SHALLOW WATER ANCHOR

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ABSTRACT

Godfrey Marine is a custom pontoon boat manufacturer based out of Elkhart, IN. They have been in search of a shallow water anchor device to pair with their unique boats. The sponsor has asked that this device be comparable in function to the competitor options such as Powerpole, yet hidden beneath the boat.

Figure 1: Competitor's device, Powerpole

The newly designed shallow water anchor will be mounted on the starboard side of the pontoon in the bow, where it appears invisible. The sponsor desires it to be hydraulically controlled and strong enough to anchor a pontoon, while not obstructing or damaging any existing components of the boat. The team has created a fully functional 3D CAD model for the sponsor along with a first prototype thanks to the guidance of Godfrey Marine.

CUSTOMER NEEDS/SPECS

Godfrey needs a reliable mechanism that will attach to the C-channels on the bottom of the boat and deploy below until it makes contact with the ground, anchoring it into a non-moving position.

Customer Needs	VALUE
Hidden	Yes
Deployment Depth	8 ft
Mechanism When Compressed	8 in max.
Parallel with Deck	Yes
Mechanism Width	5 in
Transportation Capabilities	Conform to lifts
Safety	Yes
Located in Bow on Starboard Side	Yes

DESIGN CONCEPTS

Five concepts were created to represent different mechanical movements that the design could incorporate. From these designs, two were selected to further develop before the final concept was chosen to be created in SolidWorks.

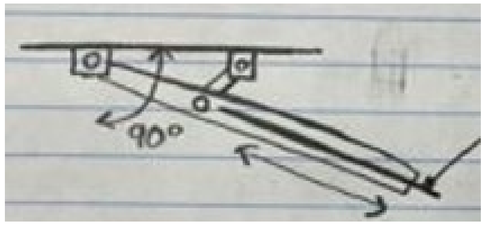

Figure 2: First Concept

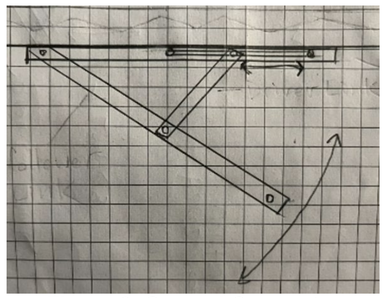

Figure 3: Second Concept

Testing & Validation

FEA was utilized to identify the maximum allowable stress at a factor of safety (FOS) of 1.00. The fiberglass rod was designed to be the failure point of the device, as it is the easiest part to fix and replace. The FEA assured that the connection on the rod would fail before any other components. The fiberglass rod can withstand about 108 lbf of force in one direction prior to deflecting and/or breaking off. Figure 4 represents the subassembly FEA that was completed on the fiberglass rod.

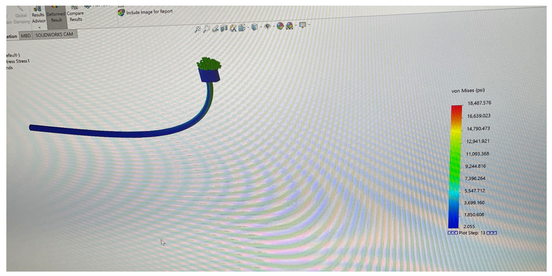

Figure 4: FEA on the Fiberglass Rod Subassembly

FINAL DESIGN

The final design features a device driven by two motors controlled from inside the boat. The device is mounted below the pontoon and attached to a C-channel. The aluminum case in the top section of the design is holding the stainless steel drive screw and platform nut that push the device to it's vertical position. The bottom casing is holding another drive screw which delivers the fiberglass anchoring pole to it's extended position.

Figure 5 shows the device when contracted, and figure 6 shows the device when extended.

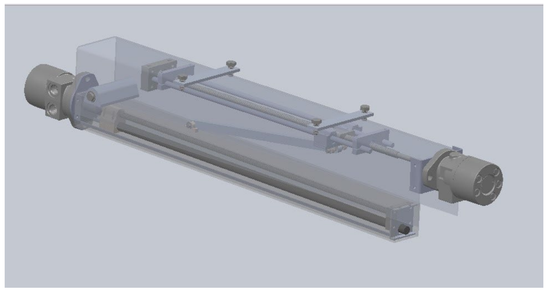

Figure 5: Model in Contracted Position

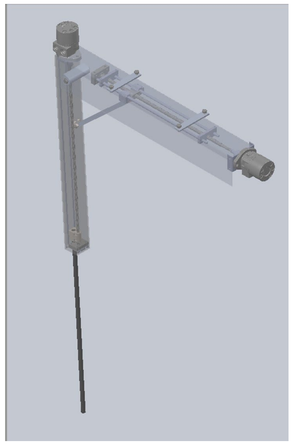

Figure 6: Model in Extended Position

During the final prototyping phase, the team used 3D printed parts as substitutes the custom manufactured parts before they were placed into the model. The 3D printed parts highlighted certain changes that needed to be made before the final product was assembled, such as tolerances and hole placements.

The final model encompasses efficiency, aesthetics, and ergonomics to give a sleek design that the industry has not yet been exposed to.

CONCLUSION

The team created a functional boat anchor deployment device that met the customer needs. The testing signifies that the device is functional, and the fiberglass pole will be the failure point for the device. The device will be operated by two control switches that allow the boat anchor deployment device to be extended and retracted.

Figure 7: Final Build

Prior to real world application, it is recommended that the device is tested and validated for marine conditions. This includes pole strength and material yield in water with actual applied force. These were not completed by the team for prototyping purposes.

LESSONS LEARNED

The team learned that designing a component from scratch is an intricate process that involves scoping, researching, developing, and testing. Following this process includes documenting all work from start to finish and preparing for any setbacks. The team encountered many setbacks but had to find ways to move the project forward when other aspects took steps backward.

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