Positive Operative Buoyancy Submersible (POBS)

Project Lead: Malcolm Ferguson

TEXAS A&M UNIVERSITY Engineering

Members: Aidan Briggs, Alejandro Avila, Bilisa Hiticha, Caleb Harrell, Elizabeth Hannsz, Jenson Jibrail, Kayson Hergert, Maygha Chatram, Trinity Powell

TEXAS A&M UNIVERSITY
ROBOTICS TEAM & LEADERSHIP EXPERIENCE

Intro & Problem Definition

POBS is an underwater device designed to float naturally in any body of water, such as lakes and oceans, due to its positive buoyancy. Using propulsion to remain submerged, the vessel can quickly resurface during emergencies without requiring any additional mechanisms by simply cutting the power to the motors.

Surfacing

- While newer submarines have more efficient mechanisms that allow them to quickly adjust their buoyancy, these systems can be rendered useless in the event of a loss of power.

Efficiency

- Energy Consumption: Traditional submarines require a constant energy supply to manage ballast systems to achieve neutral buoyancy or to surface. These micro adjustments still require a lot of energy and any mistakes can be efficiently costly.
- Drag: In shallow waters, managing a submersible with a ballast systems while navigating requires the vessel to remain deeper underwater then a buoyant positive vessel, increasing the drag of the vessel and the chances of equipment and/or environmental damage.

Control

- While engineering techniques & technology has made depth control easier, it remains a complex task that requires super precise engineering and skilled operators.

Sustainability

- Traditional Submersive vehicles are more likely to experience issues, potentially leading to waste on the ocean floor and loss of expensive equipment.
- Short explorations consume significant amounts of energy for the results they produce, making them less cost effective.

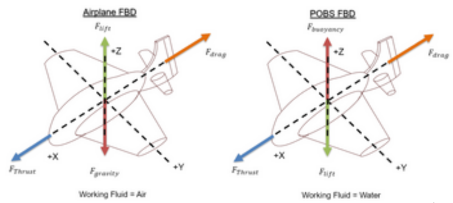

Figure 1: Comparing POBS to an Airplane

Methodology

By developing a buoyant positive submersible which is versatile in many applications within aquatic environments, we can enhance the safety, sustainability, and ease of tasks in these domains.

Surfacing

- Rapid Emergency Surfacing: In the event of an emergency, the submarine can quickly rise to the surface without the need for complex ballast adjustments.

Efficiency

- The Positive buoyancy can help the submarine maintain a higher position in shallow waters, reducing drag and making navigation easier.
- Maintaining positive buoyancy can reduce the energy required to maintain depth, as less effort is needed to counteract the weight of the submarine.
- The need for elaborate ballast system does not exist, allowing for greater energy conservation.

Control

- The positive buoyancy makes it easier to control the submarine's ascent and descent, providing stable and predictable movements.

Sustainability

- Positively buoyant vessels are less likely to sink, meaning less waste on our ocean floors while saving valuable data and equipment.
- The simple submersion technique means that short explorations consume less energy then traditional submarines.
- Positive buoyancy ensures that the submarine remains afloat even if there is a loss of propulsion

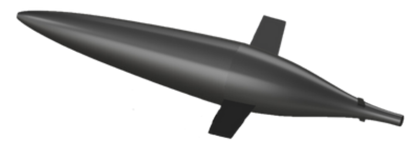

Figure 2: Bulsa's Brainstorm Contribution

Chassis

To produce a submersible chassis capable of resisting the pressure forces of water while housing the equipment for propulsion and navigation, we spend the semester brainstorming and designing innovative concepts for a new Chassis design. Learning from the lessons of previous POBS iterations, we implemented several new concepts, including:

- A more streamlined shell for better hydrodynamics and ease of movement in dense, friction inducing water.
- Chassis components separated into screwable parts to simplify inserting and removing electrical components.
- Use of stabilizing fins to counteract the spin produced by the propellers.
- A slot for insertion of antennae and attachment area for sonar equipment for RC and navigation.

Once we had considered everyone's input, we began to implement these ideas into a final V1 design by dividing up the different components of the chassis to each of the Chassis Team members.

Impact

Ideal for protecting life, equipment, and valuable research during emergencies by surfacing without energy consumption thanks to its net positive buoyancy.

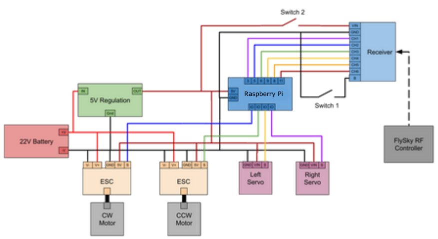

Figure 3: Electrical Map

Electrical and Navigation

This semester, we spent our time getting to know the electronic components of POBS and learning how they operate. Currently, we are using the following components:

- Zeee 6S Lipo Battery 22.2V 100C 6000mAh
- DIAMONDDYNAMICS DD TD5 Underwater Thruster 30A
- ANNIMOS 20KG Digital Servo
- Raspberry Pi 4
- Flysky RF Controller and Receiver

Going forward, we plan to implement a BlueRobotics sonar sensor, as well as two more motors to assist with depth control.

Next Steps

In the coming semester, our team plans to continue improving our project, as well as starting a subproject called Turtle.

POBS

- Get the V1 finished and water proofed.
- Implement new electrical components, including the sonar sensor.

Turtle

- Launch the new subproject and get the chassis design completed.