ADAPTIVE SYSTEM FOR THE HOBIE CAT KAYAK

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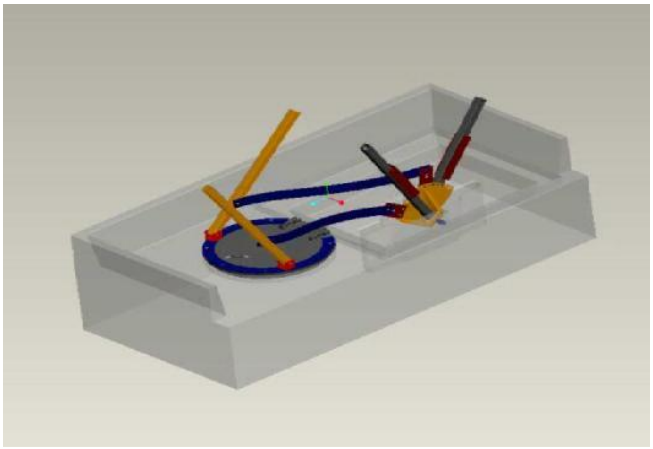
INTRODUCTION

The objective of the project, proposed by Ms. Jill Caruso and the Ability Center for Greater Toledo, is to design an adaptive system to transfer energy to propel the revolutionary Mirage Drive System of a Hobie Cat Kayak. The Mirage Drive System propels a kayak by using two oscillating foils instead of the traditional kayak paddle by transferring energy from the user's legs to the foils. The proposed mechanism will adapt the Mirage Drive System to transfer energy from the user's arms to the foils. The proposed system will reduce the minimum requirements for independent kayaking to just one functional arm in a push/pull motion.



SUMMARY OF IMPACT

Independent kayaking and fishing is a healthy, enjoyable and recreational activity that millions of people around the world enjoy. Unfortunately, hundreds of thousands of people with limited use of their legs and arms are unable to enjoy independent kayaking and fishing. The Mirage Drive System which drives the Hobie Cat Kayak allows people with limited use of their upper body and arms to efficiently propel the kayak. The Mirage Drive has been proven as a revolutionary device, but it still leaves behind anybody without use of their legs. The value that this project can provide to disabled users far exceeds its small costs in design, fabrication, and materials. By using this system, individuals with limited use of their legs will be able to enjoy this recreational activity, and experience the excitement of using a self driven watercraft on any river, lake or even ocean.

TECHNICAL DESCRIPTION

The main objective of this project is to develop a system that will adapt to the Hobie Cat Kayak. There are currently no adaptive products such as this for a Hobie Cat Kayak, so this design is unique and not derived from other designs for the same product. Based on knowledge of mechanical systems and client requirements, a simple four bar linkage was found to be the best

solution. Simplicity, weight, adaptability, and functionality were basic premises for the design guidelines of this project. It is important that the design does not have a negative impact on the steering, stability, and safety of the kayak. The design must also meet space constraints inside of the kayak without interfering with different sizes and shapes of users and without many modifications to the kayak itself.

The material used in this product needed to be strong, lightweight, and also corrosion resistant due to the environment it will be used in. When taking these requirements into consideration the most logical material was aluminum, however it needed to be high strength aluminum. After researching different alloys of aluminum, the best suited for our design is 6061-T6511 alloy. This alloy has high yield strength of approximately 45000 psi; is lightweight with a density of approximately 0.1 pound per cubic inch; and has a high resistance to corrosion.

The final design of the system consists of an input arm, a connecting rod, the Mirage Drive System, and the kayak to complete the four bar mechanism. One of the client's requirements was to include as many points of adjustability in the mechanism as possible, and therefore the input arm and the connecting rod each have a telescoping feature that allow the user to set different lengths to fit his or her own needs. The input arms and connecting rods will be machined from square and round tube stock of the aluminum alloy discussed above. Material was purchased through an online distributor at a slightly larger size than required to allow for machining a smooth and consistent surface finish. Pin joints are used to connect the input arms to the kayak and the connecting rods, as well as the connecting rods to the Mirage Drive. The Mirage Drive will be installed in the kayak as normal. These pin joints will use quick release pins that will allow for easy installation and removal of the system. These pin joints will also be used for the adjustments in the telescoping tubes to allow quick and easy changes on the water. To mount the system to the kayak, the design calls for a ring and bracket that will be mounted to a storage hatch that exists on the kayak between the users legs.

To analyze this system, it was broken down into individual components and analyzed using hand calculations to find the overall stresses in the members. The hand calculations were then verified using the computer software package Solidworks to perform Finite Element Analysis (FEA). All of the components of the system were held to a standard set by advisors of a factor of safety of two for a 150 pound input force. This standard input force was twice the input force determined through prototype testing.