

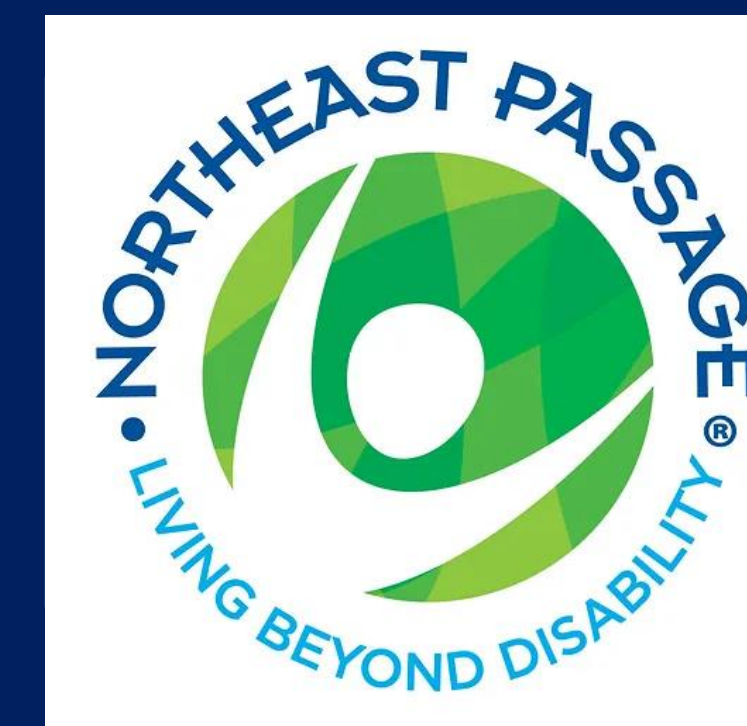


Adaptive Propulsion Sled Hockey

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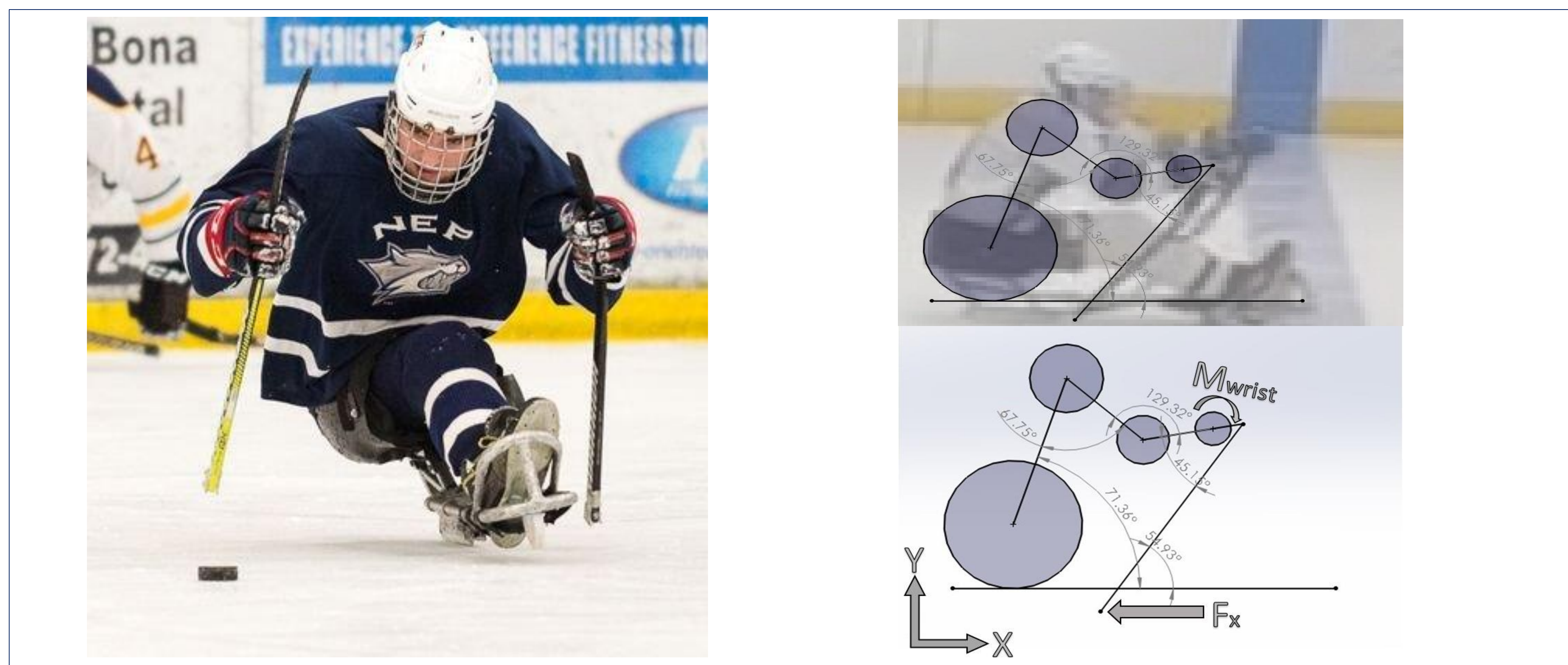
Advisor: Todd Gross



Introduction

Northeast Passage is a non-profit organization affiliated with UNH. It is dedicated to empowering individuals with disabilities to define, pursue, and achieve their Therapeutic Recreation and Adaptive Sports goals. Our focus is with one member of the Northeast Passage sled hockey team. Sled hockey is an adaptation of ice hockey but is played in sleds and uses the sticks for propulsion rather than the players legs and skates. For this project we are working with a student on the sled hockey team whose left hand is incapable of holding the stick and wrist is too weak to be able to support the forces required to propel himself across the ice. Thus, the goal of this project is to design a device that will allow him to play sled hockey independently and to his highest capabilities. To achieve this, our team explored different options but decided to proceed with the concept of an orthotic glove worn by the user that not only holds the sled hockey stick but has a safety release mechanism to ensure the stick will release when experiencing higher than normal forces.

Sled Hockey Player Motion



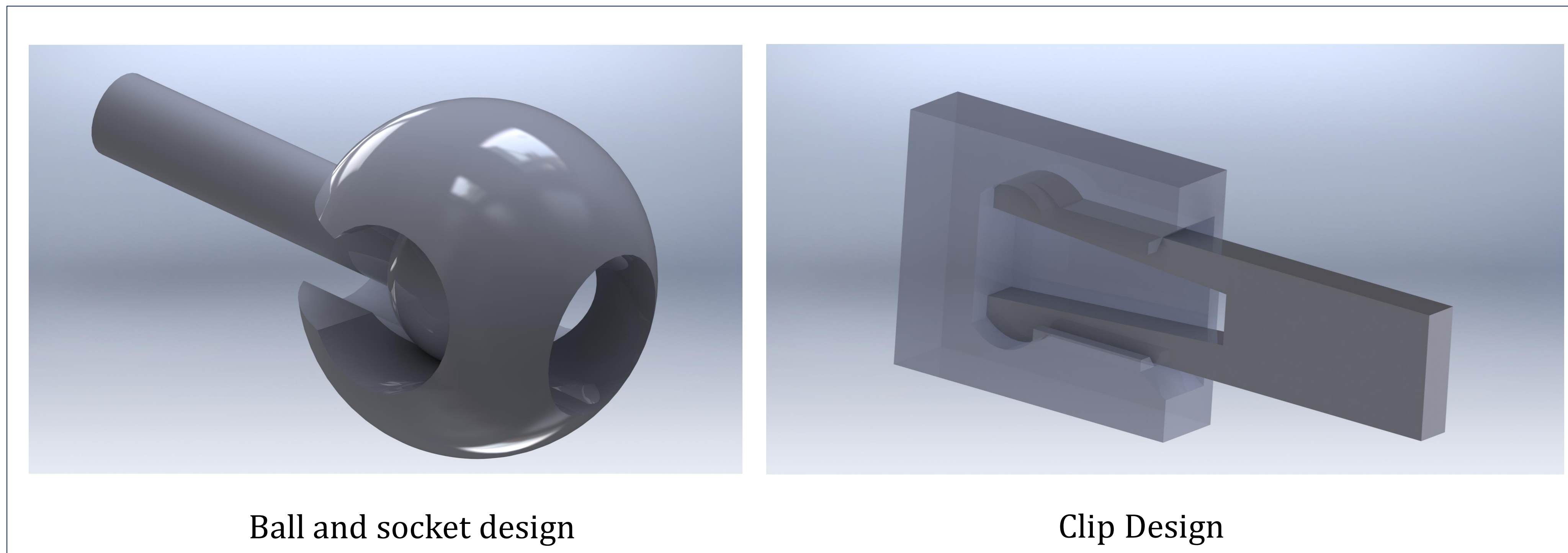
Problems and Solutions

- Sled hockey requires pushers for those who are unable to propel themselves across the ice independently
 - Electro-mechanical solution to replace pushers
 - League rules prohibit something like this
- League rules prohibit numerous things including adaptation of sticks and permanently attaching stick to player's hand
 - Rules allow for modification of glove
 - Decided to go down the path of trying to modify the glove
- Minimal technology currently exists for quick release mechanisms that release at a specified force
 - Developed our own technologies
 - Had to define the relationship between varying dimensions and the force required to release the mechanism
- Must be capable of releasing in four out of six degrees of freedom
 - Thorough research, design, and testing completed to ensure our developed mechanisms were capable of releasing in four directions
- Due to the physicality of the sport, the solution must be robust.

Methodology

- Background research was conducted to determine which options were most viable while conforming to the rules and requirements of the sport.
- Motion capture analysis was conducted to determine player accelerations and relevant forces experienced on the player and sticks.
- Occupational therapy examinations were conducted to quantify the strength and range of motion of the player to determine if the player could propel themselves.
- Iterative design and testing to create and refine the release mechanism for the stick mount.
- Testing was performed to establish a relationship between a specific dimension of the design and the force required to release the mechanism

Mechanism Designs

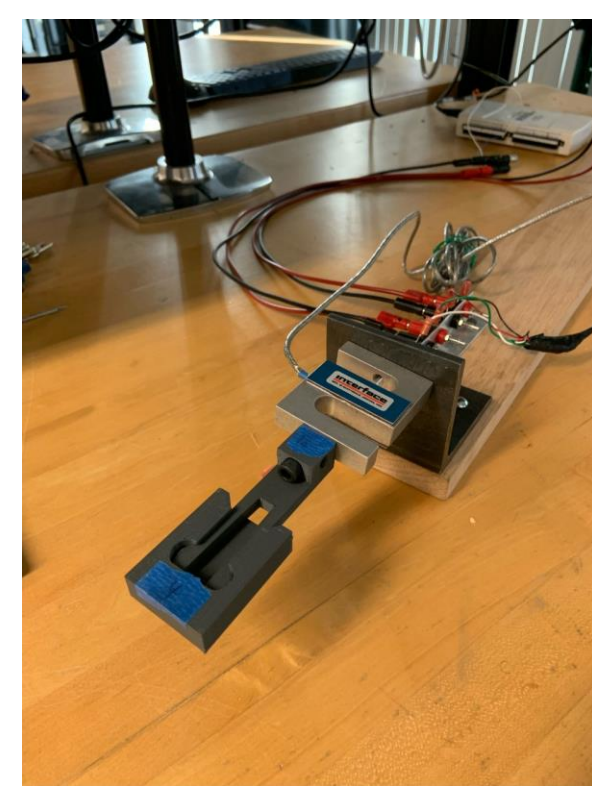
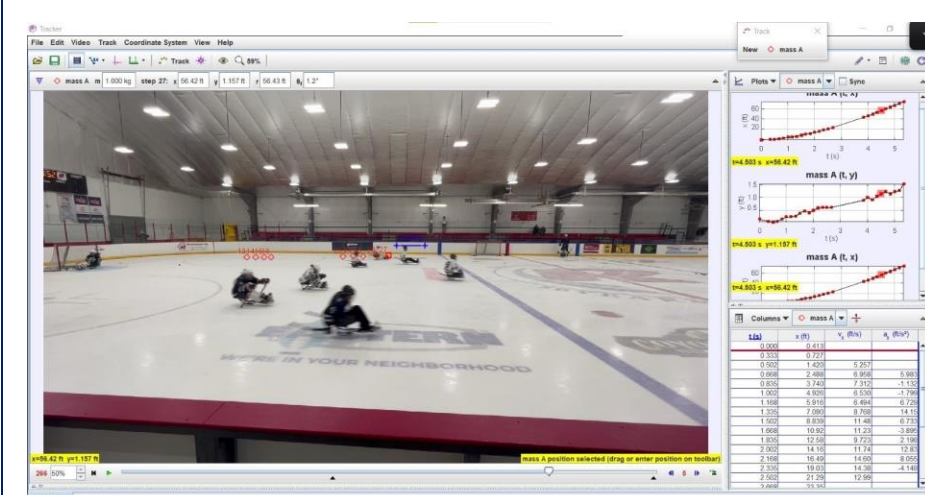


Results and Conclusions

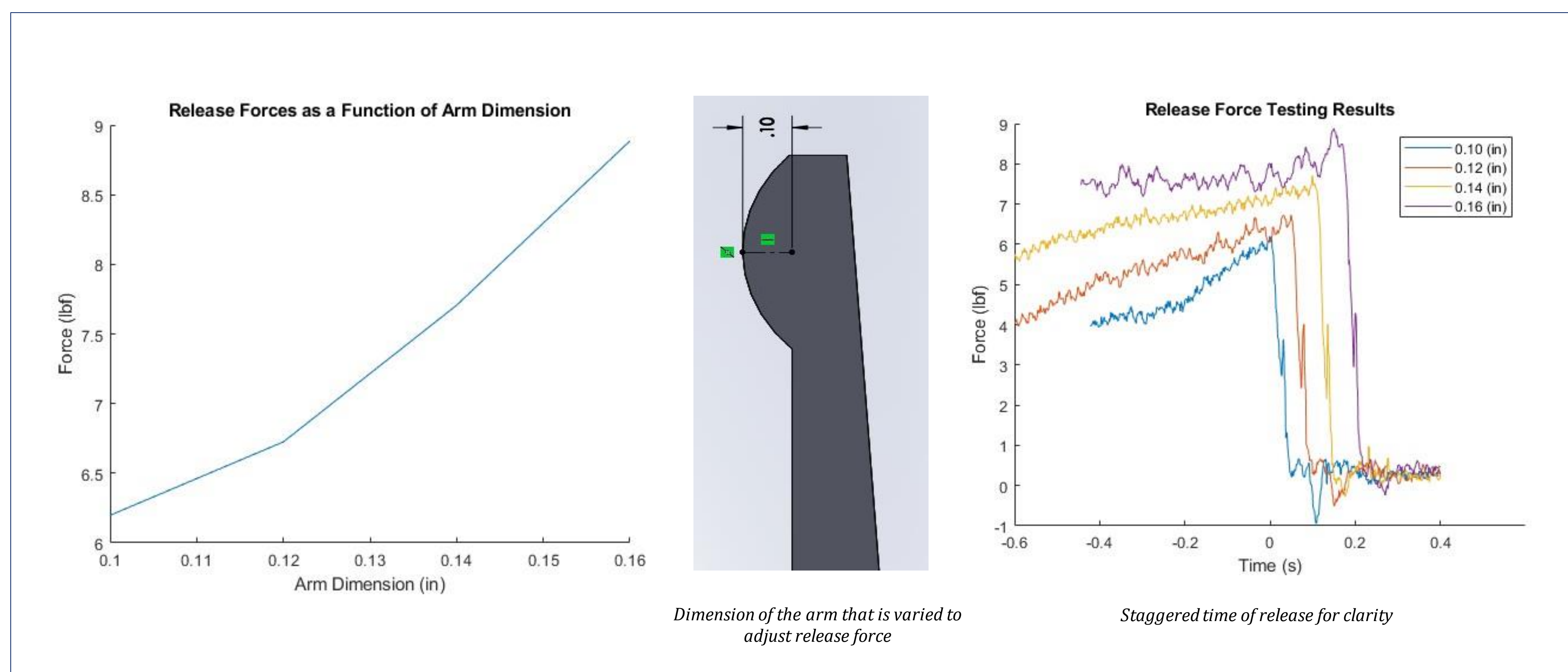
Our team has 3-D printed several prototype solutions and performed force testing to optimize the correct safety-release mechanism. The clip design has been established as the safety release mechanism the team will move forward with due to its versatility and consistent results. As a result of the force testing, a relationship has been determined between the arm dimensions of our clip design and the associated release force. Ultimately this project has developed a solution that is conscious of user safety, is legal within league equipment rules, and allows the user to stay competitive and fully independent while playing the sport of sled hockey.

Testing

- 100-pound load cells were used to collect data on the force required to release the mechanism
- All four degrees of freedom were tested on both designs the team developed
- Tracker software used to find average speed of sled hockey players
 - Used accelerations to find force applied to find desired release force for safety mechanisms



Analysis Results



Moving Forward

- Going forward the goals of this project are to:
- Determine the appropriate maximum forces necessary for the safety feature, according to our user
 - Re-design the clip mechanism according to these maximum forces
 - Attach the new clip design to an arm brace
 - On-ice performance testing

Acknowledgements

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