

Bicycle Prosthetic Arm



INTRODUCTION

Outdoors for All Mission: To enrich the quality of life for children and adults with disabilities through outdoor recreation.

- Collaborated with Seattle Public Schools to develop and implement a bike safety education program
 - Supported a student with an above-the-elbow limb difference who faced challenges during participation

Customized Prosthesis Cost:

\$ 10k - 100k

- lower end - one functional prosthetic hook
- higher end - latest technology

Adjustable Prosthetic Arm Cost:

≈\$150-200

- User-adjustable fit for various residual limb lengths and shapes
- Repair and maintenance-friendly design

FINAL DESIGN



Silicone Liner

Function: Stability and comfort
Material: EcoFlex 00-45
Connection: Shuttle lock to silicone liner

Outer Socket

Function: Adjustable diameter for residual limb
Material: PETG
Connection: Shuttle lock to forearm

Forearm

Function: Adjustable forearm length
Material: Aluminum
Connection: Connects to outer socket with bolt

Hand Attachment

Function: Quick release
Material: Steel
Connection: Threaded into machined part

VERIFICATION TESTING



CONCLUSION AND FUTURE WORK



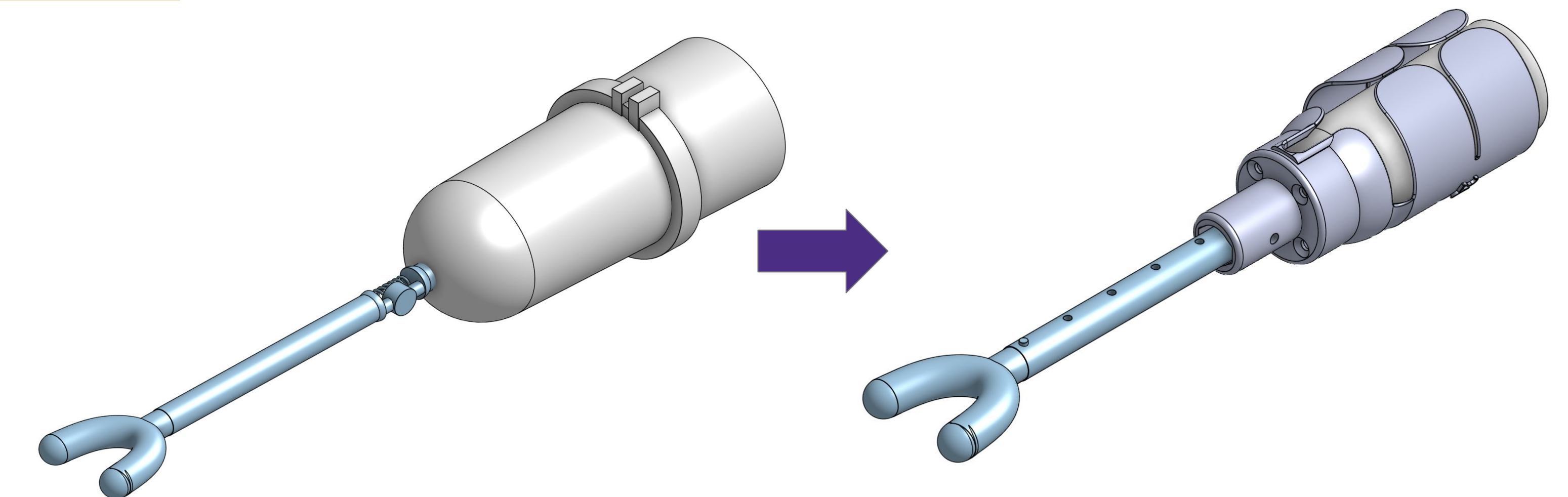
Prototype achieves core functions: adjustable forearm and upper arm, quick release with prong hand attachment, and stable component design. We were unable to find volunteers with above elbow limb differences. Future work should include:

Volunteer Testing: on-bike testing, surveys

Prototype Redesign: elbow joint, attachment for below elbow limb differences, add urethane to umbrella design for durability

Full Assembly Specs:
Total Weight: 1.90 lb
Diameter: 3.5", 4"
Total Length: 21.25"

DESIGN AND DEVELOPMENT



Three Main Components

- **Hand:** Two-prong design that enables quick release, allowing the user to easily detach from the bike
- **Forearm:** Crutch-style structure with adjustable length to accommodate different arm sizes
- **Upper Arm:** Consists of two parts—a silicone liner which provides comfort for the residual limb, and an adjustable outer socket

Key Design Decisions: No wrist or elbow joints. The hand attachment is designed for pushing and resting only. The upper arm features a strap-tightening system for a secure and adjustable fit



References

- [1] "Prosthetic arm: Function, types, cost," PrimeCare, <https://primecareprosthetics.com/blog/what-you-should-know-before-getting-a-prosthetic-arm> (accessed May 23, 2025).
[2] ITV News, "Girl, 7, is now able to ride a bike due to New Prosthetic Arm," ITV News, <https://www.itv.com/news/meridian/2022-04-26/girl-7-is-now-able-to-ride-a-bike-due-to-prosthetic-arm> (accessed May 23, 2025).

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Mechanical Engineering Capstone Exposition

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