

Spring 2022

## Prosthetic Knee for CURE Kenya: Design and Manufacturing

Josiah D. Moyer

Josh D. Mundis

Isaiah D. Bryner

Nathan E. Jaloszynski

Sarah N. Kelchner

*See next page for additional authors*Follow this and additional works at: <https://mosaic.messiah.edu/engr2022>Part of the [Engineering Commons](#)Permanent URL: <https://mosaic.messiah.edu/engr2022/10>

---

Sharpening Intellect | Deepening Christian Faith | Inspiring Action

Messiah University is a Christian university of the liberal and applied arts and sciences. Our mission is to educate men and women toward maturity of intellect, character and Christian faith in preparation for lives of service, leadership and reconciliation in church and society. This content is freely provided to promote scholarship for personal study and not-for-profit educational use.

---

**Authors**

Josiah D. Moyer, Josh D. Mundis, Isaiah D. Bryner, Nathan E. Jaloszynski, Sarah N. Kelchner, Carter D. Urich, and Jamie R. Williams Ph.D.

---



# Prosthetic Knee for CURE Kenya: Design and Manufacturing



2022 School of Science,  
Engineering and Health  
Symposium

Josiah Moyer, Joshua Mundis

## Introduction & Problem Statement

Partner: CURE Orthopedic Hospital in Kijabe, Kenya



- There are many lower-limb amputees in the region due to infection and disease
- Through-knee prostheses are very expensive (\$2,500 USD)
- Through-knee amputees often undergo a more invasive trans-femoral surgery out of financial necessity
- There is a great need for affordable through-knee prosthetics

## Group Mission

This project aims to serve individuals with lower-limb amputations by providing a knee-disarticulation prosthesis that is fully functional, low cost, aesthetically pleasing, and easily manufacturable.



Pictured from left to right (starting from the back): Josiah Moyer, Nate Jaloszynski, Josh Mundis, Carter Urich, Dr. Jamie Williams, Ike Bryner, and Sarah Kelchner

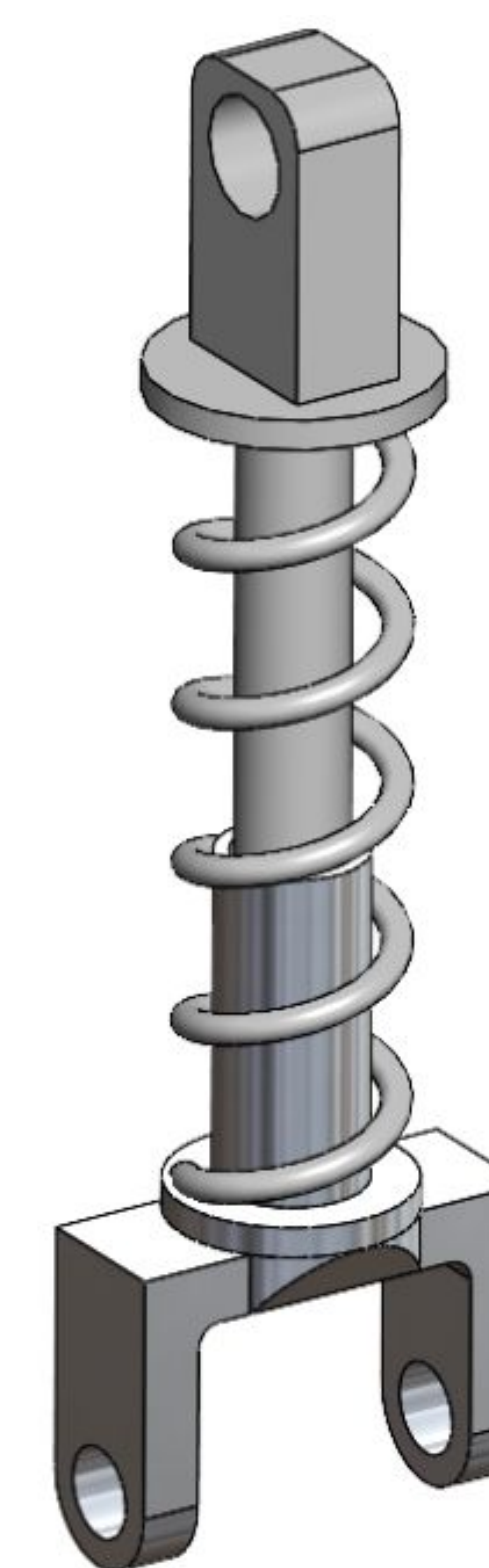
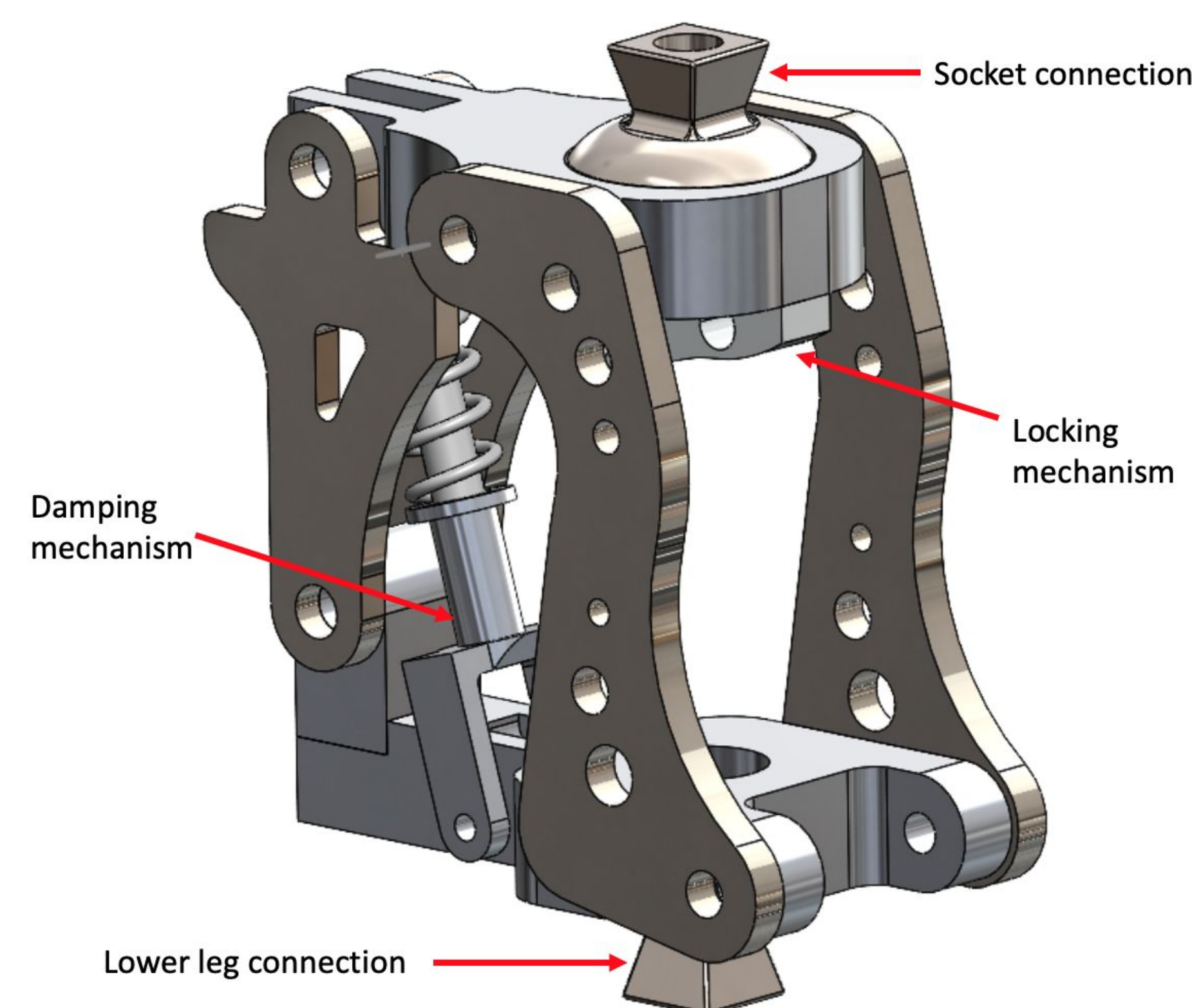
## Prosthetic Knee & Damping Mechanism Design

Our design features:

- Polycentric four bar linkage design
- Spring-based passive damping mechanism
- Strategic proportioning to minimize thigh lengthening
- Mechanical-pinned locking mechanism

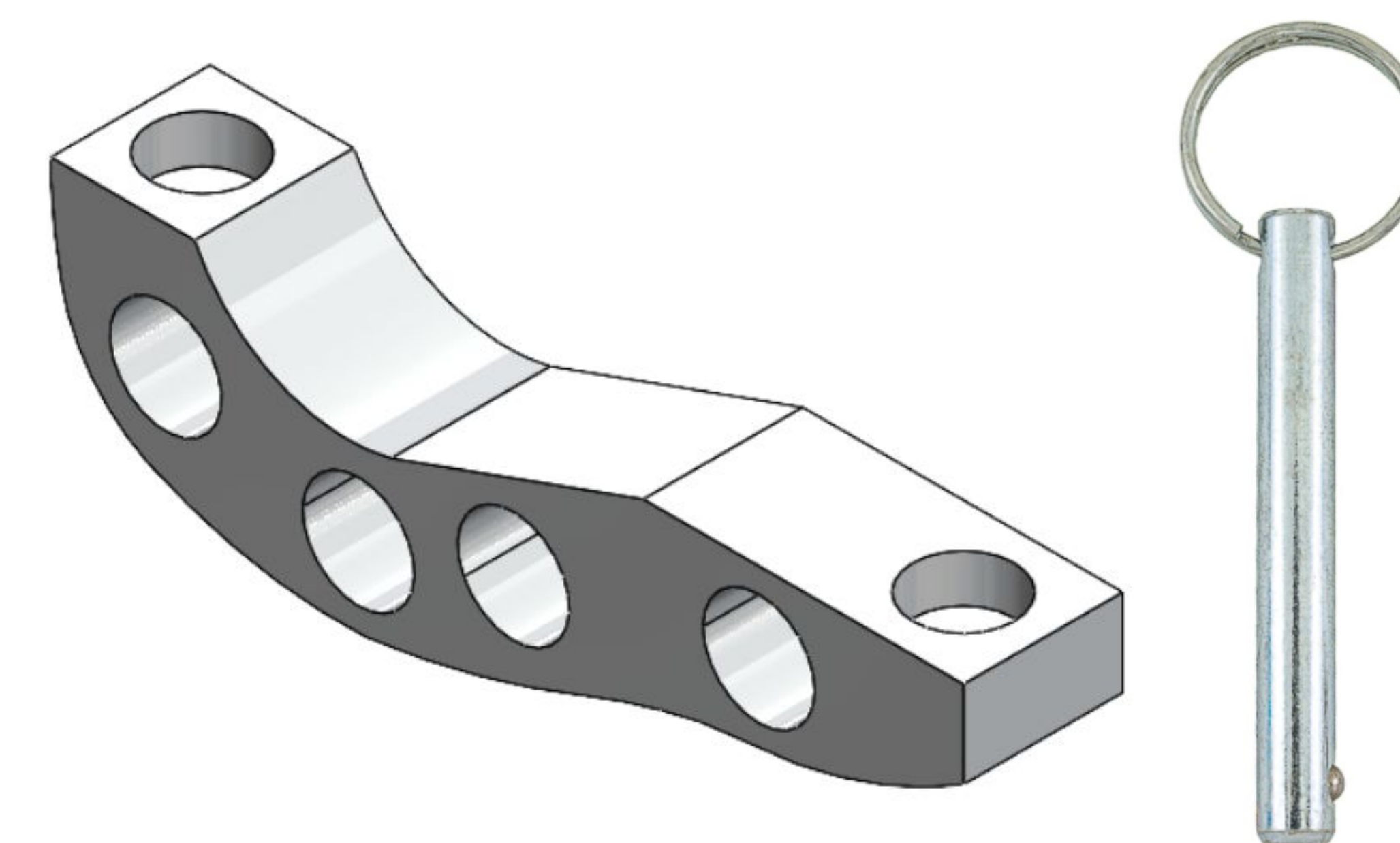
Our damping mechanism features:

- Spring-loaded design validated by SOLIDWORKS motion analysis
- Sleek, seamless integration into interior of knee
- Maintains stability of knee during extension and walking



## Locking Mechanism

A new addition to our project this year was a locking component that will hold the knee at a particular joint angle using a jamming pin.



The functional purpose of the component is twofold:

- Locking knee at 90 degrees for sitting
- Locking knee at 180 degrees for peg-leg walking

## Conclusion and Future Plans

We are currently manufacturing physical prototypes for our damping and locking mechanisms. We plan to begin physical testing on the prosthesis next semester. We aim to deliver a functional knee with a manufacturing protocol by May 2023.

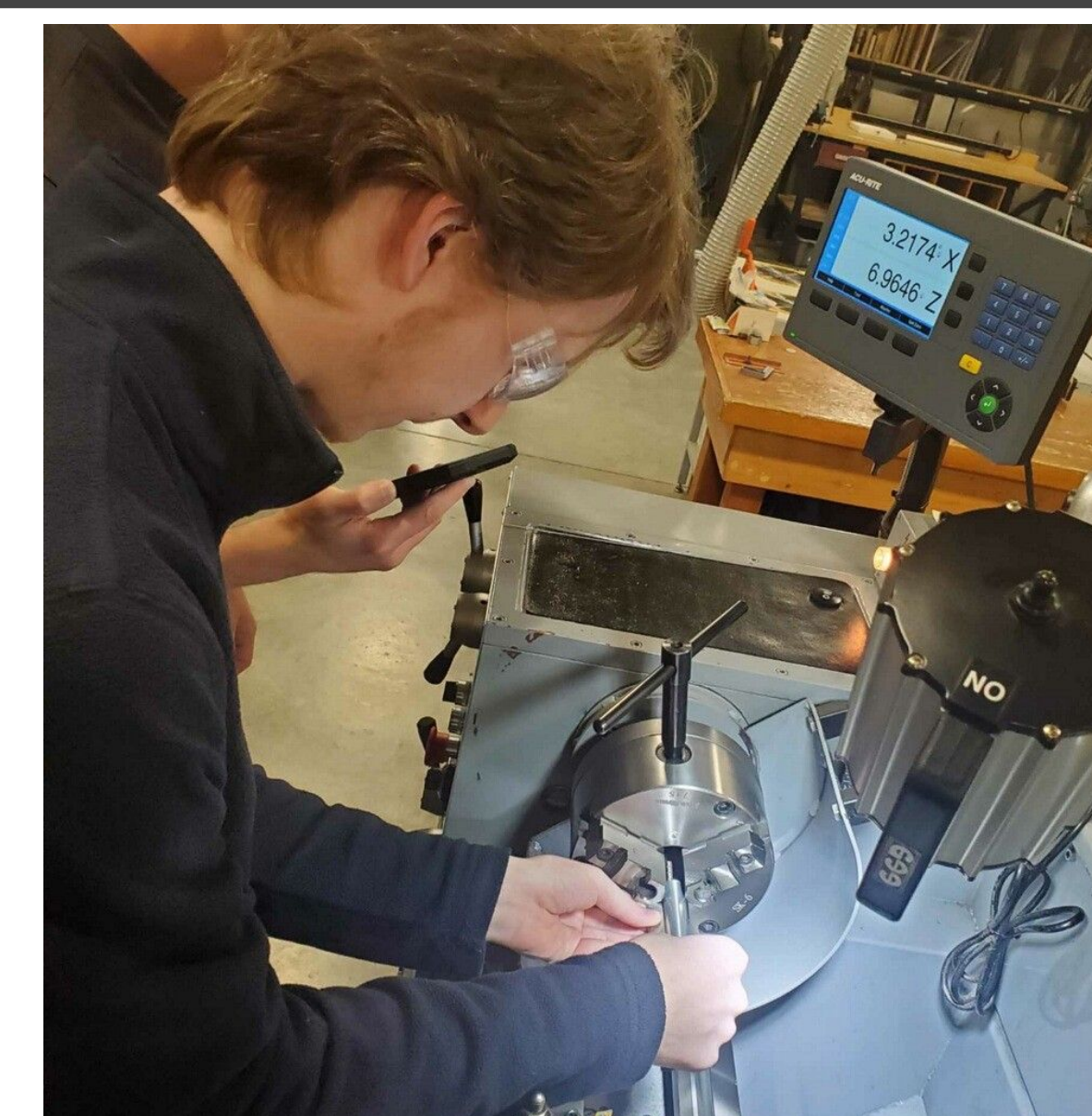
## Acknowledgments

We sincerely thank the following individuals for their assistance and guidance:

- Ike Bryner, Nate Jaloszynski, Sarah Kelchner, Carter Urich - Team Members
- Dr. Jamie Williams - Project Manager and Consultant
- Dr. Emily Farrar - Project Founder and Consultant
- Eric Shoemaker (MS, CPO) - Professional Consultant
- Tim Howell - Project Consultant
- John Meyer - Manufacturing Consultant

## Progress on Manufacturing

We have begun the manufacturing process for both the locking mechanism and top chamber of the damping mechanism, which will be integrated with the prosthetic housing design that was manufactured in the previous year. Both the locking mechanism and damping chamber are composed of Aluminum 7075 T-6.



DEPARTMENT OF  
ENGINEERING





## Disclaimer

The work presented in this document has been provided solely for educational and edification purposes. All materials are composed by students of Messiah University and are not certified by any means. They do not constitute professional consultation and require the examination and evaluation by a certified engineer through any product development process. The contents documented are the produced work by the student design team but do not necessarily represent the as-built or as-assembled state of a complete and tested design; faculty, staff, and other professionals involved in our program may have augmented the student engineering work during implementation, which may not be recorded within this document.

Messiah University, the Collaboratory, nor any party related to the composition of this document, shall be liable for any indirect, incidental, special, consequential, or punitive damages, or any loss of profits or revenues, whether incurred directly or indirectly, or other intangible losses, resulting from your access to or use of the provided material; any content obtained from the provided material, or alteration of its content.