.divediscover.whoi.edu/robotics/vehicles.html.

Hyakudome, T. (2011). Design of Autonomous Underwater Vehicle. *International Journal of Advanced Robotic Systems*, 122-130.

Kitts, C., Kirkwood, W., & Wheat, G. (2010). An Interdisciplinary Marine Robotics Research and Education Program. *Journal of Marine Education*, 7-10.

Acknowledgments

Thanks to Dr. Cheryl Li, Dr. Christopher Kitts at the University of Santa Clara, Dean Ron Harichandran, Rick Cerniglia , the University of New Haven, and the Summer Undergraduate Research Fellowship program for their support and assistance with this project.