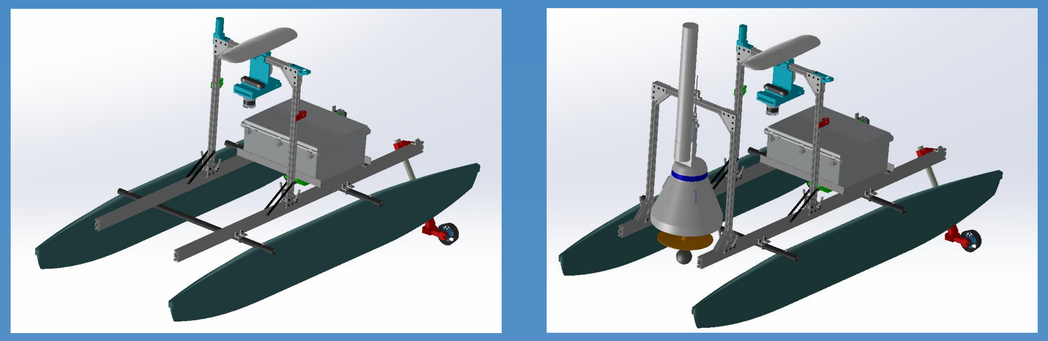
Deployable Radio Relay Communications Buoy

Introduction

The GUS-V is a remotely-operated ocean surface vessel with a limited radio communication range. The solution is a buoy, housing radio relay equipment, that can be deployed from the GUS-V to extend its effective range.

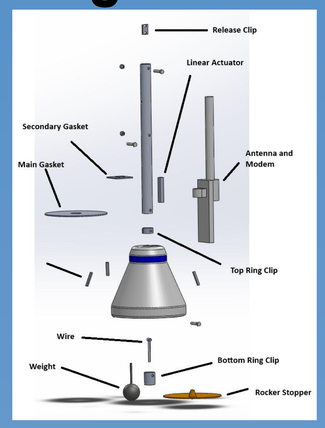


Above: The GUS-V (left) and the GUS-V with the mount and buoy installed (right).

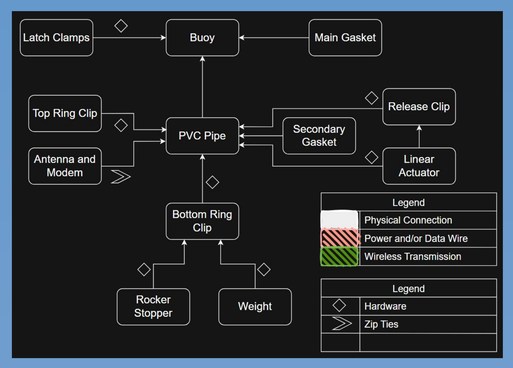
Goals

- Create a radio relay buoy that can be deployed remotely
- The buoy should extend the radio range of the GUS-V beyond 0.2 nautical miles.
- Create a mount that will attach to the GUS-V and can securely hold the weight of the buoy in Sea State 4 conditions
- Live GPS readings should be sent to the remote operator

Design



Left: Exploded view of the buoy. Below: Buoy subsystem block diagram.



Fabrication

The hull of the buoy is an off-the-shelf maritime mooring buoy. It was cut open and fitted with custom-made, watertight gaskets. On the outside are latch clamps that allow the upper and lower halves of the buoy to be separated and sealed back together.

Inside the buoy is a cavity housing electronic equipment, including a battery and Arduino microcontrollers.

Inside of the hollow center mast is a linear actuator which is used to detach a quick release clip for deployment, releasing the buoy from its mount. Perched atop the mast are an off-the-shelf modem and antenna.

Team

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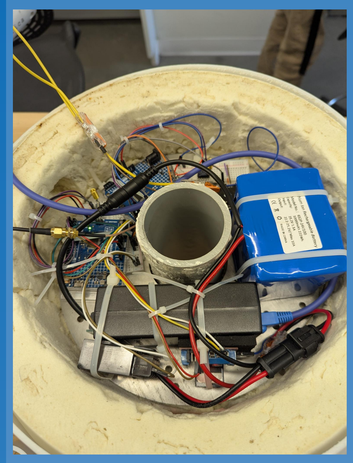
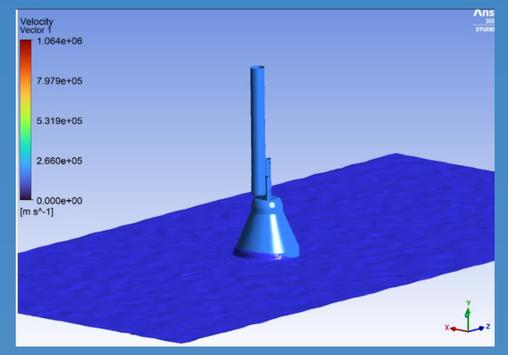


The lower half of the buoy, housing the electronics payload.



Performing a hydrodynamic analysis on the buoy using ANSYS.

Testing

- Remote buoy deployment was successful over multiple tests
- Tested radio range exceeded ¼ nautical mile.
- Buoy floats and remains upright in choppy waters
- Buoy gasket system successfully prevents water ingress during submersion testing

Deployment

1) An operator presses a button at their control station to initiate buoy deployment.
2) A LoRa (“Long Range”) radio signal is sent from the base station to the GUS-V.
3)The radio signal is received by the receiver on the buoy, and processed by an Arduino microcontroller.
4) The Arduino sends a signal to a linear actuator, which pulls on a quick release latch, releasing the buoy into the water.

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