INTRODUCTION

Within the disabled community, there are many that enjoy the sport of sailing. To a disabled person, the experience of sailing on the open water can feel liberating, while providing meaningful and entertaining recreation. However, certain disabilities restrict one’s capacity to function as a member of a sailing crew.

The sailor responsible for trimming the jib sail is required to move themselves from the port to starboard seat and vice versa, as shown in Figure 1. This motion allows the jib trimmer to assist in the tacking of the boat (changing direction during upwind sailing), and to be in the optimal position to trim the jib sail effectively. The motion also helps the jib trimmer to shift the sailboat’s weight advantageously. However, a jib trimmer with a disability may not be able to move their body across the boat. Currently, there are some simple solutions available to help the moderately disabled, but these products do not allow severely disabled to fully function as a jib trimmer.

The goal of this design is to provide an assistive device that can allow people with a range of disabilities the ability to function as a jib trimmer on a Sonar Sailboat. The Sonar was chosen due to its history as a boat for disabled sailors, as sailing in the Sonar Class became an event in the Paralympics in 2000 [1]. A device that assists sailors on a Sonar Class Sailboat would be marketable to one of the largest groups of disabled sailors and sailing associations.

PRODUCT DESIGN

The proposed prototype design provides the necessary linear and rotational translation needed to move the jib trimmer across the boat, and is shown in Figure 2.

The jib trimmer sits in the chair provided, which is mounted on a lazy susan turntable. This provides the necessary rotational motion as the jib trimmer travels across the boat. This rotational motion allows them to look around the boat and keep the skipper aware of other boats and changing conditions on the water, which is an important responsibility of theirs. The seat is shown translated both linearly and rotationally in Figure 3.

The lazy susan turntable is mounted onto a stainless steel seat bracket. The seat bracket is then mounted to a sliding carriage with corrosion-resistant polymer bearing. The carriage slides on a prefabricated linear guide rail that is mounted on a 2”x4” box tube for support, spanning the width of the cockpit. This provides the linear motion necessary for the jib trimmer to move across the boat.
needed to move the jib trimmer from port to starboard and vice versa.

The box tube is supported at four connection points: two posts supporting it on the cockpit floor, and one support point on each of the boat’s seats.

The seat bracket is also connected to a top guide bar using a corrosion-resistant pillow bearing. The top bar is supported by an aluminum L-bracket that connects the bar to the box tube.

The design makes contact with the Sonar boat in three locations: i) the base plate resting on the cockpit floor, ii) the side L-brackets resting on the boat seats, and iii) the handhold connections protruding into the boat’s handholds.

The base plate below it is made of marine plywood and structured ribs. The base plate is contoured to fit the shape of the cockpit floor. A series of repeated bolt patterns in the base plate allows the user to have some adjustability in where they would like the system to be installed in the boat.

The side L-brackets will be resting on the seats of the boat, and will be supported with a rubber block that protects the seat from the metal L-bracket.

The handholds connections are necessary to prevent any upward motion at the sides of the design. The handhold connection is essentially a metal handle contoured to fit the boat’s handholds. A turnbuckle design will be implemented to provide some adjustability to the applied force at the connection. The turnbuckle also allows for the design to be used on older Sonor models, where the handholds may be in slightly different locations. The handhold connections then are mounted to a rail of 80/20 Aluminum connected to the L-bracket, which allows the user to adjust the handhold location from front to back to fit the handholds. Accounting for this adjustability allows sailors with older models to use the product in their Sonar.

It is very important that the design be corrosion resistant. Using marine-grade hardware and anodized aluminum is essential to protecting the longevity of the design. Saltwater and freshwater are both protected against, allowing the design to be used in the ocean or inland bodies of water.

A 3-1 Purchase System mounted to the device allows the user to pull the seat linearly along the track. The purchase system is a series of lines and blocks that allows the user to pull a pair of lines attached to a block at the top of the cabin door. This line is connected to blocks mounted on the base plate, side L-brackets, and the seat bracket itself. When the user pulls the line, it will create the linear force necessary to move the user’s chair along the linear guide rail. Pulling on the lines will also create a rotational movement as the user slides linearly across the boat. The lines and blocks will be marine-ready, and can then be easily replaced at a marine supply store if needed.

A seat, shown in Figure 4, and a 5 point harness will be available to secure those with disabilities who require their torsos to be secured. The entire design must also be able to be disassembled and stored. An able-bodied person will be able to install the system on the boat. The system’s total weight is below 75 pounds.

Figure 3: CAD Model of Jib Transfer Bench at port position

Figure 4: RCI High Back Aluminum Racing Seat

BUDGET & MARKET ANALYSIS

There is market potential for a product like this within the disabled sailing community both in the United States and around the world. The few solutions found are simple, custom-built benches that span the gap between the port and starboard seats. A typical Sonar jib trimmer bench has sloped sides that help sailors remain seated in the boat and is designed for those with no leg use but fairly good trunk control. However, not all disabled sailors have core strength and trunk control. This design would expand the sailing roles of the more severely disabled.

The budget for this project has been funded through a grant from the National Science Foundation through the Rochester Institute of Technology. The anticipated budget is around $2,500 to build and test the product.

The product design will use as much pre-fabricated sailing equipment as possible. This would allow the user to replace any parts fairly easily at their local sailing supply store. Other components used will come from local hardware stores, as well as some online suppliers. Some of the major parts will need special manufacturing or treating.

When comparing this device to the custom-built simple benches discussed before, this product is both more complex and more expensive to fabricate. However, the expectation is that a disabled sailing club will purchase this device and allow their disabled members to rent or borrow it. There are thirty organizations in sixteen states that are specifically registered with US Sailing as a Disabled Sailing Organization, and many provide equipment for disabled members [3]. However, many of the hundreds of other sailing associations in the United States also have disabled members.

For instance, the Piers Park Sailing Center in Boston Harbor has a device that their disabled members with no mobility can use to command a sailboat [4]. The Disabled Sailing Association of British Columbia also offers adaptive devices for its disabled members [5]. Many other disability-friendly associations are found both on salt and fresh water in North America.

The product could be marketed to sailing clubs with disabled members. If sailing clubs make initial investment for this device, they should be able to recoup their initial investment either by renting it to their members or through increased membership numbers due to more having more inclusive equipment. It is estimated that at least ten to fifteen customizable units can be sold per year to sailing clubs around the nation.

This product is marketable to a larger population of disabled persons with a wider range of disabilities than the previous solutions. It is believed that a device such as this could reach many disabled people across the country and around the world, and can add greatly to their sailing experience.

REFERENCES