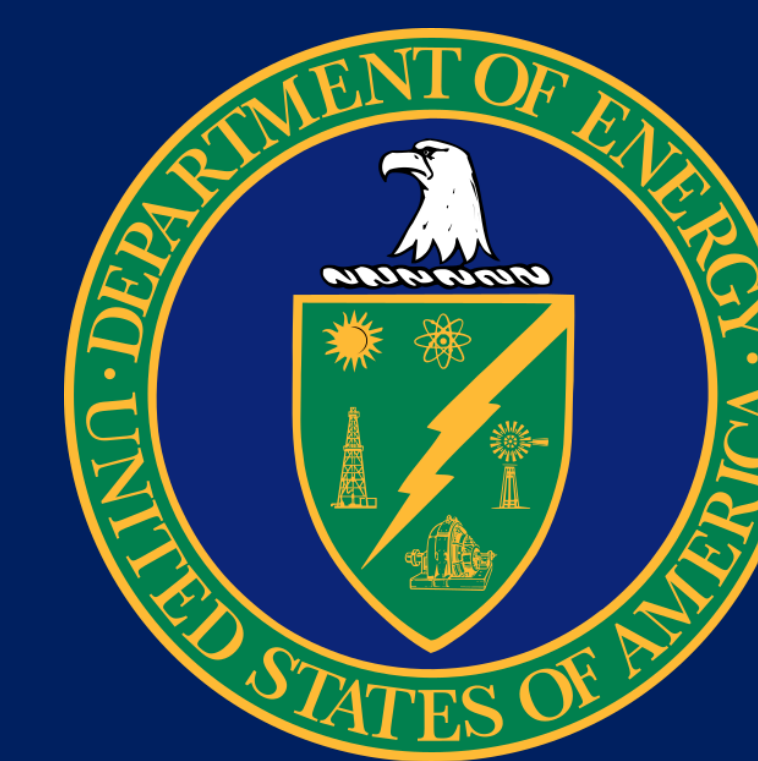




Air Sea Flux LiDAR Buoy

Ethan Hickey, Tatum Laws, Joey Baker

Department of Ocean Engineering, University of New Hampshire, Durham, NH 03824

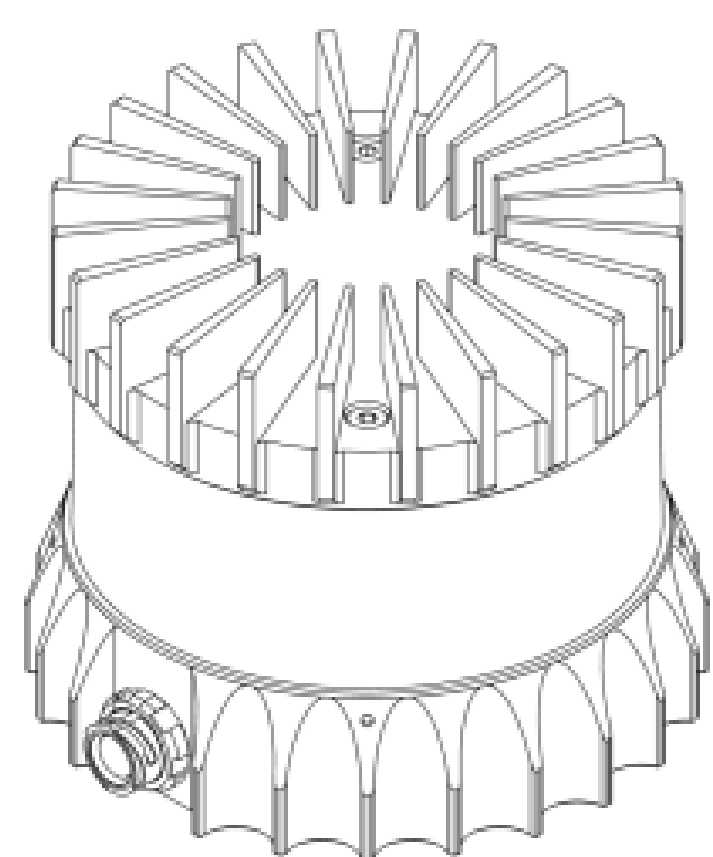


Introduction

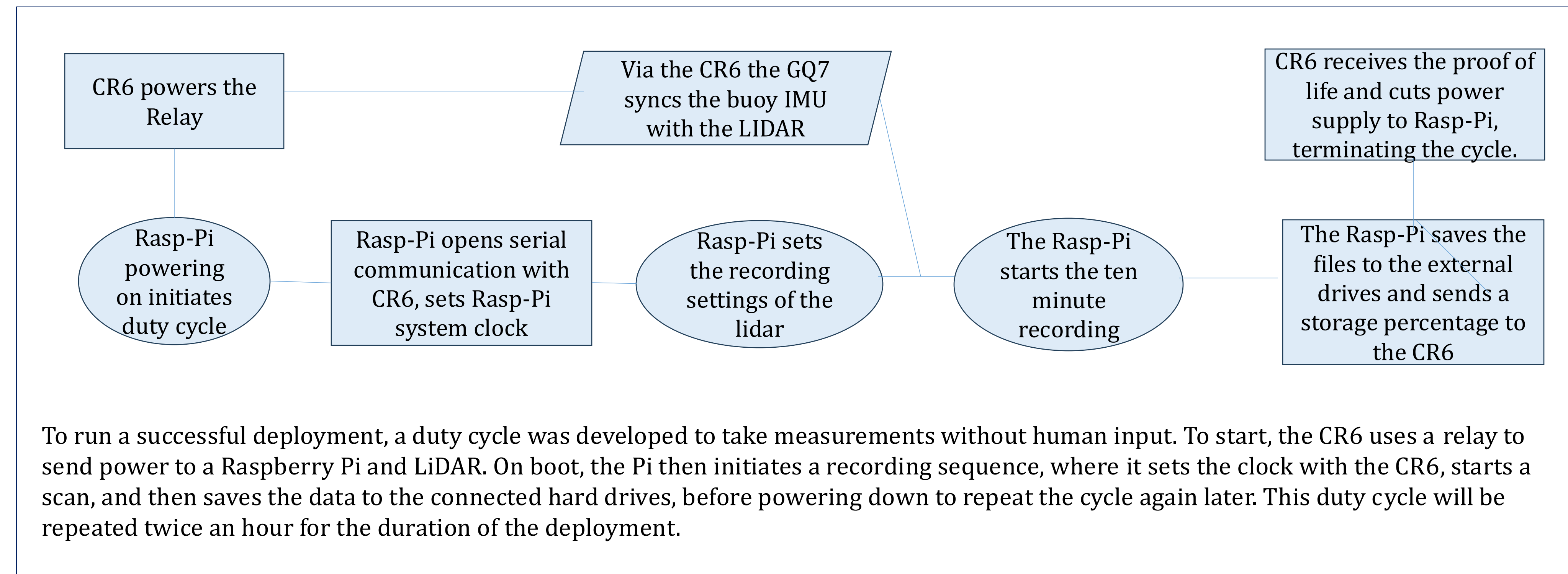
- The ASFLB is a metrological buoy that collects measurements that are used to research the stability conditions relating to the turbulent air-sea boundary layer.
- With these parameters, researchers have been able to study the changes in momentum, heat, gas, and humidity fluxes that can help characterize the behavior of the Air Sea Boundary Layer.
- One of the parameters the buoy cannot measure is locally wind driven waves. The goal of this project is to incorporate a scanning LiDAR into the buoy so that these waves can be recorded.
- The LiDAR will be controlled with a combination of the onboard CR6 and a Raspberry-Pi. This will allow researchers to study the local wind forcing and the effect of surface roughness and atmospheric stability conditions.

Os1 Ouster LiDAR Specs

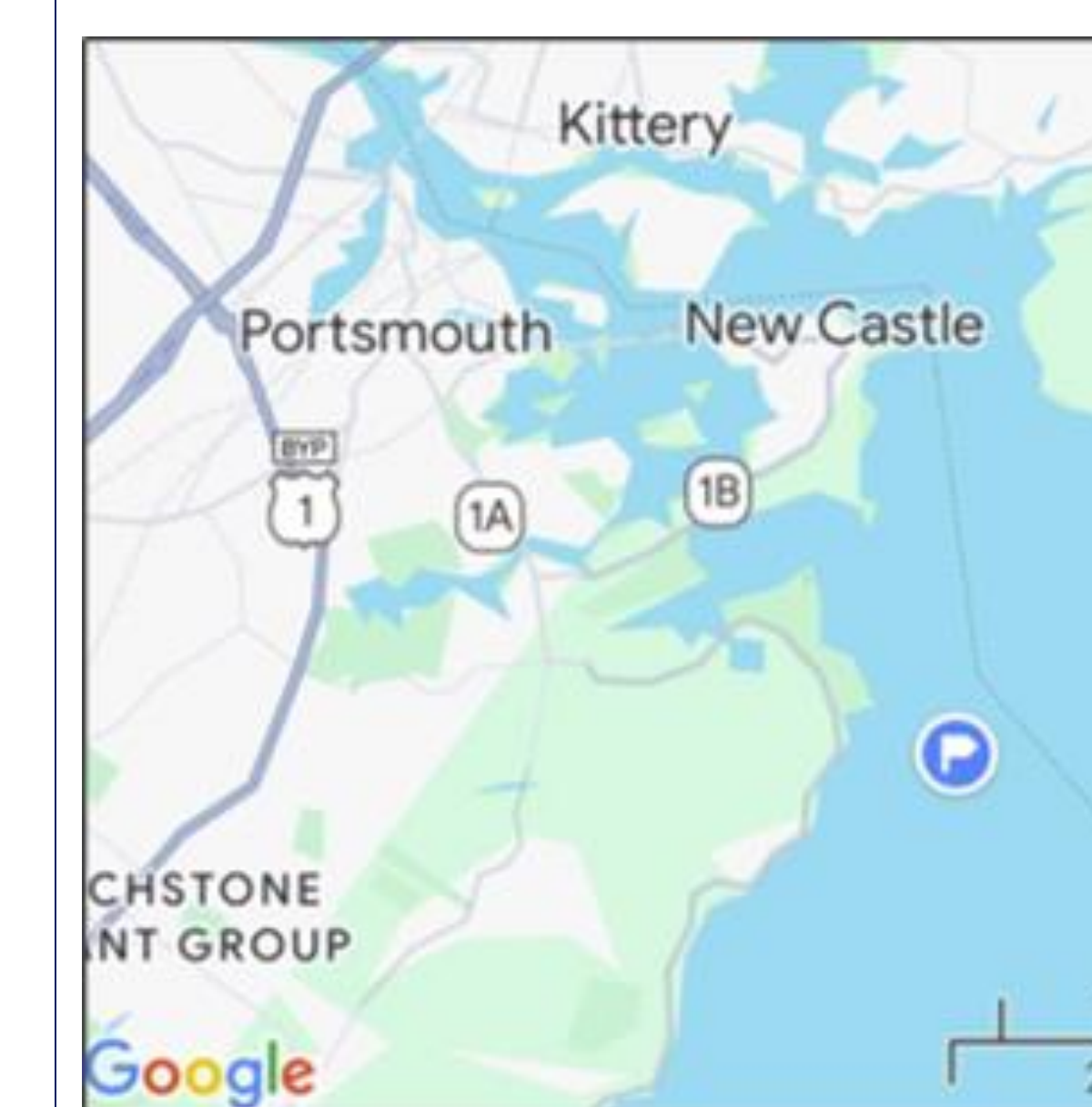
- OS1 Ouster LiDAR: This LiDAR uses an 865nm laser and has 64 vertical channels that cover 42.4 degrees, recording up to 2048 data points at each channel to create a 360-degree point cloud.
- This LiDAR is cable of doing this at a rate of 20 times a second, allowing it to recording high frequency waves.
- For this project, the LiDAR will record at a rate of 10hz with 512 points per channel, and 120 degrees of the horizontal range will be.



Duty Cycle

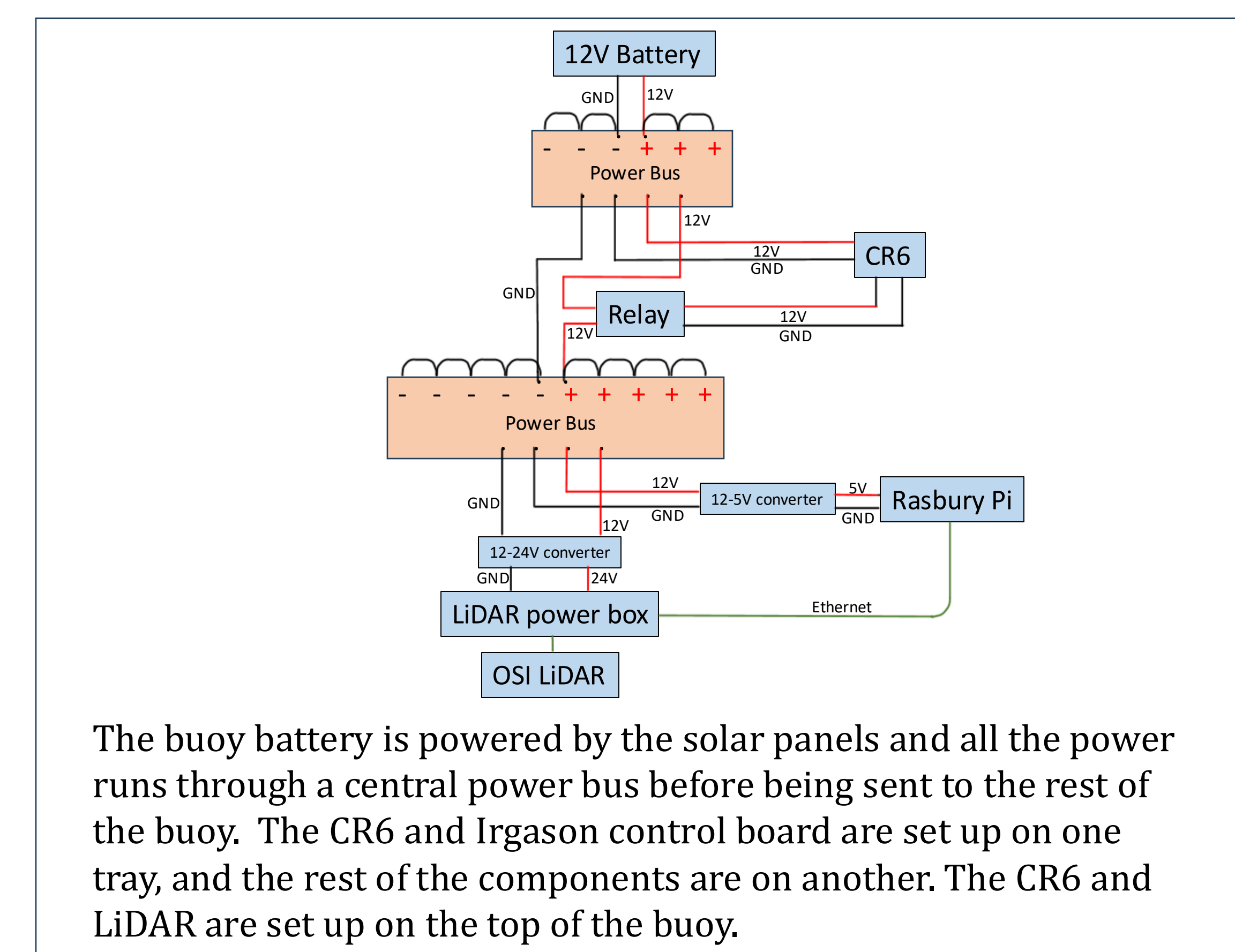


Deployment Site

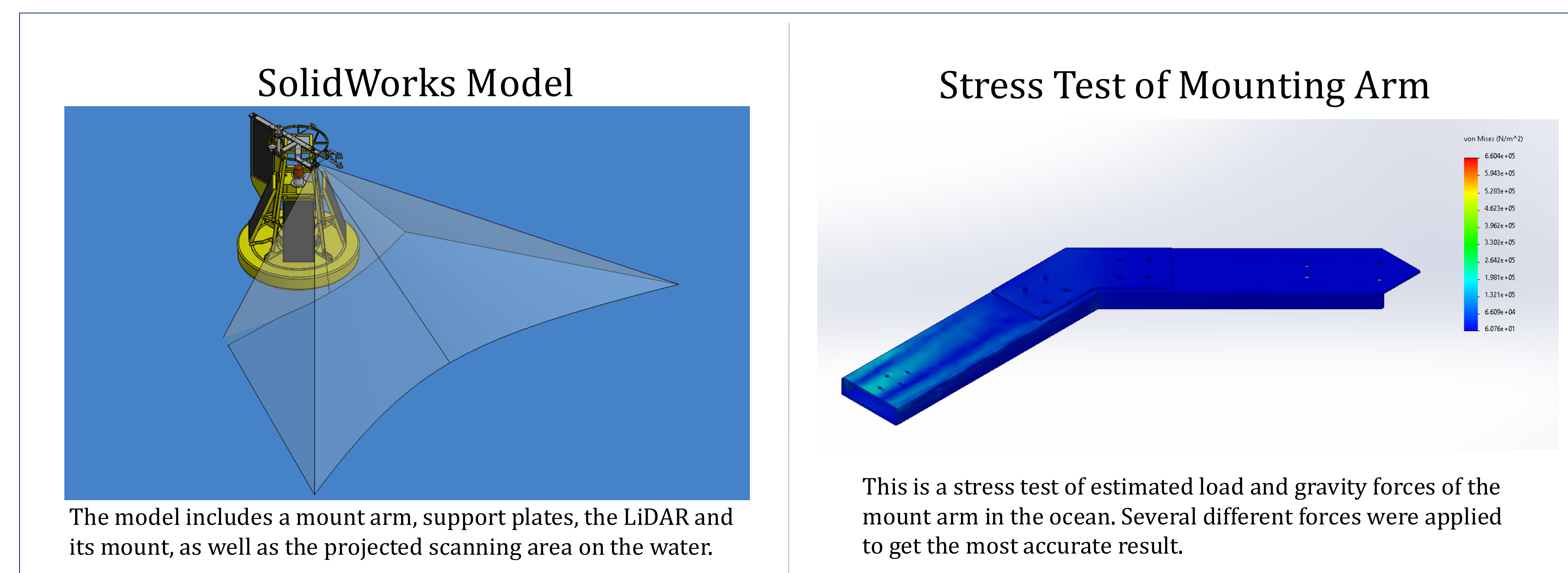


- The completed Air-Sea Flux Buoy will be deployed off the New Hampshire coast late Spring of 2026.
 - It will remain there for around three months. The buoy will be deployed by the R/V Gulf Challenger.
 - The mooring site is exposed to surf action and wind stress. It is close to shore for easy drone access from Odiorne Point.
- Location:** 1 km off Rye NH
Depth: ~15 m
Date: Late May

Circuitry and Electrical Components

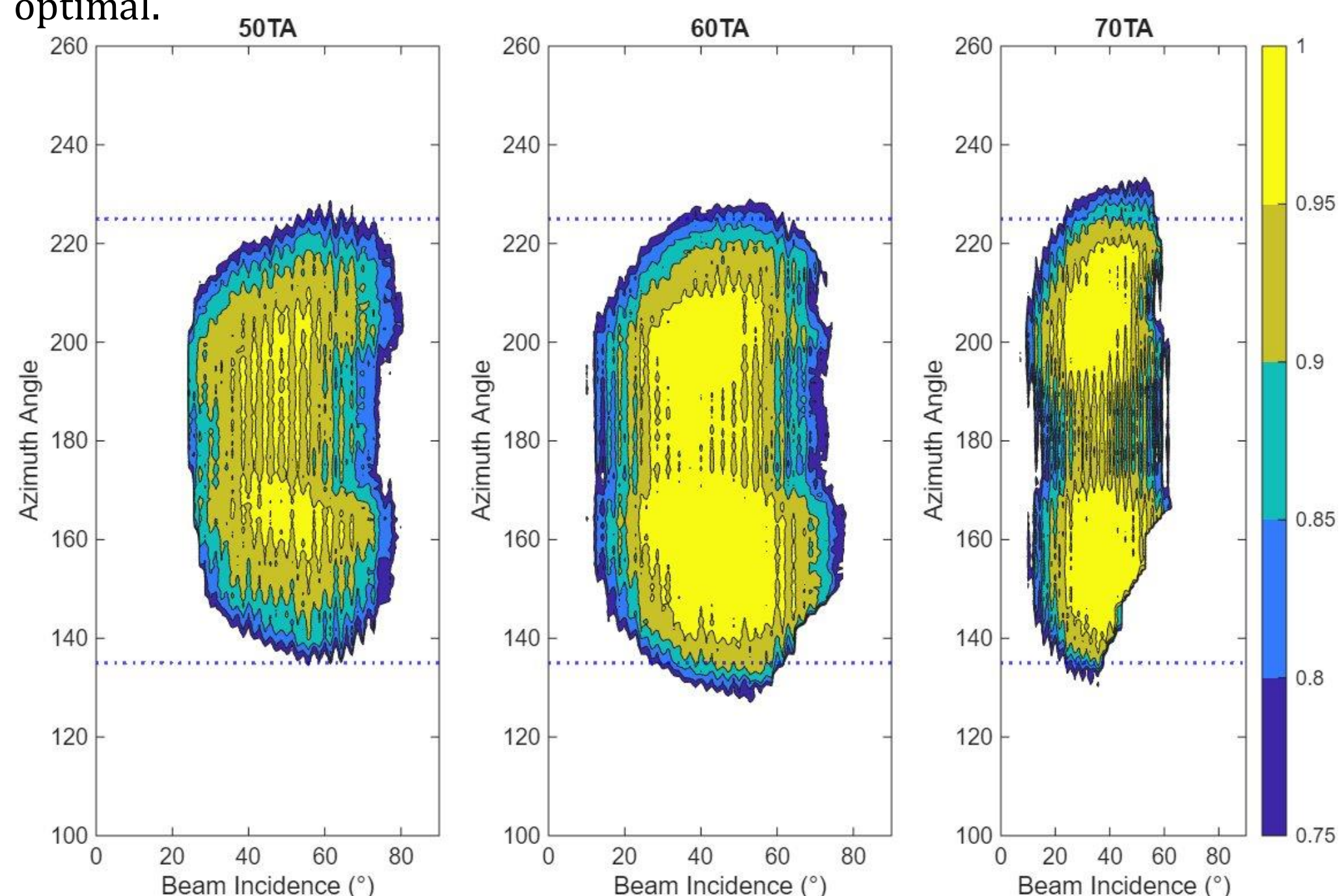


Designing a Mount



LiDAR Recording Angle

- To optimize the mounting angle for the LiDAR a scan of capillary waves was taken from a bridge.
- Using the recordings taken from multiple incidence angles, it was determined that a beam incidence angle of 60 degrees below the horizontal was most optimal.

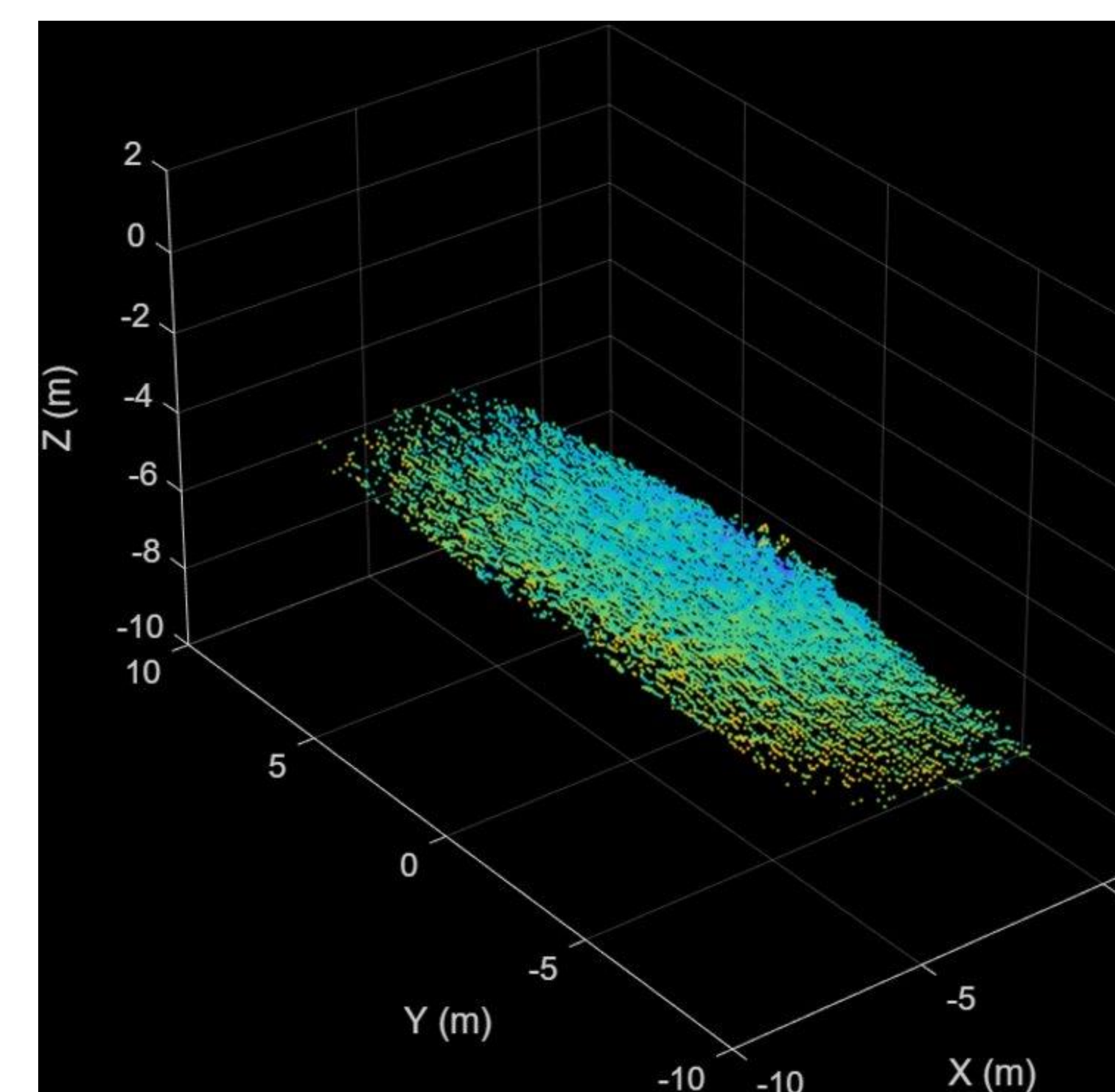


Motion correction

- A motion correction routine was developed to ensure accuracy during data acquisition.
- Takes acceleration data from the Inertial Measurement Unit, calculates pitch and roll of the buoy, then applies rotation matrices to the actual LiDAR point cloud.
- An example output of the code can be seen below, and an example point cloud is shown to the right

```

Mean accel: [0.02141194 0.00836453 1.01228745]
Roll (deg): 0.4734240002377345
Pitch (deg): -1.2117002928298268
Saved: real_motion_corrected.npz
Original first nonzero point: [-0.32420473 1.17421263 0.49481622]
Corrected first nonzero point: [-0.31387409 1.17826107 0.49184449]
  
```



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Machine Shop: Chase OE Lab; Mike Tuttle
Organizations: DOE, UNH, NH Sea Grant, NSF

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