

Transtibial Liner Donning System

Team Members

Matt Guthrie (ME)

Jenifer Rainy (BAE)

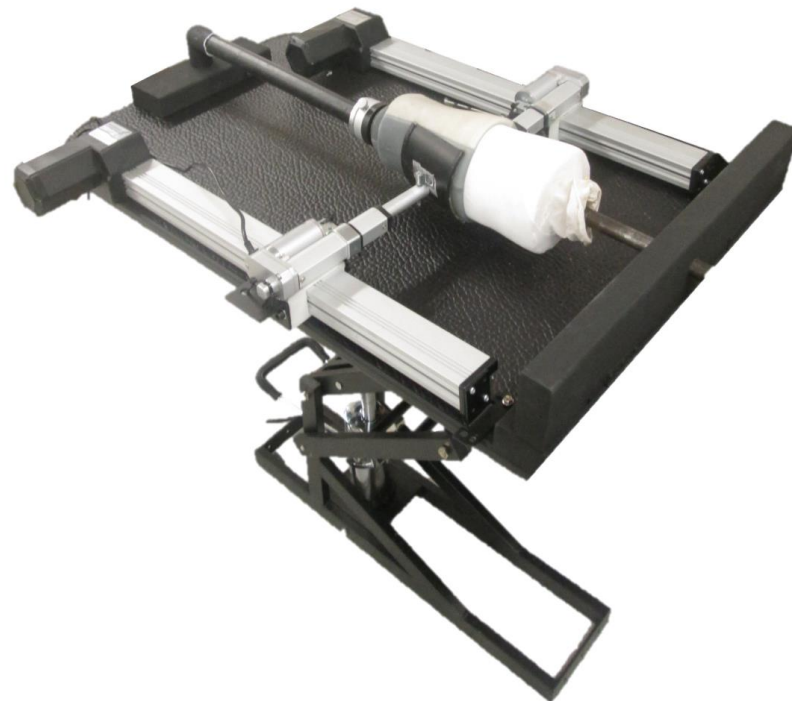
Jordan Simonson (BAE)

Samantha Sutherland (BAE)

Sponsors

Lisa Huffman

University of Idaho: Biological
and Agricultural Department



Transtibial Amputations

- 40,000 are performed a year
- 60% are caused from type 2 diabetes
- Common Complications
 - Loss of sensations
 - Reduction in vision
 - Obesity
 - Loss of vision

Background & Complications

Liner Donning Difficulties

- Liner Material
- Hand dexterity
- Flexibility
- Poor Vision



Improper Donning Results

- Air Pockets
- Blisters
- Rashes



Overview

Main Purpose

- Assist amputees don their liner
- Restore independence to those with amputations

- Design Goals
- System Components
- Goals Accomplished

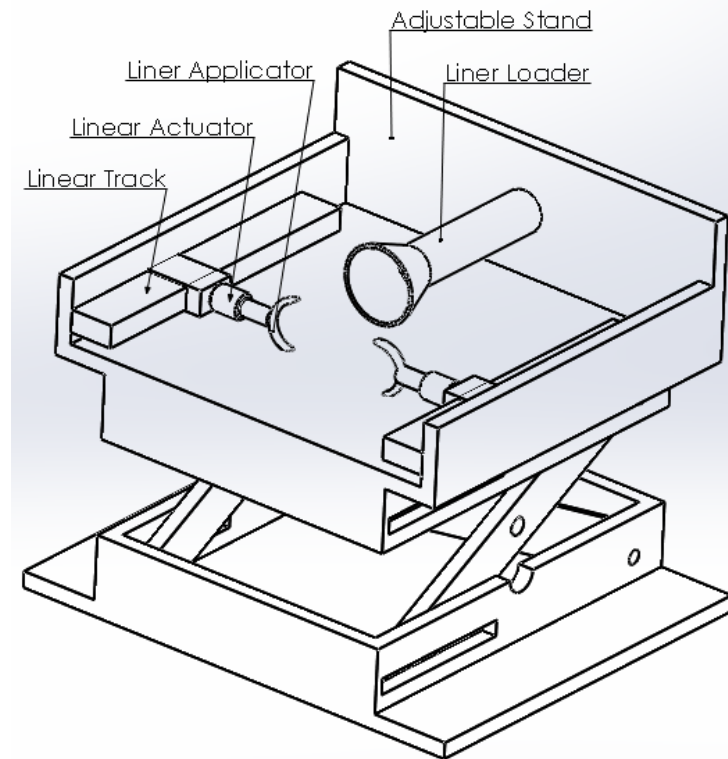
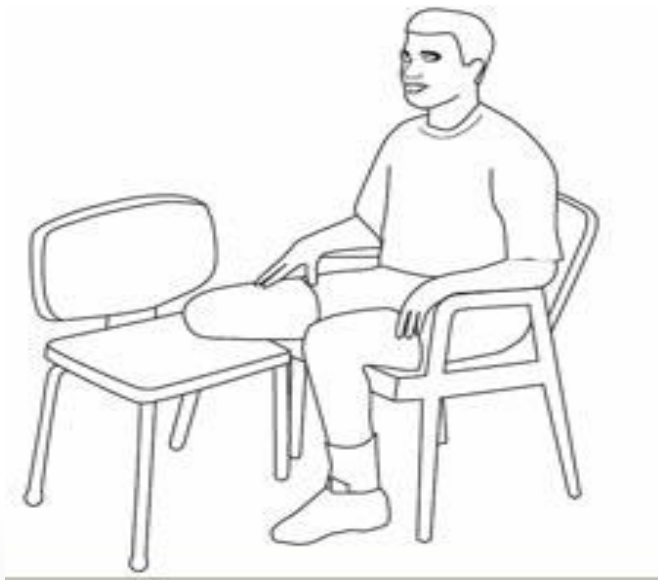


Design Goals

Design Goals	Resulting Components
1. Reduce pin alignment errors	Liner Loader
2. Make a flush contact between the liner and residual limb	Umbrella support cup
3. During the donning process, significantly decrease the need for the following: <ul style="list-style-type: none">• Hand strength and dexterity• Flexibility at waist and lower limb• Vision	Automated track/linear actuators with applicators

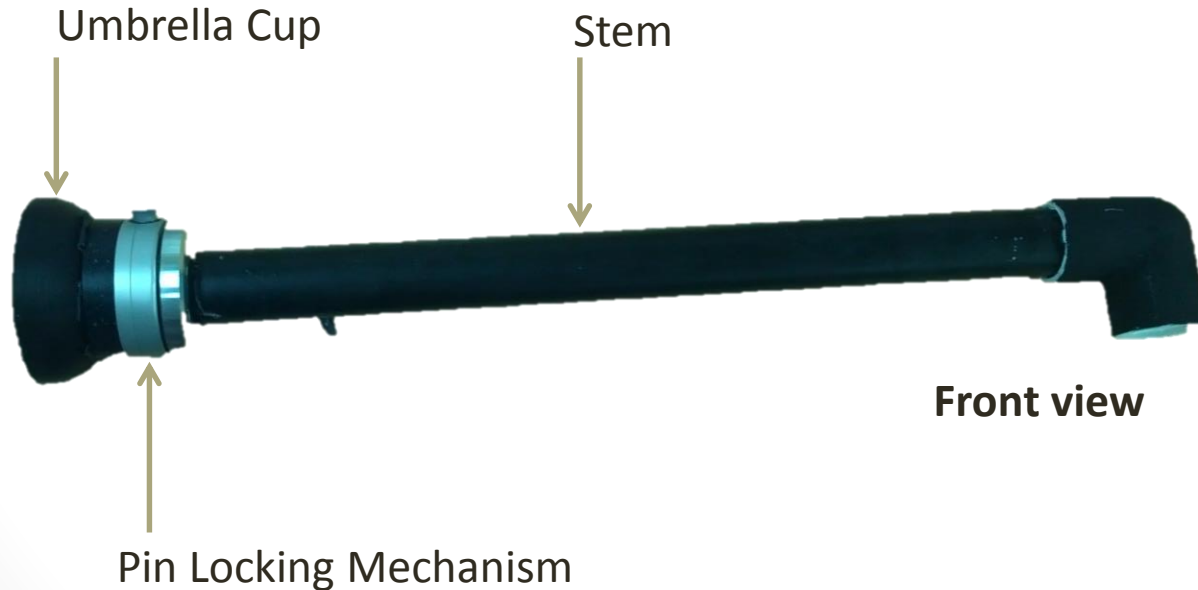
Prototype

- Visualization
- Dimensions
- Proof of Concept



Liner Loader

- Ensures proper pin alignment
- Supports the liner umbrella
- Steadies the users limb

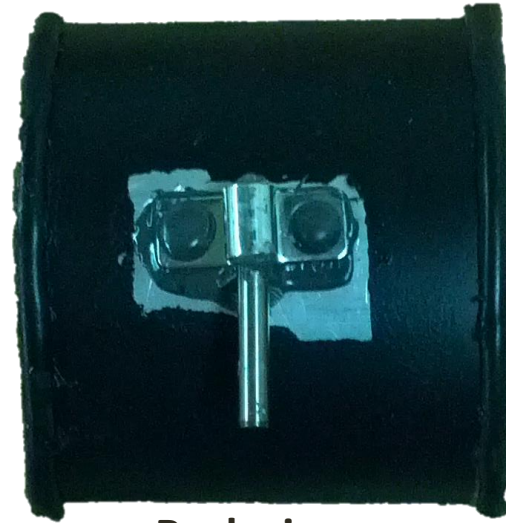


Liner Applicators

- Material: Aluminum
- Arc length 4.75 "
- Radius of curvature 2.6"
- Thickness 0.125"



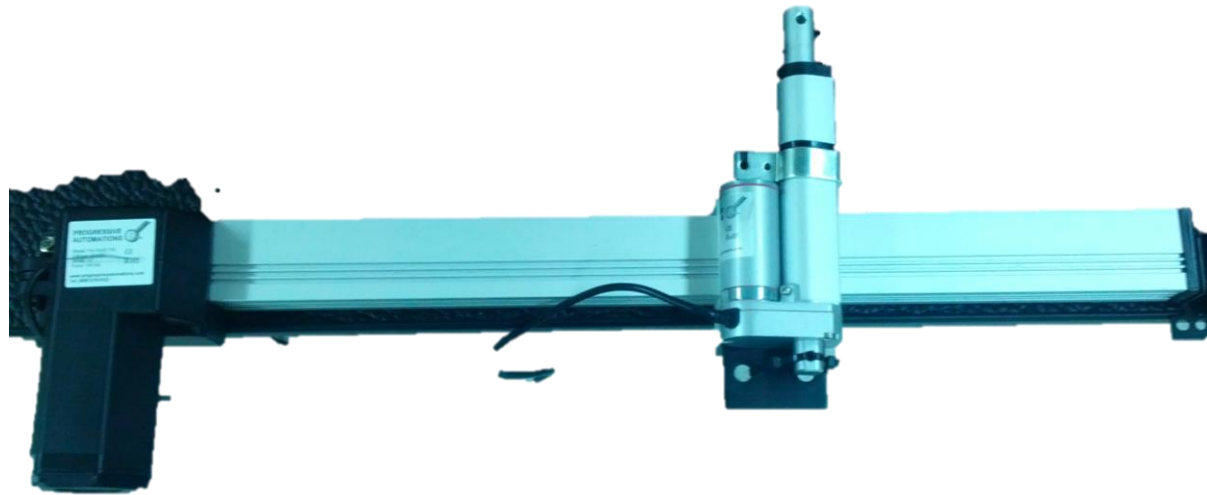
Side view



Back view

Purchased Parts

- PA-4-35 Linear Actuator
- PA-22-150 Track Actuator



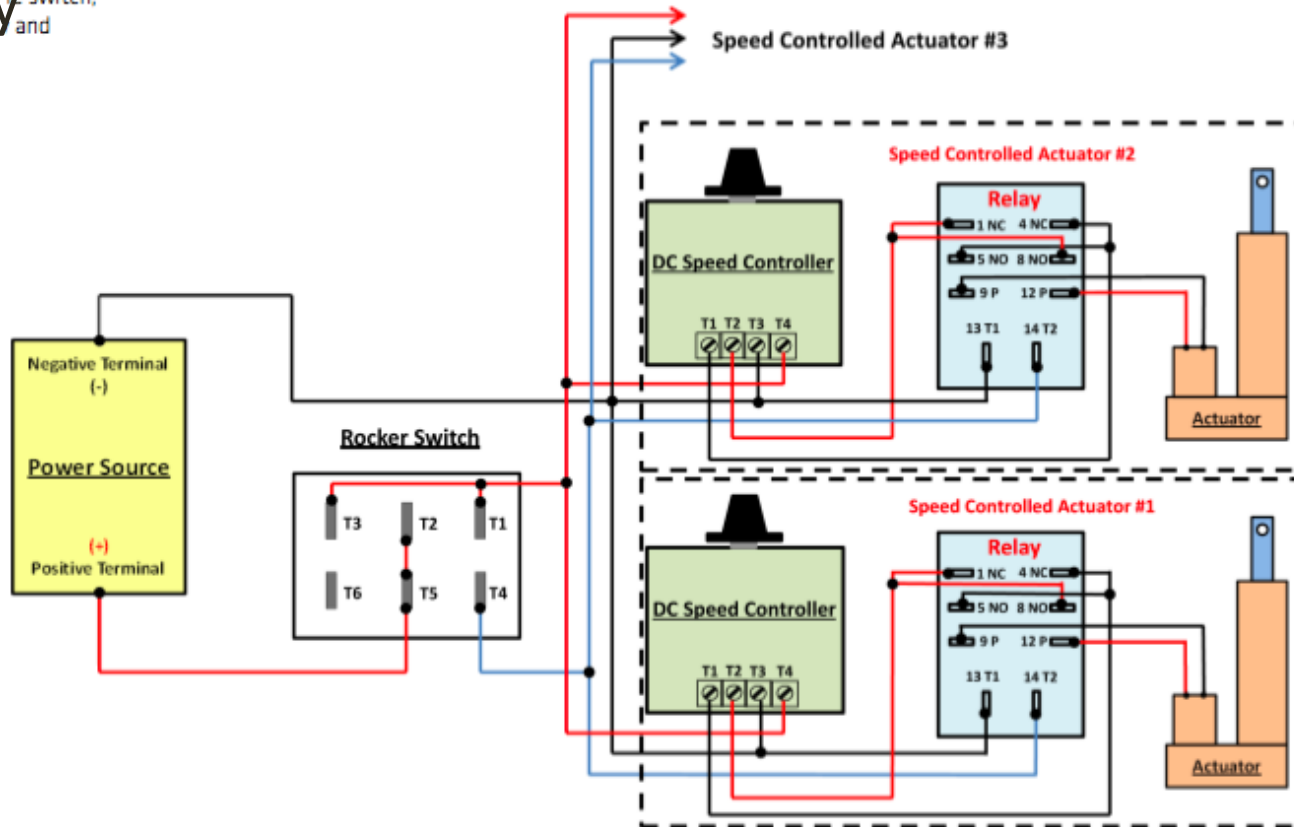
Top view

Safety Measure: DFMEA

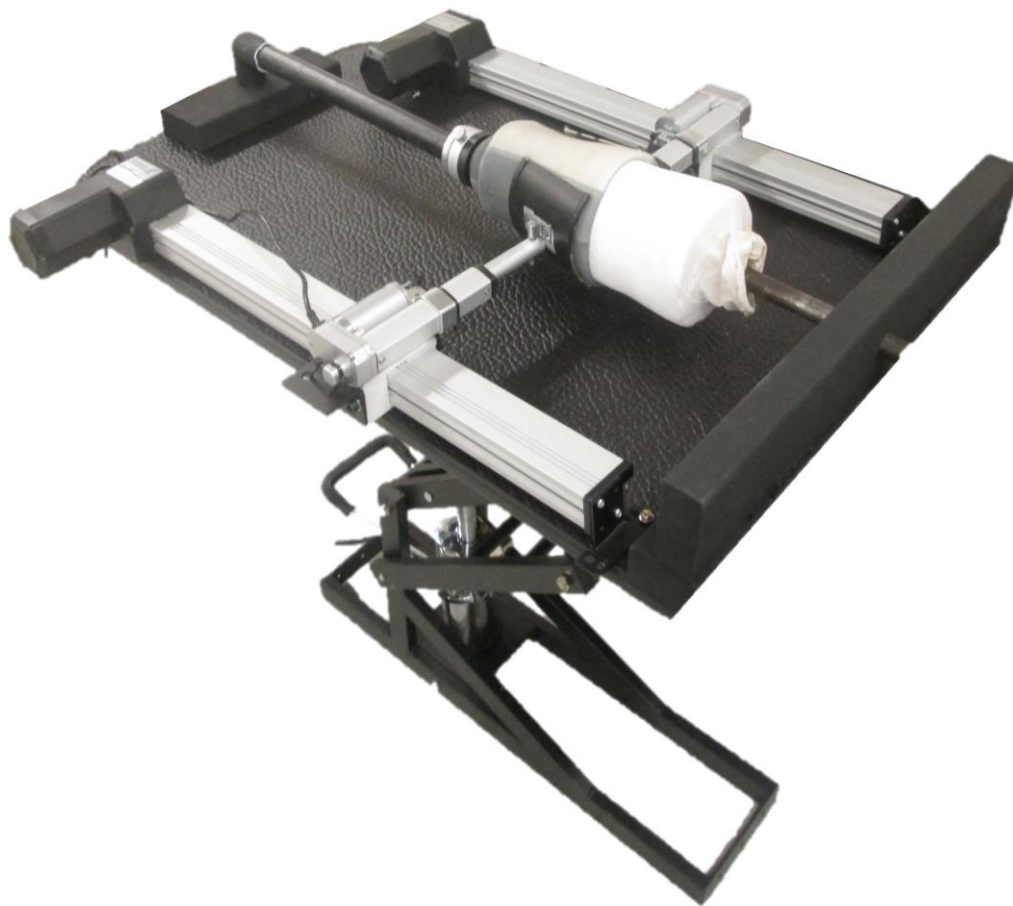
System	Potential Failure Mode	Potential Failure Effects	SEV	Potential Causes of Failure	OC	Current Controls	DET	RAN
Umbrella Cup	Doesn't properly fit the liner.	Cause airpocket/injury to user	5	improper design	1		2	10
Liner Applicators	Damages the liner	Injury to user	5	material selection	1		2	10
				pressure sensor failure	1		2	
				coding error	1		2	
Connection to Linear Actuators	Allow movement	Liner not donned properly	1	manufacturing error	1		2	2
	Shearing off of connection	Liner not donned properly/possible damage	3	material selection/design flaw	1		2	
Linear Actuators	Too fast	Injure the user/frighten user	4	coding error	3		2	24
				glitching	1		2	
	Not retracting	Injury to user	5	pressure sensor failure	1		2	
				coding error	3		2	
	Not Stopping	Injury to user	5	pressure sensor failure	1		2	
				coding error	3		2	
Connnection to Track	Allow movement	improper donning/possible damage	3	material selection/fastener issue	1		2	6

Safety Implementation

- Speed Control
- Relay switch, and



Final Design



Questions?

