Conductivity, Temperature & Depth Sensor for ASV

Matthias Page, Jacob Zercher, Andrew LePage, Devan Sack
Innovation Scholars—Ocean Engineering Cohort

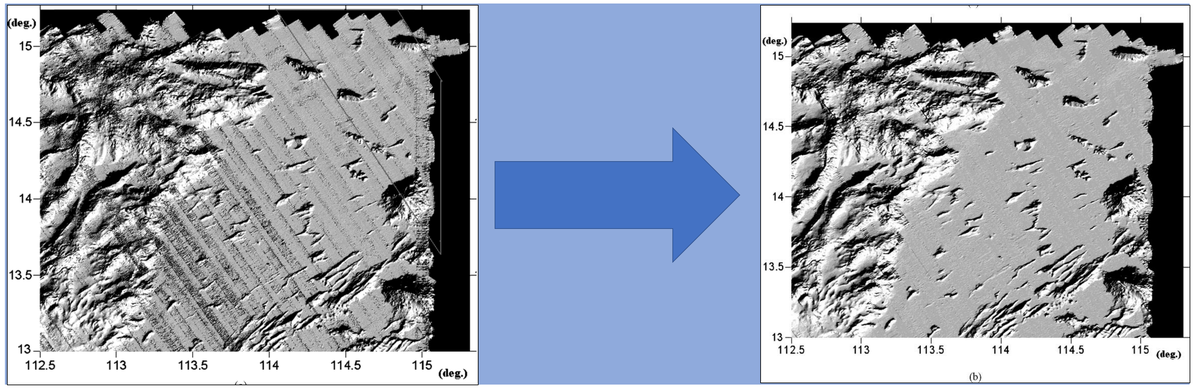
University of New Hampshire
College of Engineering and Physical Sciences

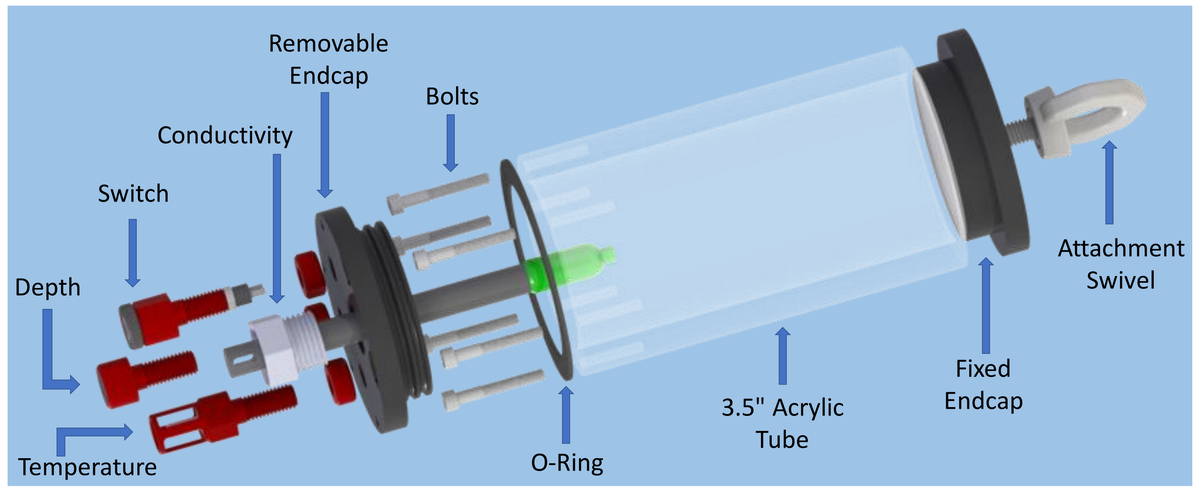
Abstract

The goal of this project was to develop a sensor package that autonomously measured the conductivity, temperature, and depth of seawater. This package (the CTD) was designed to be towed behind an autonomous surface vehicle (ASV) to assist the ASV in mapping the seafloor via sonar. A high quality CTD package is essential because sonar readings are dependent on the speed of sound in water, which is dependent on the variables that the CTD measures.

Commercial CTDs are expensive, and the deployment of CTDs runs a considerable risk of losing them if their physical connection to the ASV is severed. By developing a CTD in-house at UNH, the financial losses incurred by a lost CTD would be defrayed.

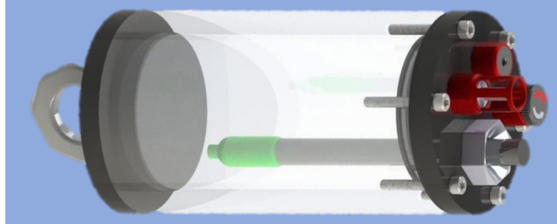
Over the course of this research project, the CTD was designed, a prototype circuit was built, and code to collect and store data using the I2C protocol was written. Power consumption for this circuit was calculated, and sensor noise was calculated and accounted for using Allan Variance.





Design

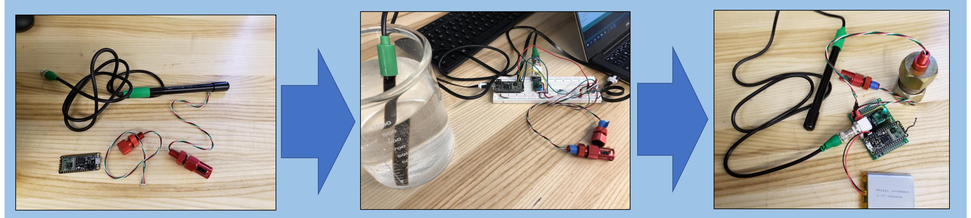
1. Housing
   a. 3.5"x6" Acrylic Tube
2. Sensors
   a. Atlas Scientific Conductivity Probe
   b. Blue Robotics Temperature Sensor
   c. Blue Robotics Pressure Sensor
3. Electronics Sled
   a. 3D Printed Sled
   b. Circuit Mounting Points
4. Electronics
   a. Adafruit Feather M0 LoRa Microprocessor
   b. 1500mAh LiPo Battery
   c. Custome Circuit Board
   d. Blue Robotics Switch



Methodology

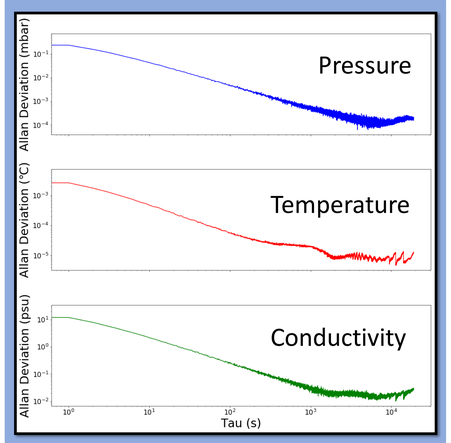
To design, program, construct, and test the CTD a systematic design process was utilized. The steps of design are outlined below:

1. Identifying Constraints:
   a. Inexpensive
   b. Provided Parts
   c. Small Profile
   d. Lightweight
   e. Good to 100m
   f. 8 Hour Runtime
   g. Data Acquisition
   h. Radio Data Transmission
2. Prototype Construction:
   a. I2C protocol decided
   b. Breadboard Circuit
   c. Create test program with I2c
   d. New Program w/ Excel Output
   e. 3D Model
   f. Permanent Circuit
   g. Program for data storage



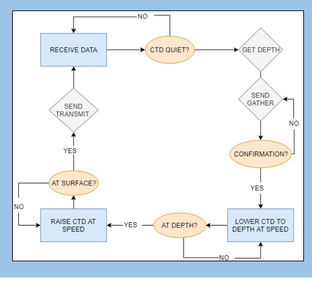
Results

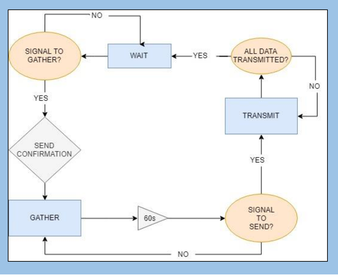
1. Read values from each of the sensors
2. Calibrated each of the sensors
3. Tested each sensor for Allan Variance



Outlook

- Circuitry
- Coding
- Radio Communication
- Quality Control
- Final Housing
- Winch System





Acknowledgements

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