

ABSTRACT

Jim Haugel, a lake house owner and avid maritime enthusiast proposed an idea to Innovation One for selection. Mr. Haugel wanted a mechanical device that can remove a dock easier than the more conventional way of taking sections in and out manually. This project has been a continuation for 3 years now and many designs and iterations of the project have occurred. In the past, cart designs were proposed but were found to be cumbersome. The current iteration of the design uses two mechanical devices that are capable moving, installing, and removing individual dock sections using two people. The image, Figure 1, shows the sponsors dock on the lake.



Figure 1: Sponsors Dock on the Lake

CUSTOMER NEEDS

Table 1 shows the needs and specs required to fulfil the project for a successful device.

Table 1: Needs and Specs

Needs	Specs
Portability	Portable transportation of dock sections.
Storability	Small size to be hung up in a garage.
Lifting Capability	Capable of lifting 200 lbs.
Fork Simplicity	Ridged to avoid deflection.
1-2 Users	Utilizes one to two operators.
Rotation	Rotate 180 degrees to clear legs.

Initial Testing

Testing of last year's design occurred October 10th to see how the device works, Figures 2 -3.

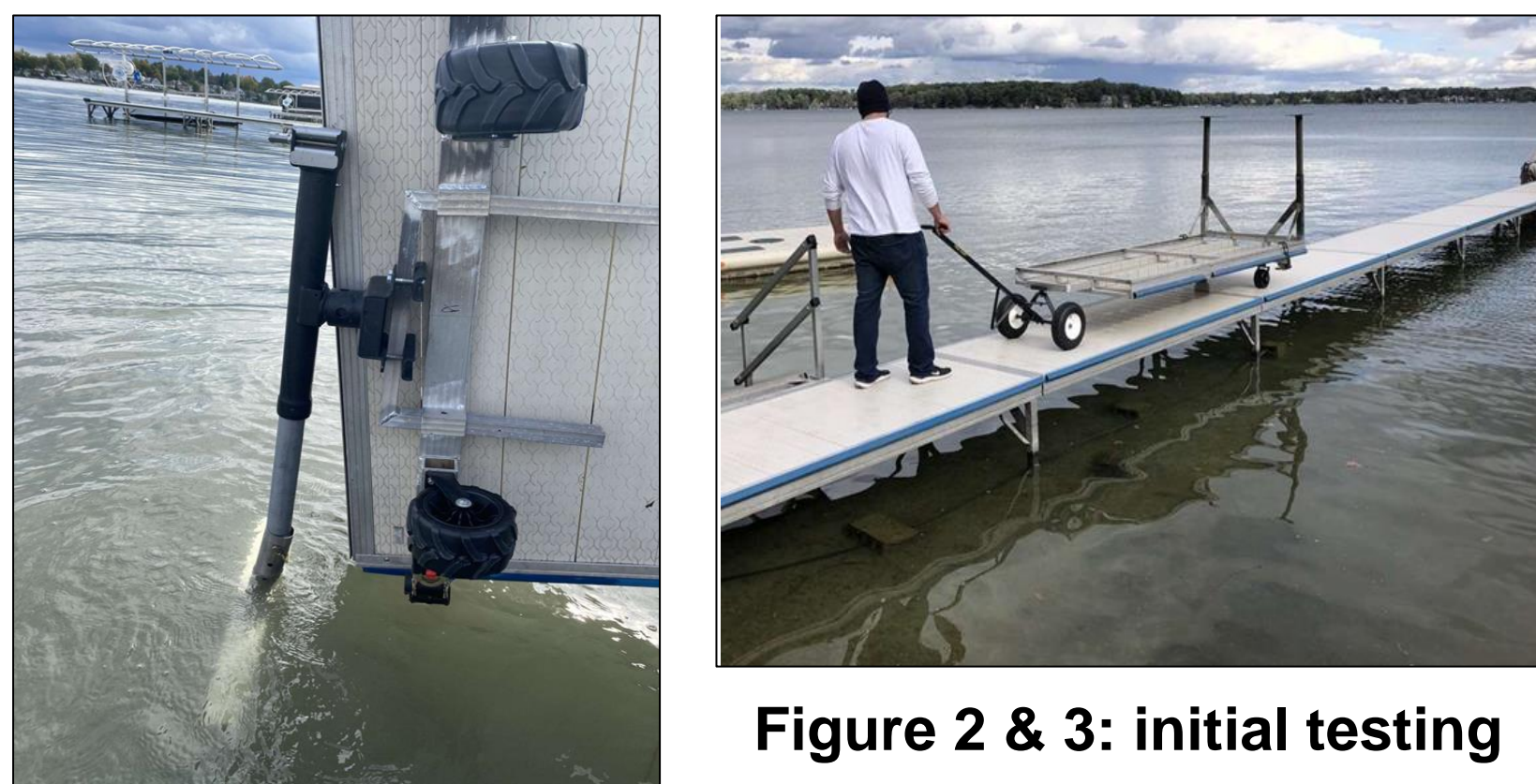


Figure 2 & 3: initial testing

DESIGN CONCEPTS

Multiple concepts were submitted to the sponsor. These initial concepts were comprised of varying components as seen in Figures 4-7.

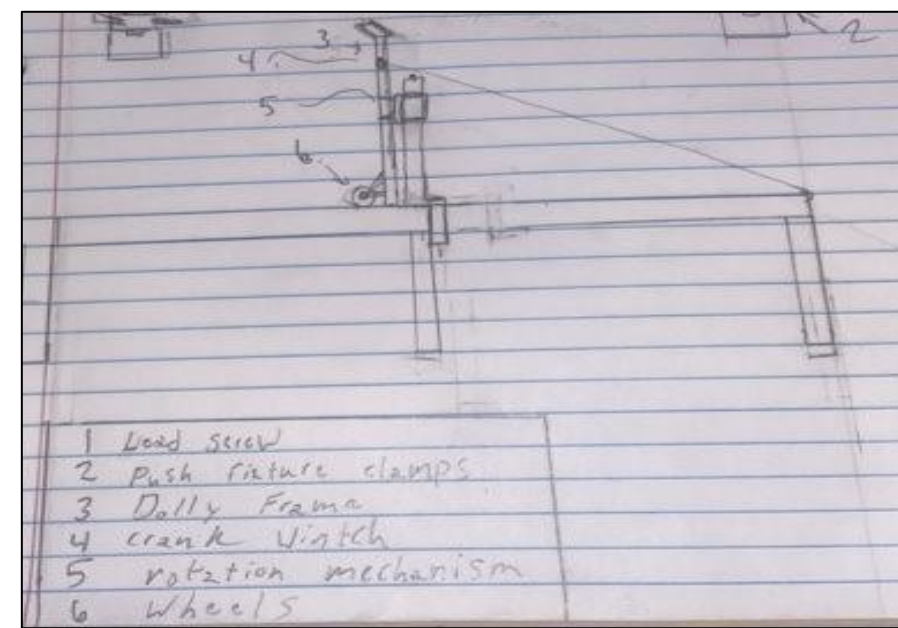


Figure 4: Dolly with Winch and Lead Screw

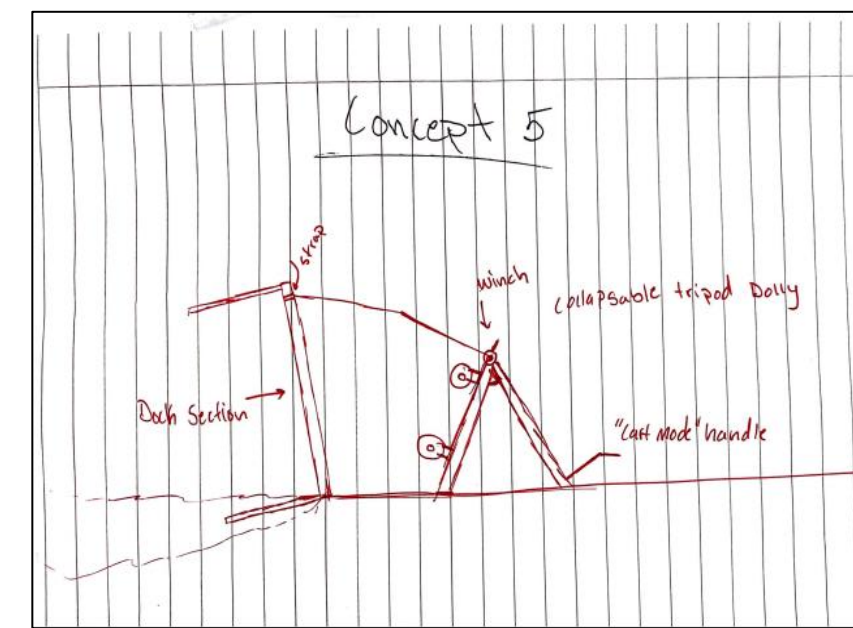


Figure 5: Collapsible cart with winch

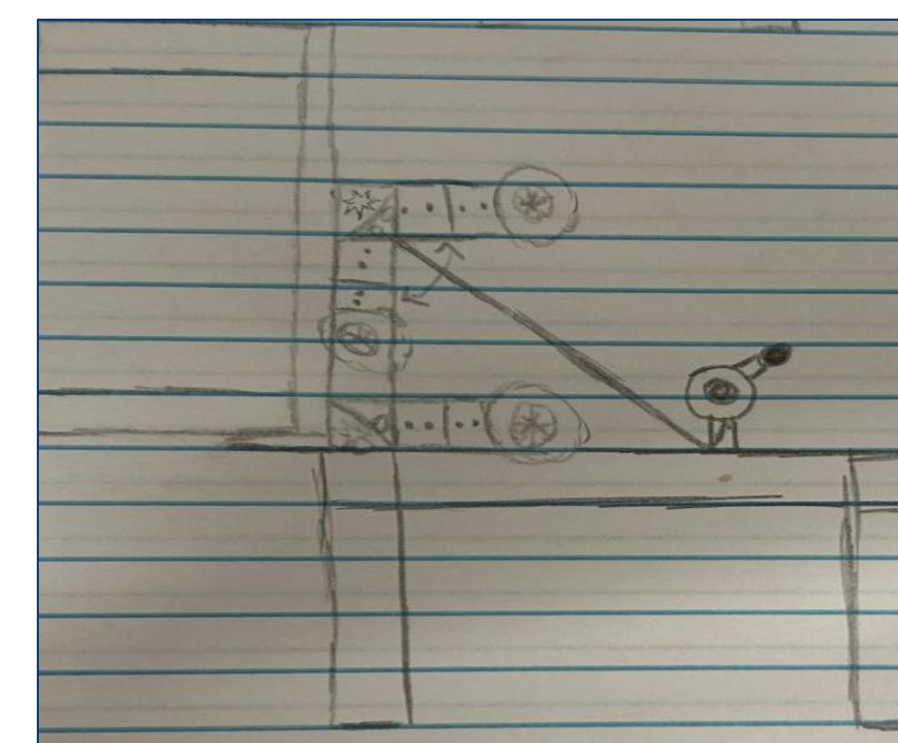


Figure 6: Hand Winch with Roller Dolly



Figure 7: Concept of lead screw mounted to dolly

FINAL DESIGN

The final design has the following components: shore end and lake end mechanism, ratchet bars (2), and a dolly. The shore and lake end mechanisms help with the rotation and lift of a dock section. The ratchet bars and dolly serve as the means to transport each dock section. The ratchet bars will ratchet to the side of the dock section, then with both shore and lake end mechanisms, the user will be able to transport and either lift or lower the deck section in or out of the water. Figures 8 and 9 show the shore and lake end final designs.

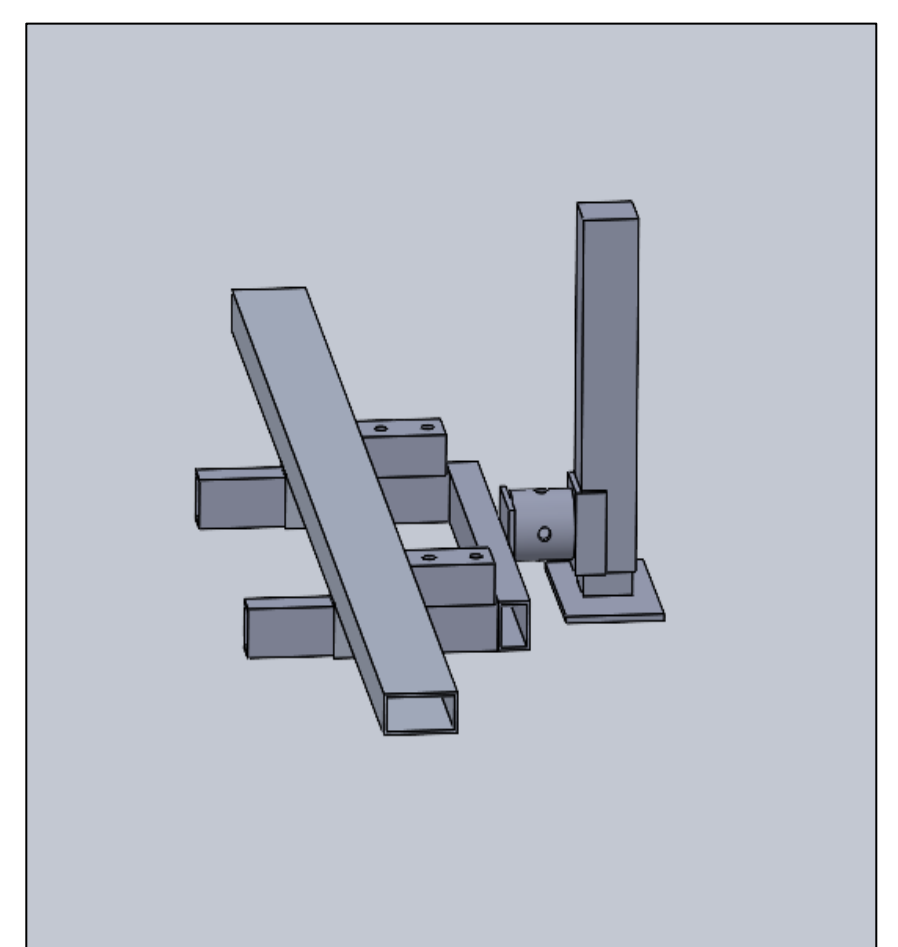


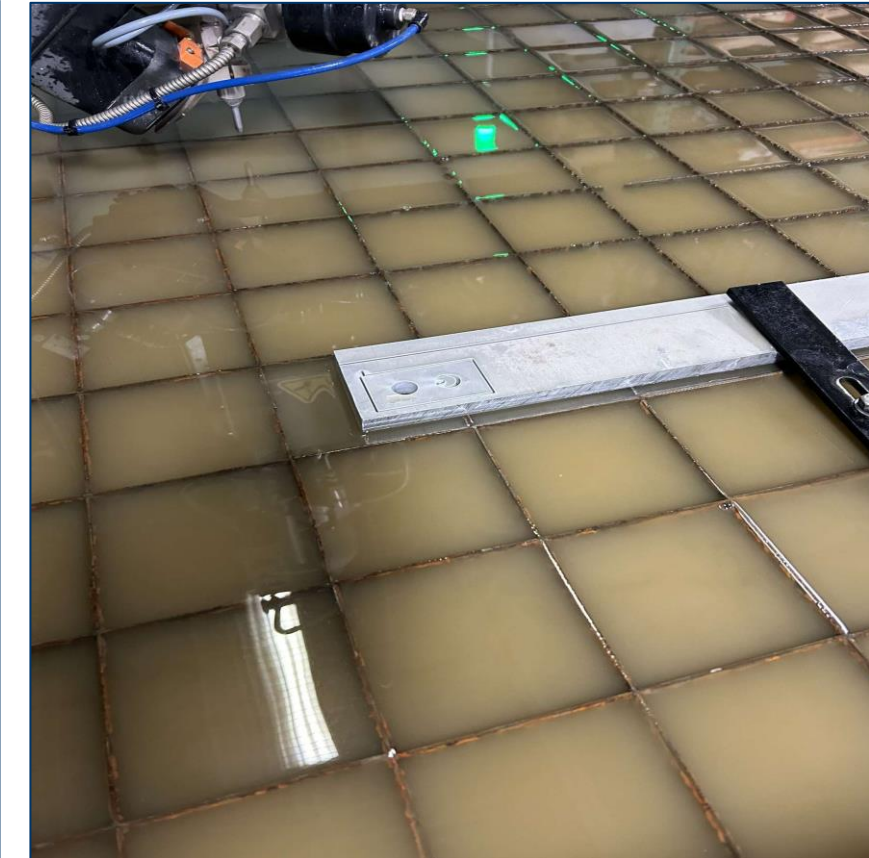
Figure 8: Shore End Design Model



Figure 9: Lake End Design Model

FABRICATION

The mechanism required various fabrication techniques including welding, drilling, water jet cutting, and grinding (Figures 10-13).



Figures 10-13: Shore and Lake End Fabrication

TESTING

The team successfully tested the first prototype March 13th, 2024 (Figs. 14-17). The refined mechanism was tested April 15th.



Figure 14: Dock Section in Storage Area

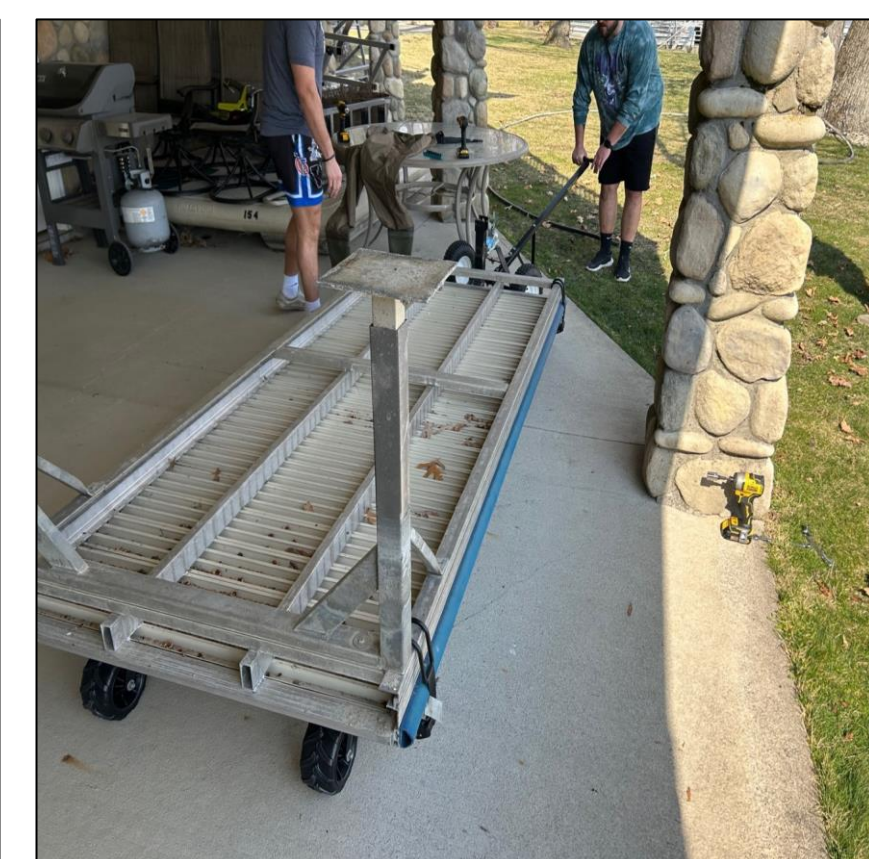


Figure 15: Transportation of Dock

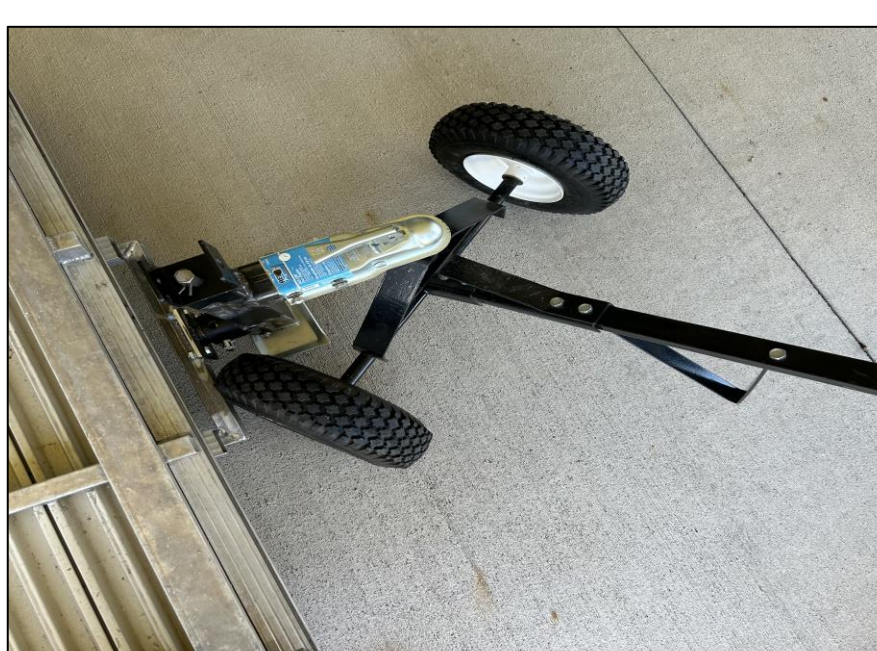


Figure 16: Turn Radius of mechanism



Figure 17: Installing a Dock Section

CONCLUSION

Following the previous iterations of the dock section removal tool, this year's design team successfully designed and fabricated a working mechanism. Additionally, the team's design successfully meets the customer needs stated in the previous section. Figures 18-19 showcase the completed mechanisms produced in this year's iteration of the project. The Dock Dolly project has further development needed to become a commercial product.



Figure 18: Ratchet Bars



Figures 19: Dock Section Removal Tools

LESSONS LEARNED

The design process is ever changing and new developments in engineering are a guarantee. A few of the lessons the team members learned over the design project are as follows:

- How to manage an engineering team
- Proper documentation practices of a design process
- Communication and time management are important for success

ACKNOWLEDGMENTS

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