Safe Shower Solution for Below-the-Knee Amputee
Progress Report 10

November 8, 2026 – November 14, 2026

Client: Mike DeGrave

Advisor: Prof. Murphy

Team:n
Sam Dudek - dudek4@wisc.edu (Co-Team Leader)
Ben Willihnganz - bwillihnganz@wisc.edu (Co-Team Leader)
Claire Matthai - cematthai@wisc.edu (Communicator)
Katelyn Williams - kmwilliams37@wisc.edu (BWIG)
Kimberly Jarrard - kjarrard@wisc.edu (BPAG)
Marcus Wentzel - mfwentzel@wisc.edu (BSAC)

Problem Statement

Below-the-knee amputees are unable to wear their prosthetic in the shower, as most prosthetic legs are not waterproof and are prone to corrosion and slippage. This forces individuals to either remove their prosthetic and shower while seated, or attempt to stand on one leg using unsafe workarounds - both of which carry significant fall risk. The objective of this project is to design a device that gives below-the-knee amputees the autonomy to safely enter, stand, and bathe in the shower without their prosthetic, restoring independence and reducing injury risk during a daily activity. This project is being developed in partnership with Mike DeGrave, a below-the-knee amputee whose personal experience with this challenge is the driving inspiration behind the work.

Brief Status Update

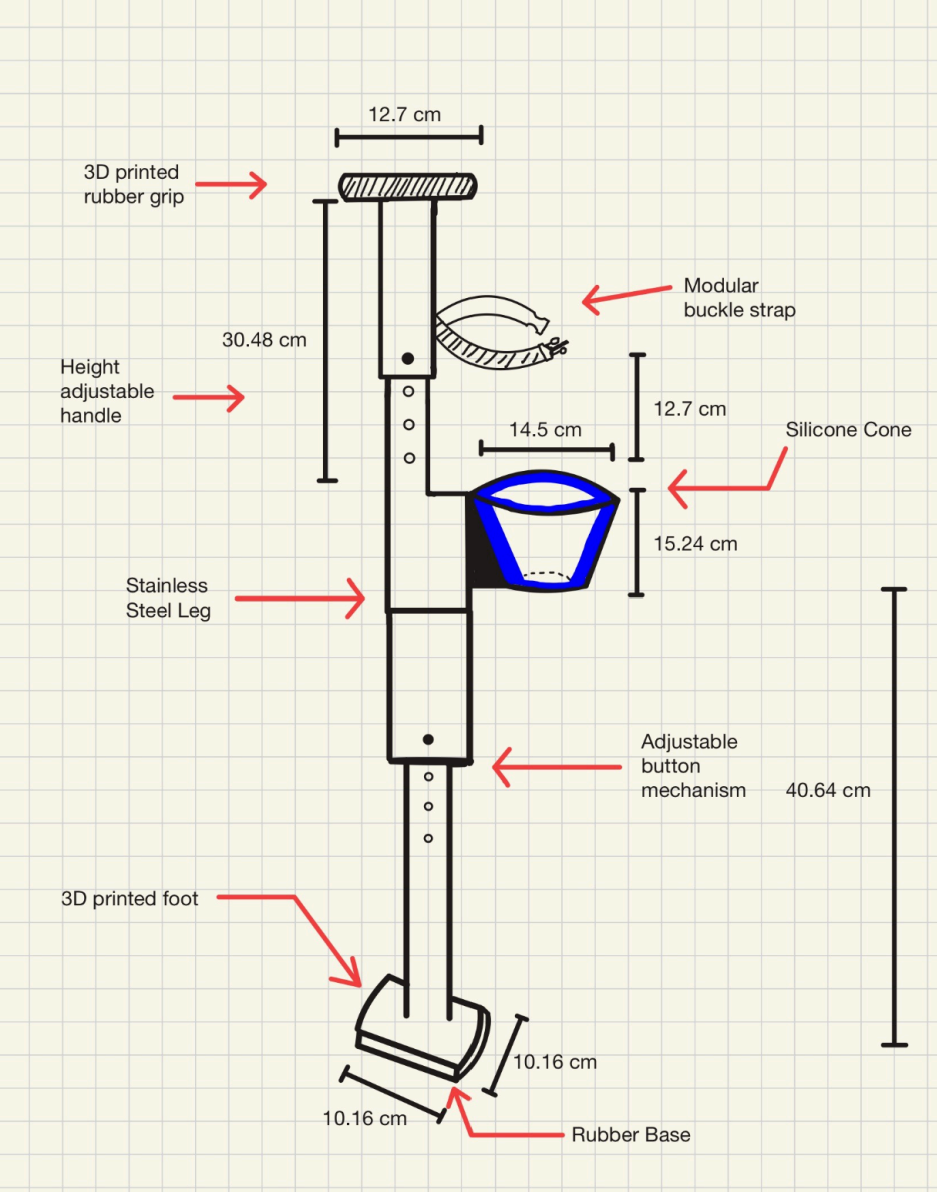
This week the team ordered our final materials for fabrication and started drafting our protocols that we will run on Friday. The foot team has ordered a 4x4x12 block of HDPE that we will fabricate into the foot, and afterwards will run through our adhesion protocol. The cone team participated in fabrication and print of the cone this week. The team prepared testing and fabrication protocols and prepared for in person testing next week.

Difficulties / Advice Requests

N/A

Current Design

Modified Air Jordan:



Materials and Expenses

Item	Description	Manufac-turer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
Preliminary										
Drive Air-Crutches with	Anodized Aluminum Crutches	Drive DeVilbiss Healthcare	MD10300BK	DME Superstore	MD10300BK	10/19/2026	1	$109.99	$109.99	Crutches

Airgonomic Underarm Cushions - Onyx										
SoleTech Genuine Grip Soling Sheet, 4mm, Black	Rubber Grip Sheet	SoleTech, Inc.	87G10323 2	Shoe and Boot Acessories 4 U	N/A	11/6/2026	1	$22.16	$22.16	Grip Sheet
Tear-Resistant Super-Cushioning EVA Foam Sheet, 1/2" Thick, 24"x24"	EVA Foam Sheet	N/A	N/A	McMaster-Car	86095K55	11/6/2026	1	$53.33	$53.33	EVA Foam
Moisture-Resistant HDPE Bar, 4" Thick, 4" Wide, 1 Foot Long	HDPE Bar	N/A	N/A	McMaster-Car	8671K88	11/6/2026	1	$52.39	$52.39	HDPE
Category 2										
									$0.00	
									$0.00	
								TOTAL:	**$237.87**	

Goals

Major team goals for the next week

1. Finalize fabrication of the cone and the base.
2. Begin testing of the comfort for the cone and schedule a client meeting.
3. Begin testing the coefficient of friction of the base to ensure safety measures are met.

Next week's individual goals

- Sam Dudek
    - Fabricate the foot by using our HDPE block and the mill down in the ECB
    - Use the protocol for adhesion between rubber and HDPE to glue our antislip tread onto the foot
    - Do coefficient of friction testing on wet and dry shower material
    - Do stabilogram testing with the client next week Thursday

- Ben Willihnganz
    - Complete prototyping of the cone by adding foam
    - Complete all protocols for testing and begin testing specific cone pieces
    - Perform in person testing
- Claire Matthai
    - Print out the cone and add the EVA foam with the cone team
    - Create a travel plan to share with our client
    - Finalize testing protocols
- Katelyn Williams
    - Add the EVA foam to interior of printed cone
    - Test cone piece with specific testing protocols
    - Complete in person testing of prototype with client
- Kimberly Jarrard
    - Fabrication of the Foot
    - Attach the rubber to the HDPE foot
    - Start testing
- Marcus Wentzel
    - Fabricate the Foot of the prosthetic in ECB using the mill
    - Attach the rubber sole to the HDPE using a sanding, heating, and glue method
    - Complete the intended testing for the foot of the prosthetic both with and without the client

Timeline

Task	September				October					November				Dec	
	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11
Project R&D															
Brainstorm	X	X	X	X											
Research		X	X	X	X	X	X	X	X	X	X				
Prototyping & Fabrication								X	X	X					
Testing & Validation											X				
Deliverables															
Progress Reports		X	X	X	X	X	X	X	X	X	X				
PDS			X												
Design/Decision Matrix Criteria				X											
Prelim Presentation					X										
Show and Tell									X						
Final Poster															
Meetings															
Client			X	X	X										
Advisor	X	X	X			X	X	X	X		X				
Website															

Update	X	X	X	X	X	X	X	X	X	X	X				

Filled boxes = projected timeline
X = task was worked on or completed

Detailed Accomplishments

The team split up into two groups and separately have been doing extensive research and designing of our two main individual pieces: the foot and the cone. Our groups are as follows:

Cone: Katelyn, Ben, Claire

Foot: Marcus, Kimberly, Sam

We have all of our materials ordered. Friday we will be fabricating in order to have a prototype done by next Thursday.

Previous Week's Goals and Accomplishments

- Sam Dudek
    - Research different properties of EVA foam for our anti-slip material on the bottom of our foot
    - Research adhesion properties of common plastics and foams to try and find a way to connect our materials together
    - Met with the cone team to talk about how to fabricate our foot via machining
- Ben Willihnganz
    - Research fabrication methods for silicon and EVA foam to line the inside of the cone
    - Implement comfort measure to the inside of the cone to ensure
- Claire Matthai
    - Work with the cone team to create initial prototype
    - Create comfort testing protocol for client visit
- Katelyn Williams
    - Decide materials that will be used for lining the cone and create fabrication steps aligned with those materials
    - 3D print the cone prototype with selected material
- Kimberly Jarrard
    - Finalize materials that we will be using for the foot and order them
    - Start fabrication for the foot of the design
- Marcus Wentzel
    - Finalize the materials for the foot
    - Order the materials for the foot so that we can begin machining

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Sam Dudek	11/10	Meet with Dr. Wille about testing protocol for stabilogram testing and a coefficient of friction testing	1	3	37
	11/11	Look more into a way to do our protocol for friction testing and order materials for the group	1		
	11/12	Catch up on how mills work and the means of fabrication for the foot.	1		
Ben Willihnganz	11/10	Prepared Fabrication Protocol for the cone portion of the design	2	4	37
	11/11	Brainstormed fabrication changes that could benefit the design	2		
Claire Matthai	11/10	Met with Dr. Willie to gain advice on potential testing protocols with the force plates.	1	3	37.5
	11/12	Created a test protocol for next week's force plate testing with our client.	1		
	11/12	Created a comfort test for our client to fill out during testing.	1		
Katelyn Williams	11/10	Modified existing CAD model to match exact dimensions needed based on crutch and layer of EVA foam.	2.5	4	33
	11/10	Researched cross pins and insert concepts based on FEA results and design concerns.	1.5		
Kimberly Jarrard	11/9	Finalize between HDPE vs UHMW-PE and order the necessary material	1	2	28.5
		Update the material expense sheet	1		
Marcus Wentzel	11/6	Finalize the anti-slip material and determine a final product to order	1	2	29.75

	11/8	Research methods of attaching the anti-slip material to the HDPE foot	1		