Haul-A-Day

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Abstract

For our 2022 senior capstone project our group wanted a project that allowed for a lot of hands on work and innovative design. Noticing that long distance runners often used objects not designed for running to carry their gear on long trips we decided to set that as the focus of our project. In the end we designed a cart capable of carrying 100lbs of gear that the runner could pull behind them hands free.

Motivation

Extremely long-distance runners lack a sufficient way to carry their supplies on long trips.

Research

- Survey distributed to over 80 long distant runners with questions regarding distance, terrain, importance of specific features, items carried, etc.
- Messaged online with long distance runners
- Data analyzed and translated into design criteria

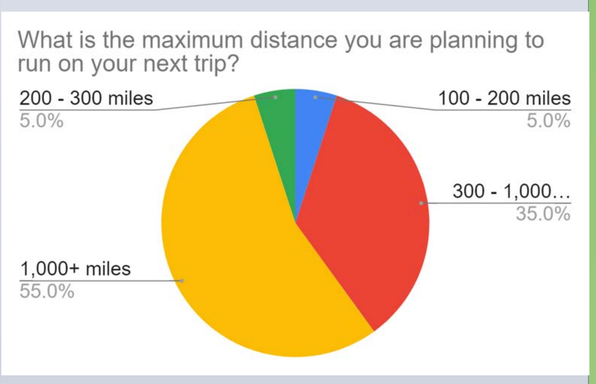


Figure 1: Pie graph showing how long runners plan to run if they had necessary gear

3D Modeling & Testing

- ANSYS modeling was used for finite element analysis of chassis and compliant arm for deformation, stress, and strain.

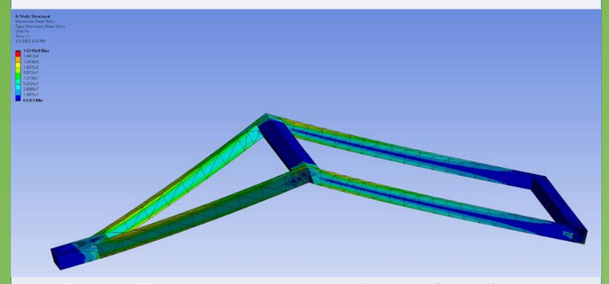


Figure 2: FEA Model showing stress applied to the frame of the cart.

- SolidWorks models of the cart design were used for prototyping, analysis, and final fabrication.

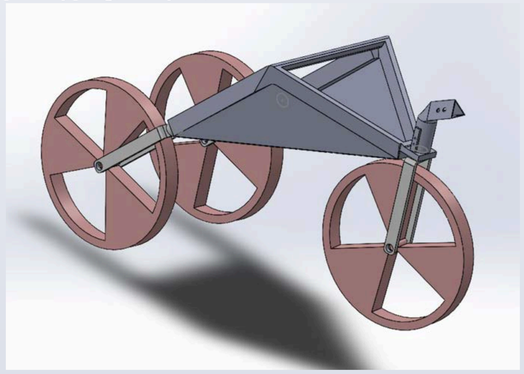


Figure 3: Complete 3D model of one of the final prototypes of the cart.

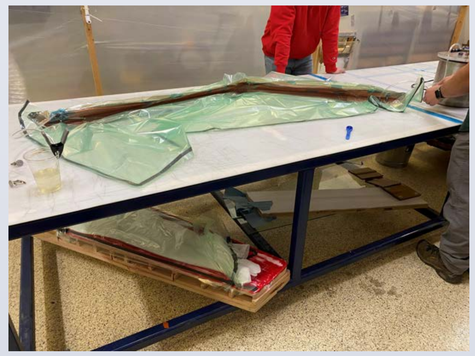
Prototyping

Extensive prototyping was critical at every stage of the process. Prototypes allowed the team to locate hidden assumptions, generate new ideas, and design the best possible system.

Figure 4: One of the final prototypes to test fitment of designed components.

Fabrication of Compliant Arm

Ashton Engineering in Spanish Fork shared their experience and workspace to help us a create a compliant connection arm out of carbon fiber.



Figures 4 & 5: Applying carbon fiber layers and vacuum sealing connection rod.

Fabrication of Compartments

The running cart's compartments were sewn out of UVU Green canvas material for lightweight durability.

Figure 6: Example of sewing the canvas for the cart's soft shell/compartments.

CNC Components

Critical elements of the cart, like the connection, are from the cart frame to compliant arm were designed in Fusion360, fabricate on a CNC Machine and assembled by hand.

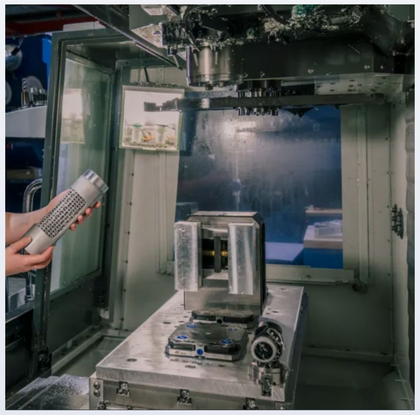


Figure 6: Example of components machined on the CNC.

Fabrication of Frame

The majority of the frame was fabricated out of aluminum. The bike forks were purchased online and mounted to the frame to ensure perfect alignment and stability.

Figure 8: Nearly completed assembly of the frame of the cart.

Conclusion

Throughout the course of the year we successfully designed, tested and manufactured a cart to carry gear for long distance runners more efficiently than what is currently on the market.