

Prosthetic Adapter for Agricultural Machinery

Our Story



Hugh Herr's BiOM (MIT Lincoln Lab)



Discovery



1/10 (-National Safety Council)

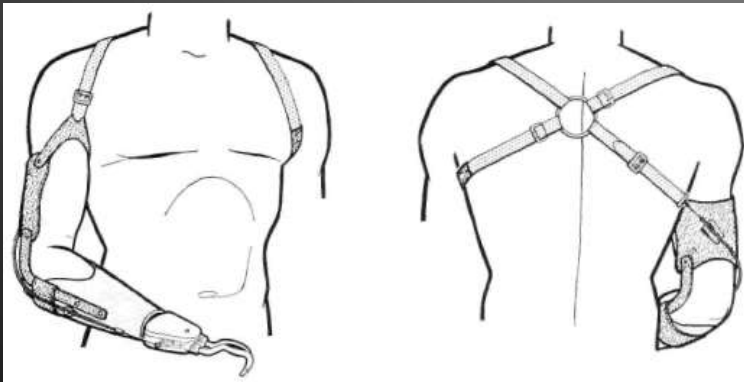
Problem



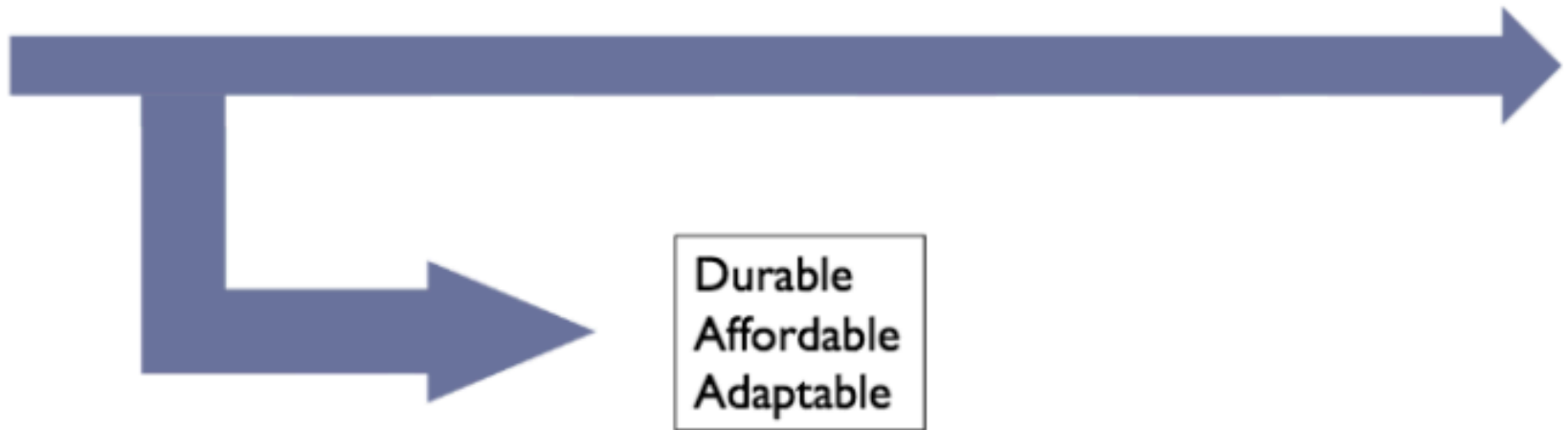
Otto Bock "Michelangelo"



Fillauer "Workers Hook"



Evolution of Prosthetic Design



Learn



(Athol, MA)

Learn

ottobock.



Bill Hansen, President
Liberating Technologies



Byron Backus, CP,
Clinical Specialist



Craig Heckathorne, MS,
Research Engineer, NUPOC

Design Goals

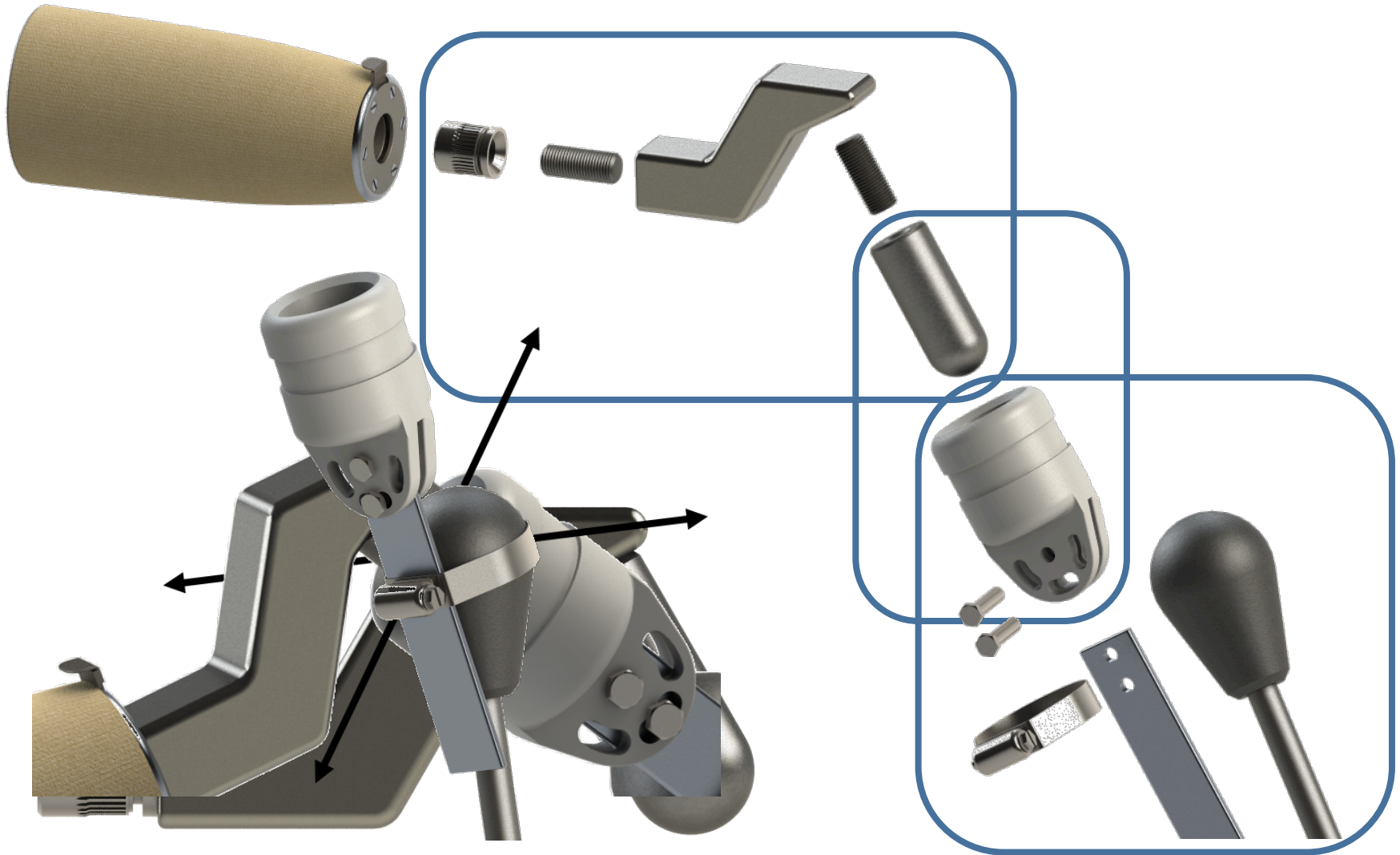
Functional Requirements

- ▶ Force
- ▶ Speed
- ▶ Durability
- ▶ Adaptability
- ▶ Safety

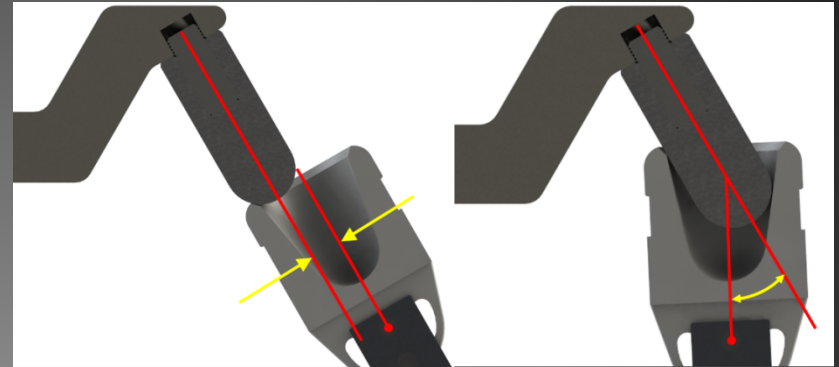
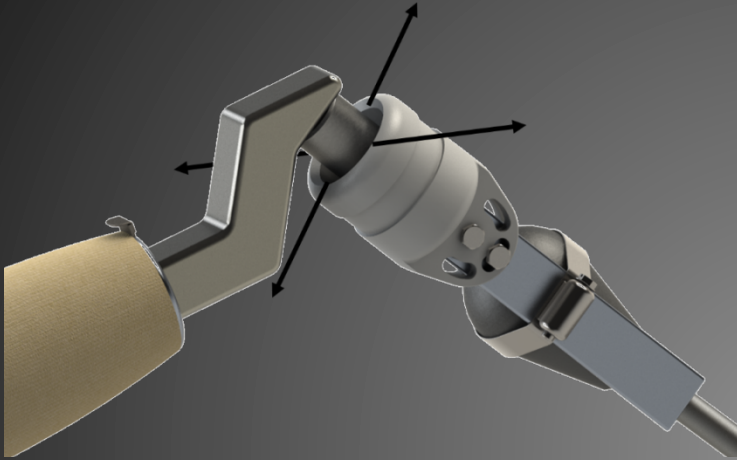
Ergonomics

- ▶ Range of Motion
- ▶ Posture
- ▶ Length & Weight
- ▶ Tactility

Design

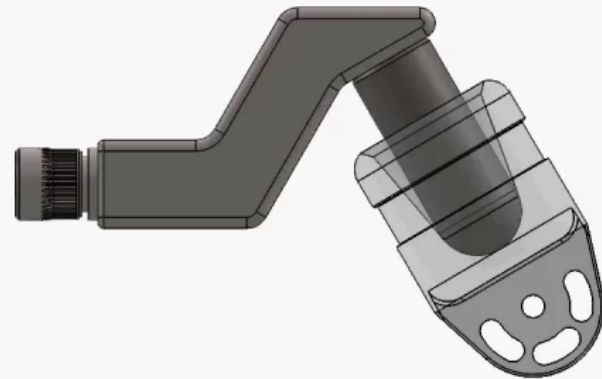
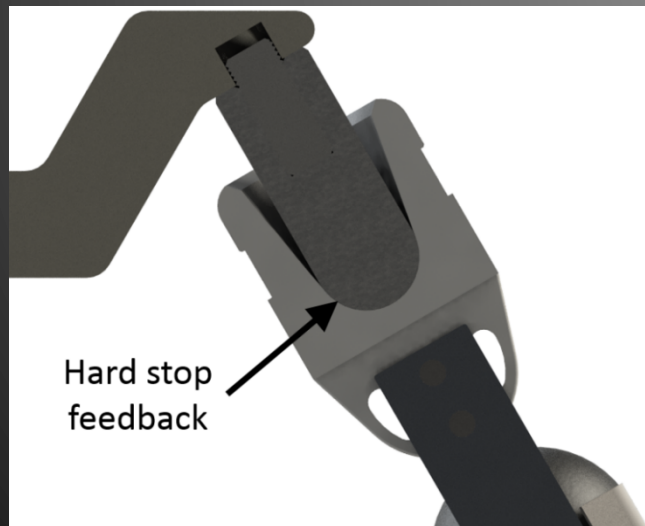


Design - Interface



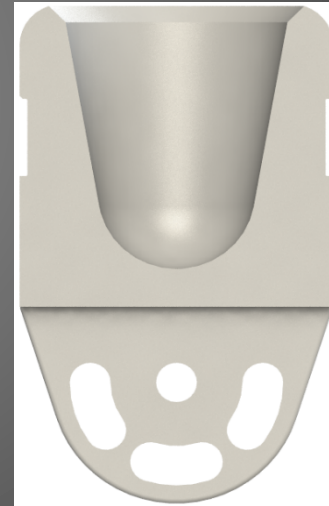
**Translationally
misaligned**

**Rotationally
misaligned**



Design - Adapter

- Angle adjustment
- Non-permanent connection
- Simulates original control knob

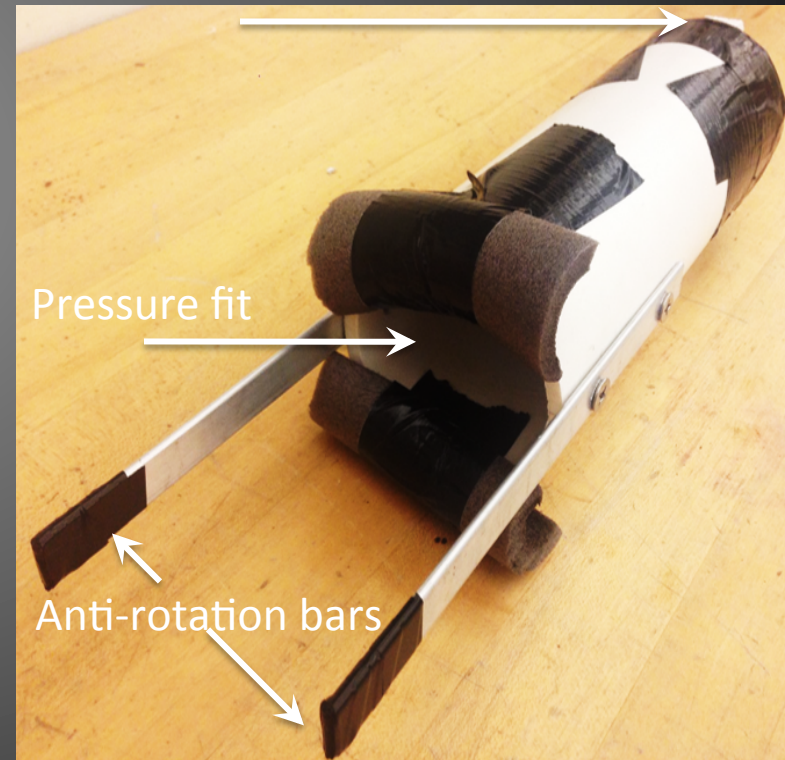


Design – Use Simulation

- ▶ Bypasses wrist joint
- ▶ Prevents forearm rotation
- ▶ Limits tactile feedback



Mating surface attachment point

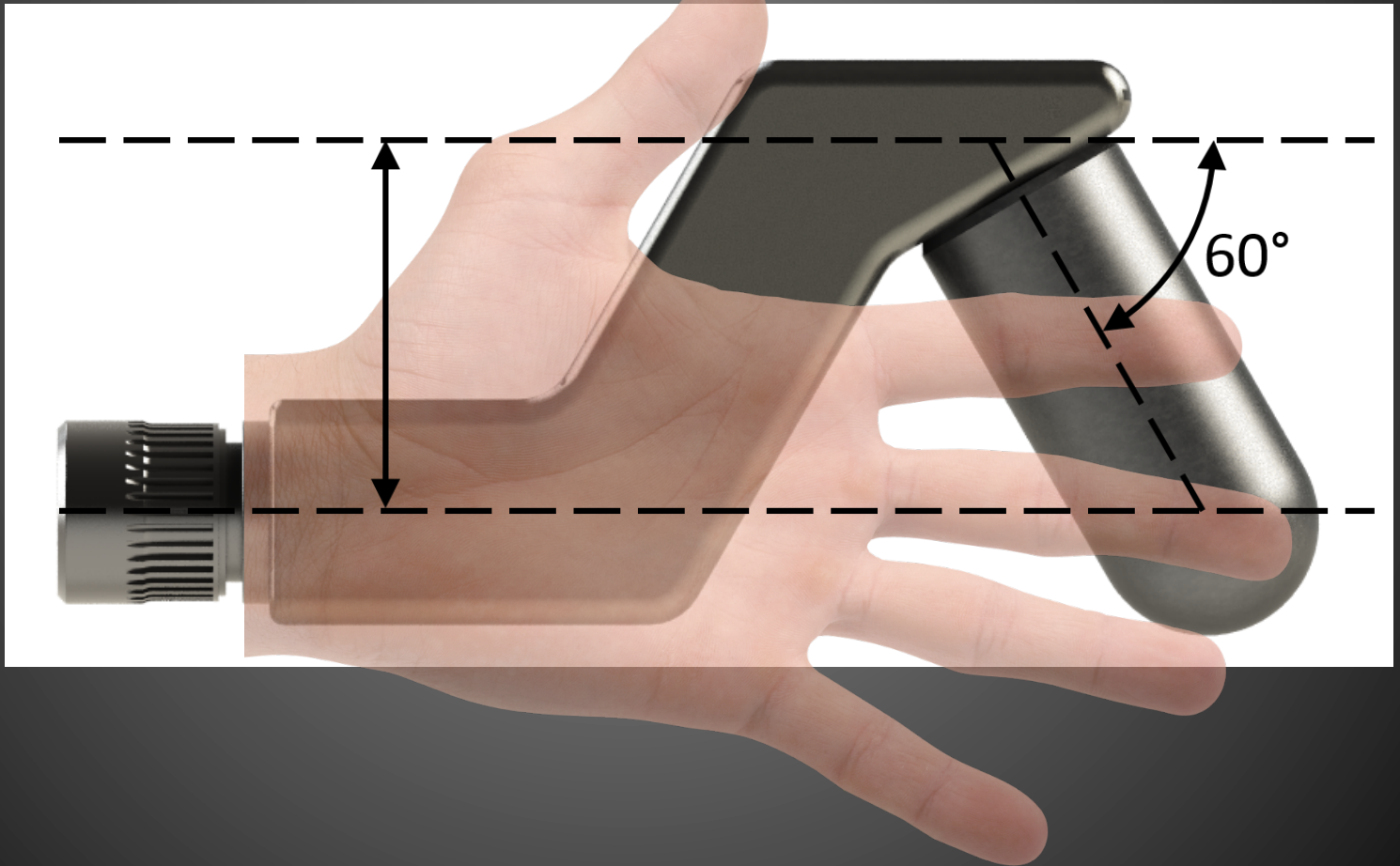


Field Test Results



Design - Terminal Device

- Vertical offset
- Terminus angle



Material Considerations

▶ Terminal Device

(Prototype 1 Prototype 2)

▶ Wrist attachment

- ▶ **Stainless Steel**

▶ Body

- ▶ **6061 Aluminum**

- ▶ **85 Shore-D
PolyUrethane**

▶ Terminus

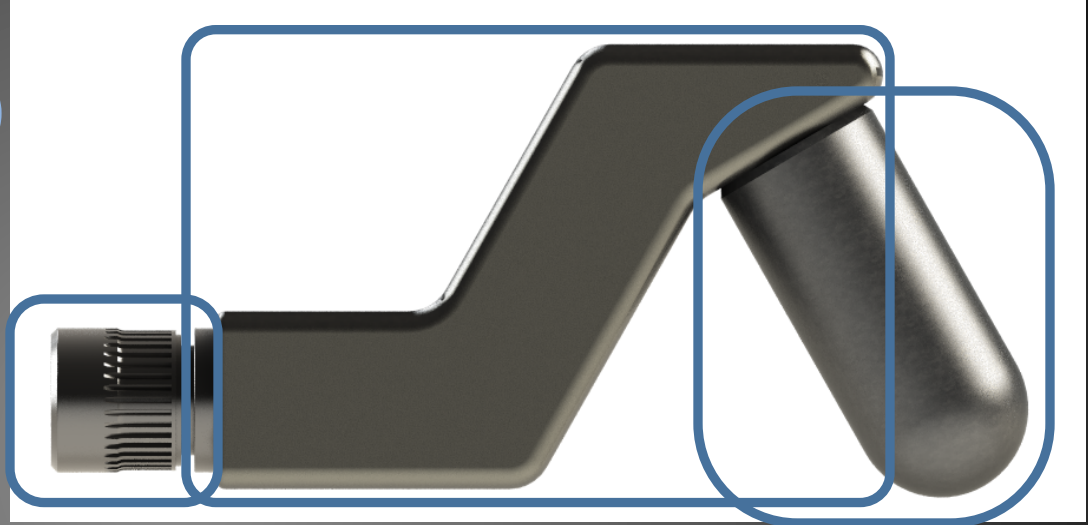
- ▶ **6AL-4V Titanium**

- ▶ **Delrin**

▶ Adapter

- ▶ **UHMW-PE**

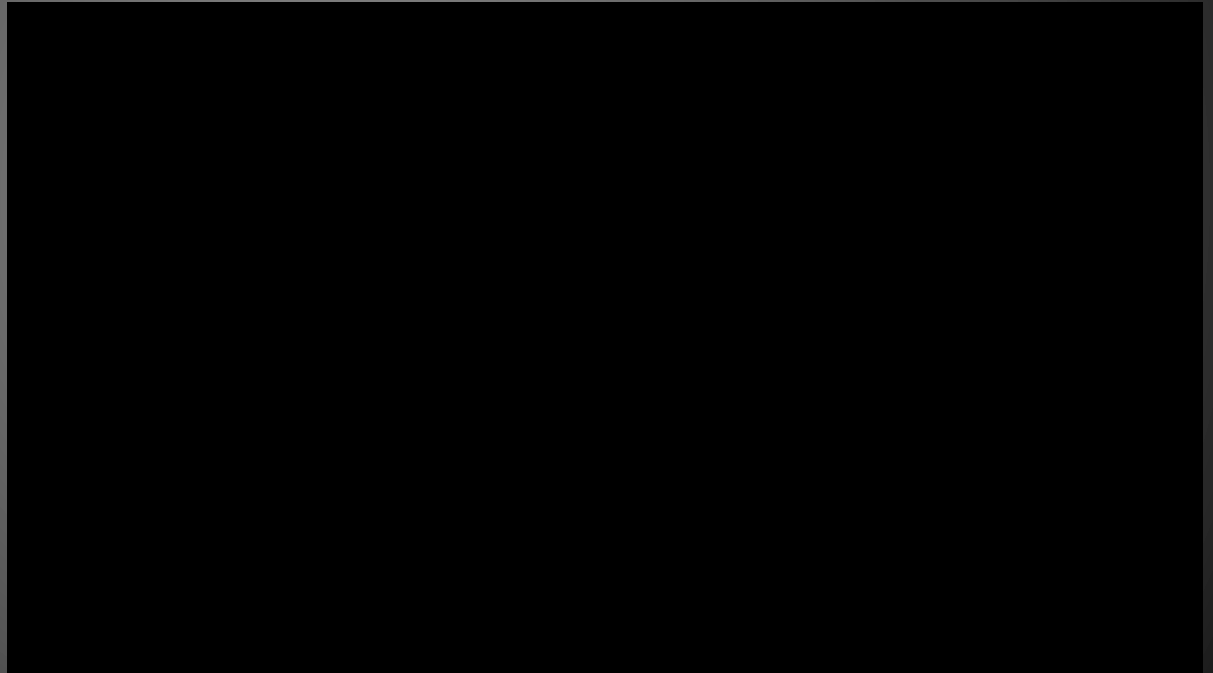
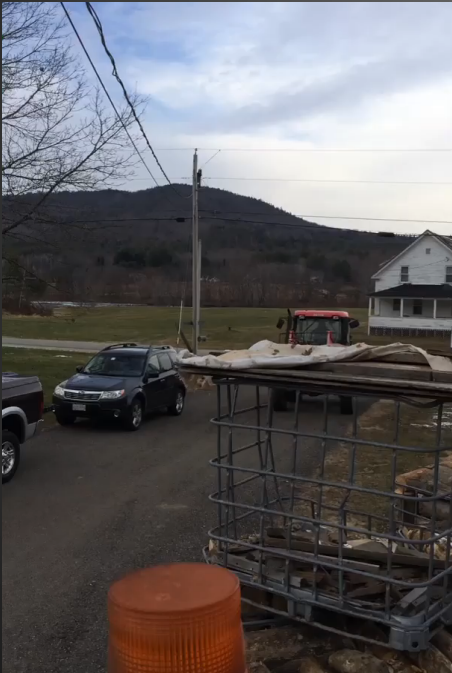
- ▶ **Delrin**



Feedback (Rumford, ME)

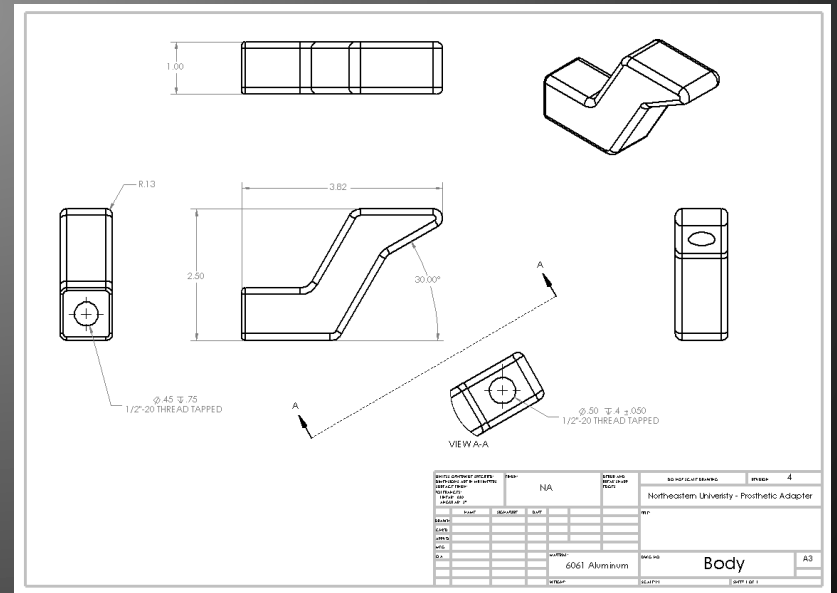
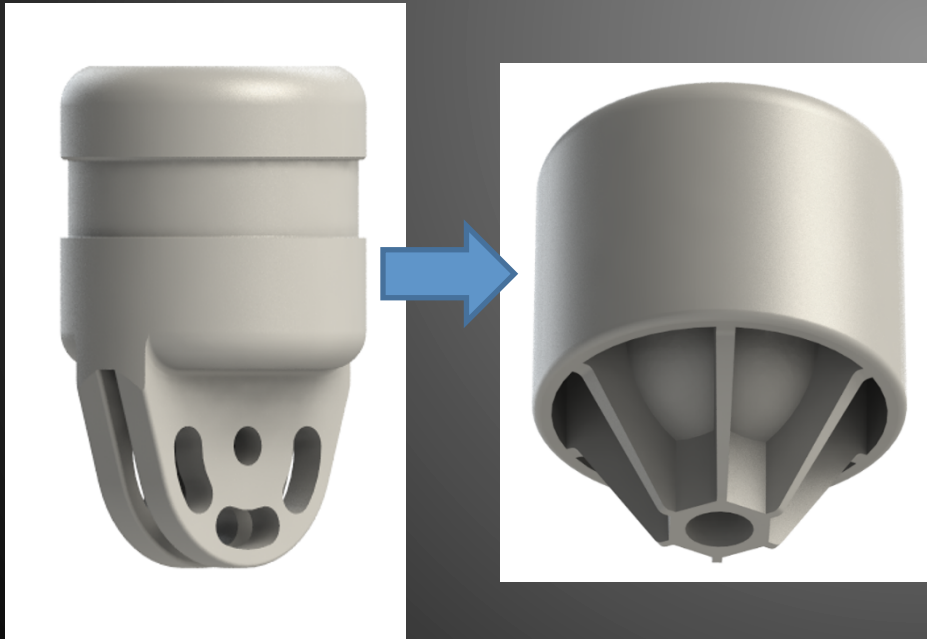
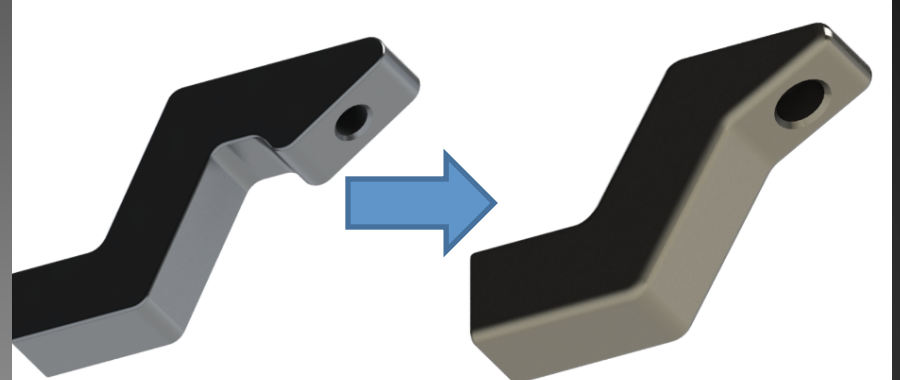


Design Validation

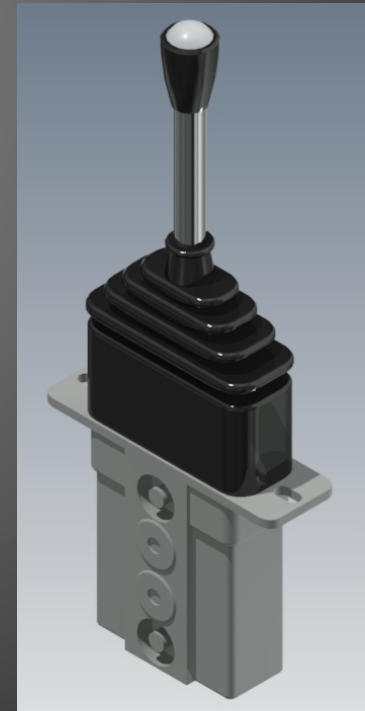
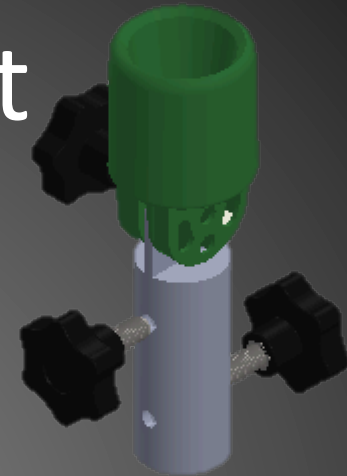
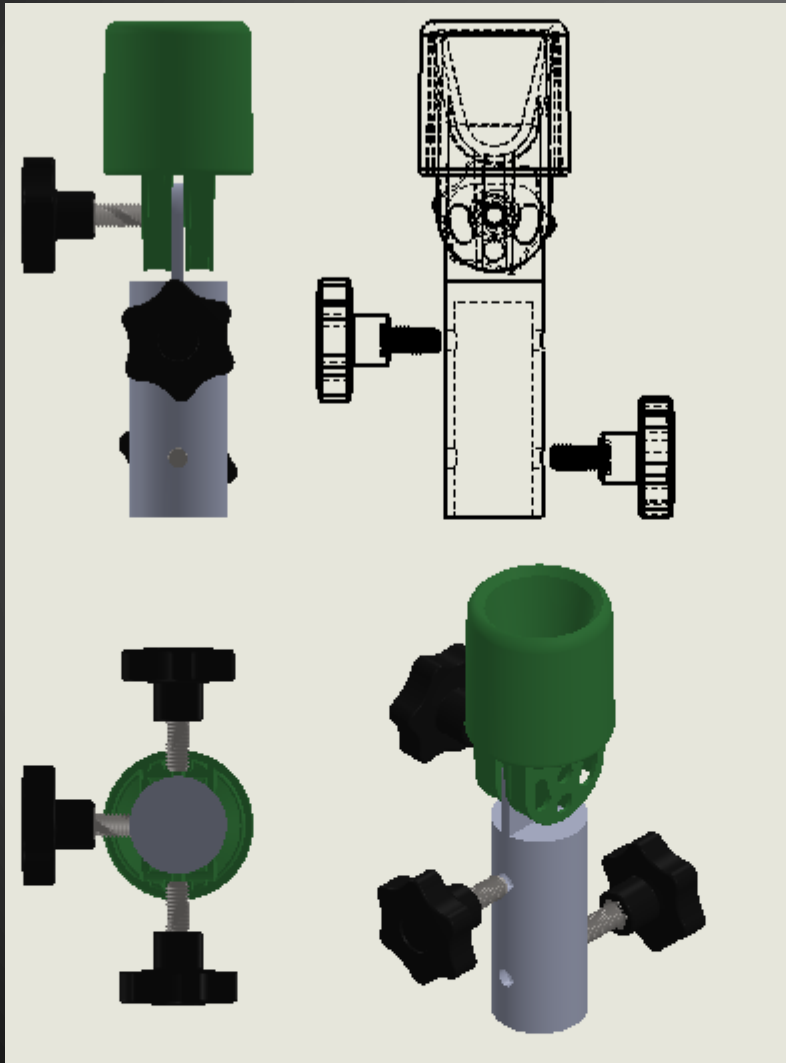


Design for Manufacturability (DFM)

- GOAL: reduce tooling and production cost



Adapter Mount



Differentiation

A whole, ripe orange with a textured, bumpy skin, positioned on the left side of the image.

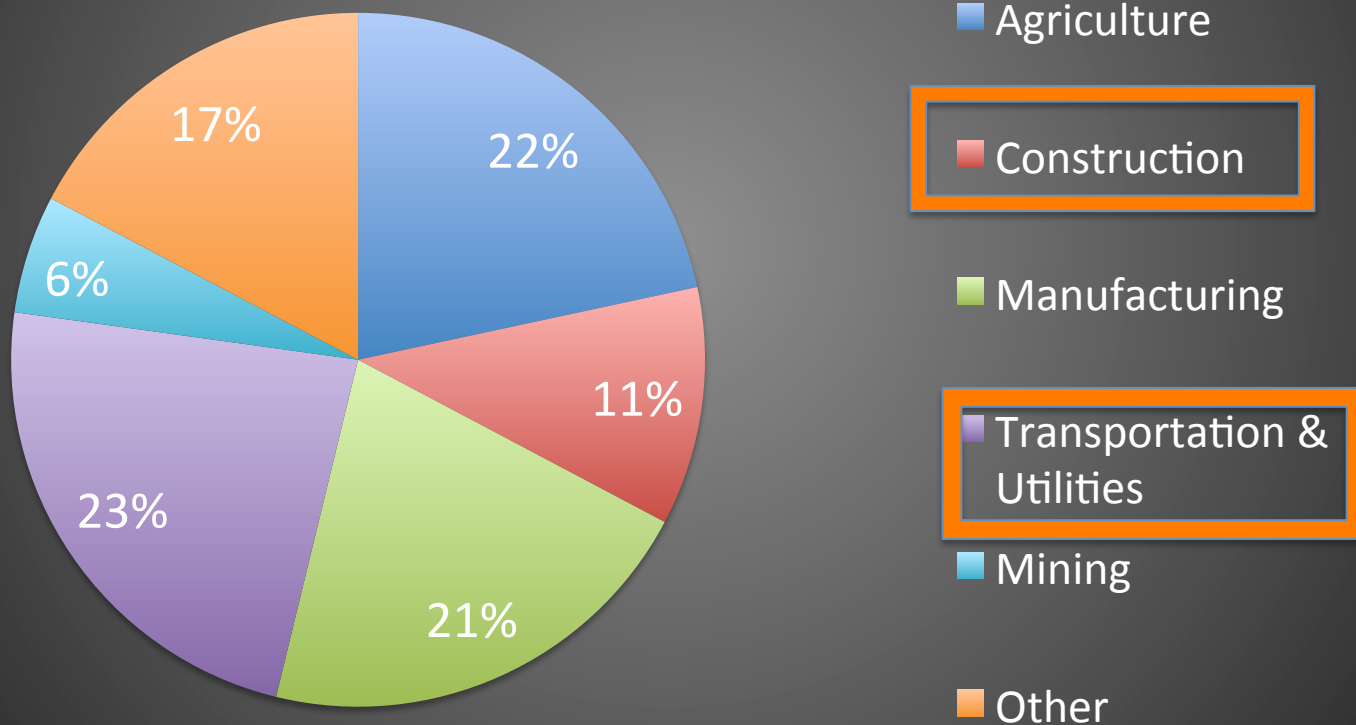
**Current
Prostheses**

A whole, shiny red apple with a single green leaf attached to its stem, positioned on the right side of the image.

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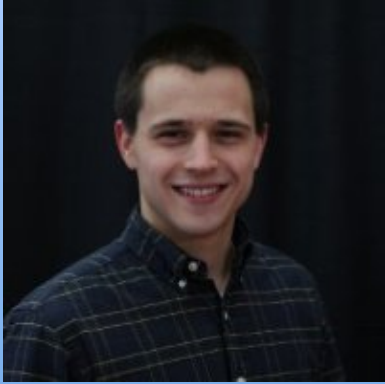
Markets?

Amputation Frequency by Industry



Bureau of Labor Statistics (2007)

Current Team



Andrew Waite
M.S. M.E. '15
Design & 3D-Modeling



Jon Leydon
B.S. M.E. '15
Hardware/Design



Jacob Cohen B.S.M.E. '15
Machinist, Material Science
Industry: MD&D



Danny Walsh, B.S.M.E. '15
Medical Device R&D Engineer
Candidate for M.B.A. 2017



Partners



ottobock.



Recent Visits



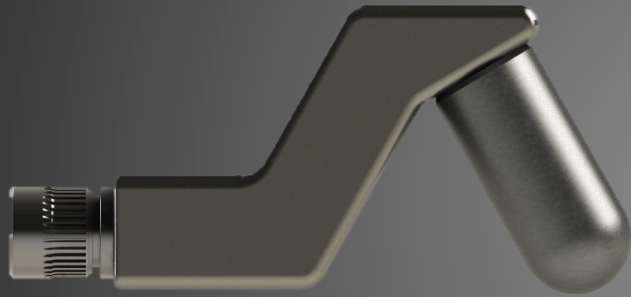
Bob Radocy, CEO



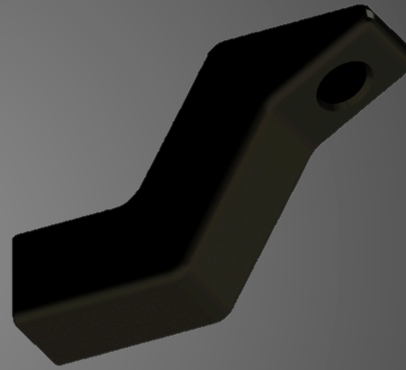
Jay Roy, CP



Product Options



Durable



Consumable

Current Plan

- **Goal:** accessibility and expediency
- **How:** IP -> Improve Prototype -> Partner
- **Channels:**  
- **Prototype Refinement**
- **Target Goal:** 50 units distributed per year (~1,000 market segment size)

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?

Market Statistics

of U.S. Farmers? *21 million*

of people living in
US with an
amputation today? *2 million*

Likelihood of injury
farming? *2.5 X >*