VDR 3: Prototype

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Objective:

The objective of this project is to design and construct an underwater glider.

Selected Solution:

Based on concept selection the final design was chosen to be a dual ballast tank glider. Much like a catamaran, the two ballast tanks will provide extra buoyancy control for the glider and the independence of each tank will allow for control of roll. A small housing unit will be the connection between the two tanks and house all major electronic and pneumatic components. Branching from each cylinder will be one half of a delta wing configuration. This configuration uses roll and pitch control to handle all deviations in yaw thus allowing for no rear rudder to be necessary. Added ailerons on each wing will aid in pitch and roll maneuvers. Pitot static probes and a temperature sensing device will be mounted to the exterior of the craft.

Current Work:

A CAD model of the glider body has been made and is currently being simulated to assess feasibility. Currently, basic calculations concerning the body properties have been made and the team is starting to conduct CFD analysis with laminar flow in COMSOL. Electronic and pneumatic components needed have been identified that will achieve the team's goal of developing a physical model. MATLAB is being used to simulate the system response of different functions within the glider. As of now, only basic models have been simulated using software. Different software, libraries, and tools are constantly being assessed for their potential to help the project.

Next Steps:

Team 502 plans to improve the design through simulations and experiments. These include wing foil shape and the internal component layout. Solutions for the wing foil shape are being explored through the computer modeling the team has planned. The lift coefficient, drag coefficient, and weight are being tested using FUSION's fluid simulation suite. The glider will be tested at depths of up to 18 meters at a velocity of 0.5-1.5 $\frac{m}{s}$. The team plans to construct a physical model to validate simulations when multiple iterations of CFD simulations show desired characteristics, such as a lift-to-drag ratio of 40.

Team 502 is actively seeking outside help for materials selection and manufacturing. Several contacts have already been made with faculty and professionals in industries related to our project. More contacts are currently being pursued from the High-Performance Materials Institute. In particular, the team is seeking insight into how different materials behave when subjected to dynamic conditions. Discussions with contacts within the industry have dealt with best practice for manufacturing and the methods that can be used to make a physical build.

Potential Problems:

A problem that has been identified is defining the dynamics of the system. Properties such as the center of pressure, coefficient of lift, and center of mass are all heavily dependent on the conditions with which the glider is subjected to. The challenge lies in determining what dynamics we can realistically simulate and meaningfully apply to a physical model given time constraints, knowledge, and ability. It has been a topic in every advising meeting that the team has had with faculty and is a continuing point of discussion.