**Team 516 Virtual Design Review 3**

**November 29, 2022**

**Current Design State and Prototyping**

Our selected design concept was the concentric helix design. Currently, our design involves two concentric cylinder-like structures, made from rods aligned circularly, that allow the fiber optic cable to weave in a helix shape in and out of the cylinders to cover more radial distance from the center of the tank. The rods supporting the structure will have rings along their length to guide the cable through the structure. The rings exhibit a figure-eight shape that connects to the rods through one opening, and the cable to flow through the other. The holes in the ring are much larger than the cable diameter to allow for slack in the cable so that it does not experience excess stress under cryogenic conditions. Our structure and FOSS system will likely be connected to the lid to allow for easy installation and prevent any construction work inside the fuel tank.

The current prototyping process involves modeling the dewar using a Home Depot bucket, with the lid of the bucket being the lid of the dewar. The FOSS system structure will be constructed outside of the dewar, so our prototype was constructed the same way. First, we drew concentric circles on thin wooden plates to mark off the locations of the support beams. The wooden dowels representing the G10 beams were then super glued to the top and bottom wooden plates, forming our structure. To model the rings holding the FOSS, staples were glued to the individual dowels. String was used to model the FOSS cable itself, with portions taped around to represent thermocouples. The string was guided through the staples on the wooden dowels in the same fashion the FOSS cable would be. Once the FOSS structure model was assembled, it was glued to the lid of the bucket allowing us to demonstrate the installation of the FOSS structure into the dewar.

**Future Work**

First, we will need to begin assembly and experimental design. However, we cannot begin testing until we have completed safety training from the MagLab. Last year’s team proposed several tests, but we will need to speak with Dr. Vanderlaan about what is feasible and what is the best use of our time. We need to conduct tests to ensure that our design doesn’t place too much strain on the cable, and that we can interpret the data that is output by the FOSS system. One assumption we made early on was that the FOSS system is accurate, however, we may find that we need to perform validation tests. Our next point of focus will be to create code to calculate the mass of fuel left, then create a display method. Lastly, we will need to look back to our targets to analyze how well our project performs.

**Identified Problems**

Due to material shortages and shipping concerns, the timings of our parts' arrival are uncertain. While we do have vendors through the College of Engineering to supply most of our needs, some of our needs will involve going through a third party, which may cause purchasing issues with the university. Another issue is the need for open-dewar testing since the data acquisition system is housed outside the dewar and connects to the cable. This means we will be unable to simulate zero gravity conditions as we had originally planned, and that the propellant will behave differently than it would in space. Without a lid, there is a clear issue regarding the anchoring of our structure inside the dewar. Last year’s design was able to be twisted and we are trying to resolve it by adding support bars between the concentric sweeps. Similarly, we are also looking into ways to more securely attach the rods to the platform, and the platform to the dewar itself. This may involve elements like drywall hooks, or setscrews sealed with cryogenic grade epoxy.