

Transtibial Liner Donning System



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Problem Statement

Design a donning system that will aid lower limb amputees don their prosthetic liner. The system will ensure that the liner sits flush against the stump, properly aligns the pins for connection into the prosthetic, and enables those with limited hand dexterity, flexibility, or vision to don their liner independently.

System Design Goals

- Comfortable
- Easy to use
- Work with commercial liners
- Accommodate majority of patients
- Reduce need for hand strength
- Aid inflexible individuals
- Properly align the pin
- Allow independent donning

Transtibial Liner Donning System

- Who can use it
- What components make it
- How does the system accomplish our design goal
- How affordable/marketable is it

Life With an Amputation

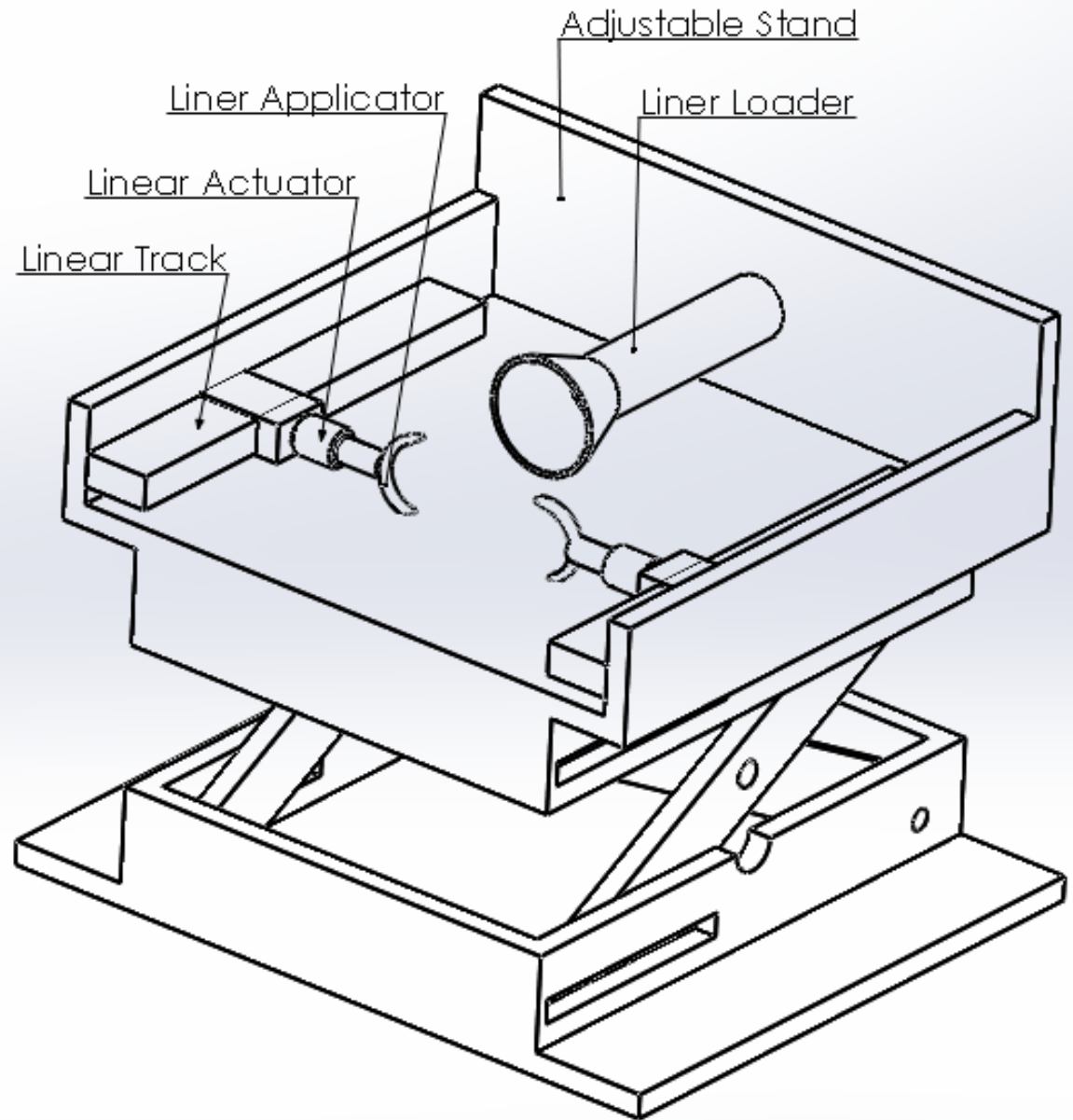


Results of Improper Donning

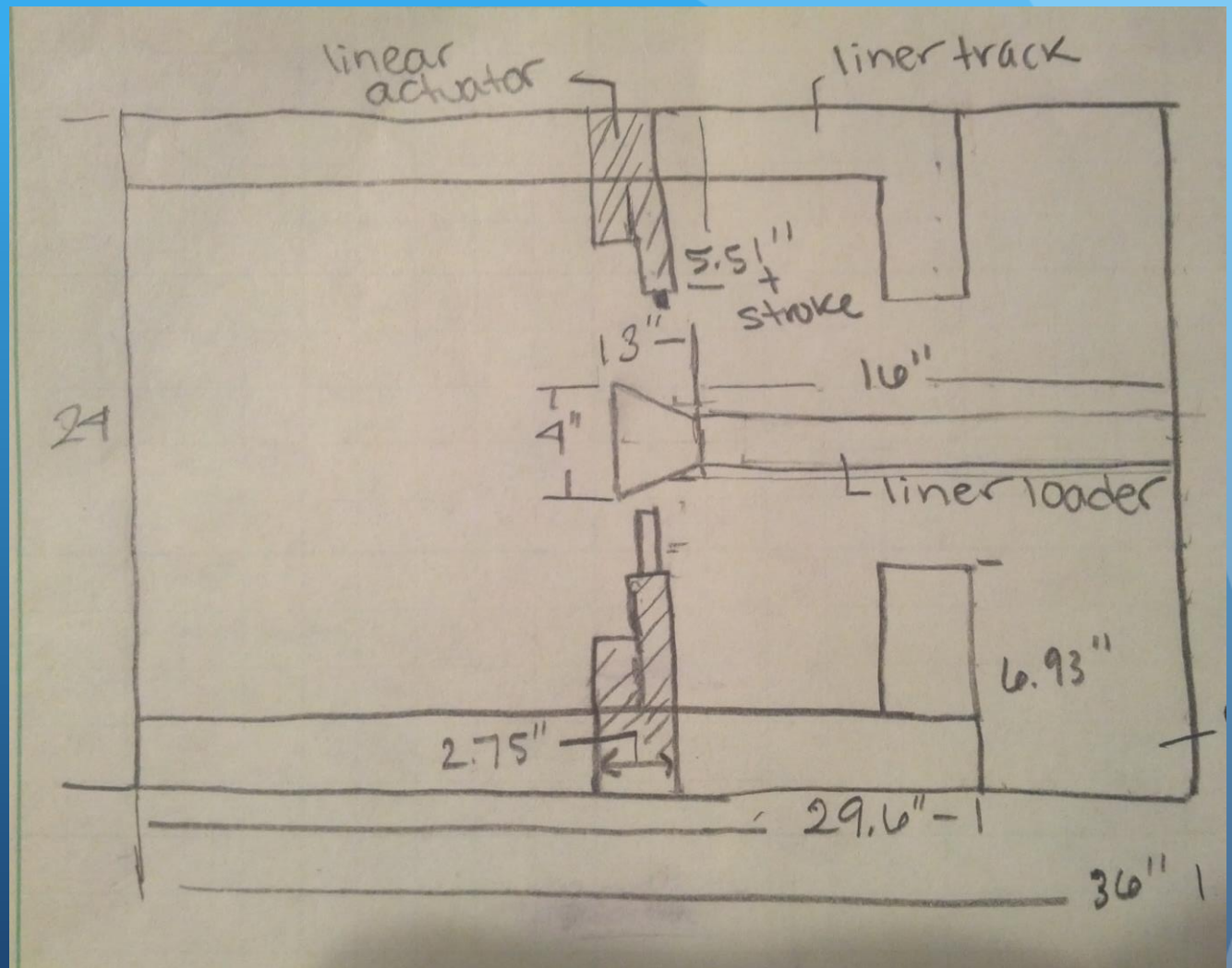
- Distal stump wounds
- Blisters
- Rashes
- Discomfort



Transtibial Liner Donning System



Top View

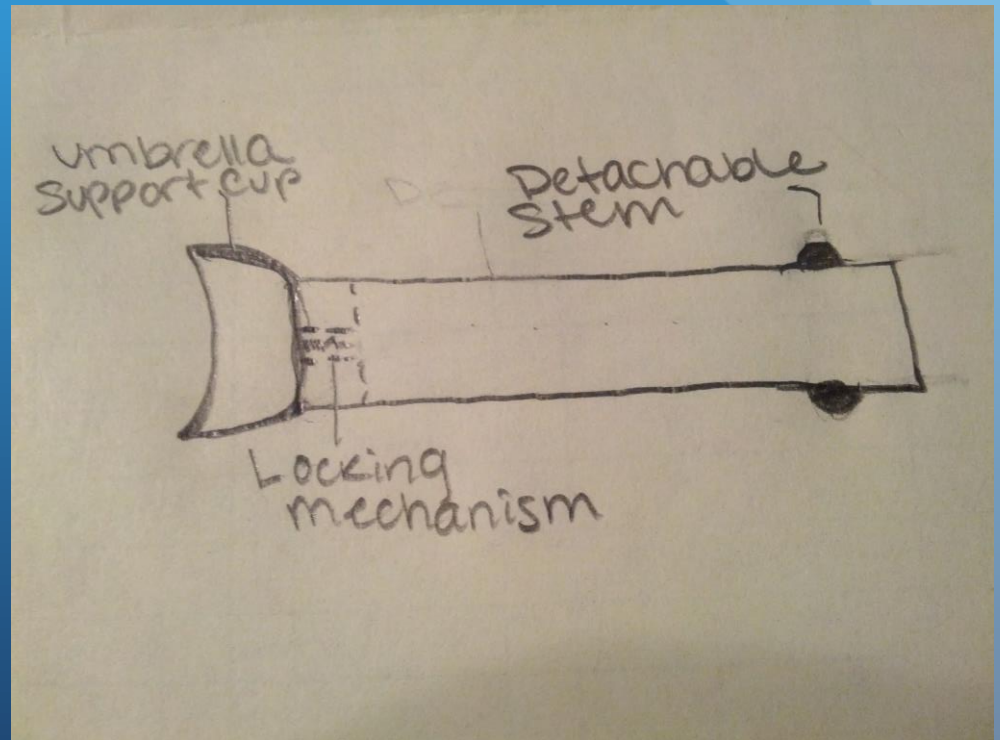


Purchased parts: Track and Linear Actuators



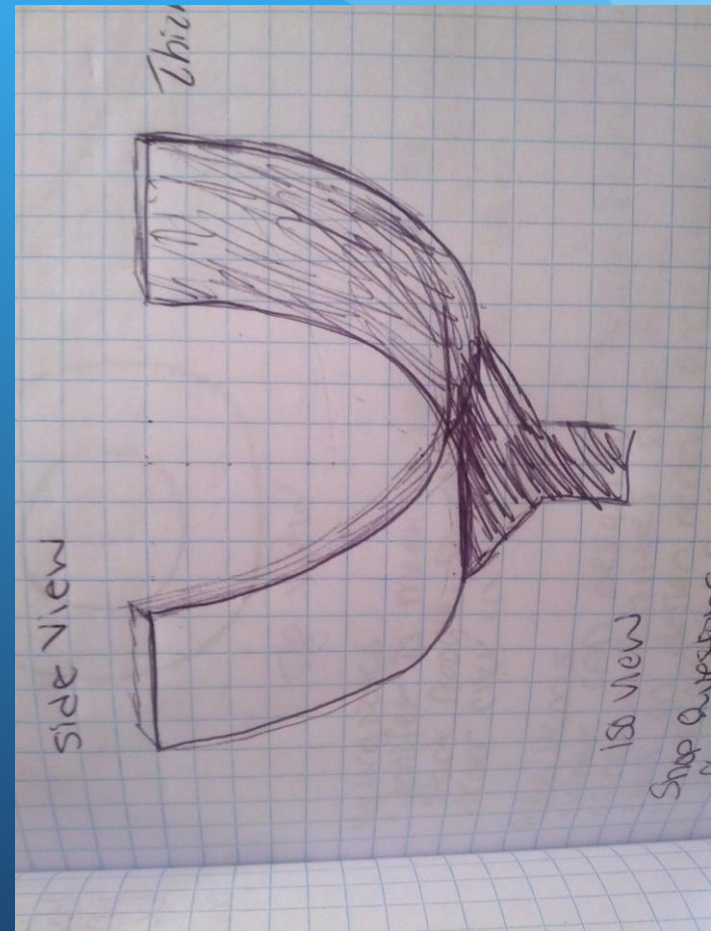
Liner Loader

- Sub Component
 - Umbrella support cup
 - Locking Mechanism
 - Stem



Liner Applicators

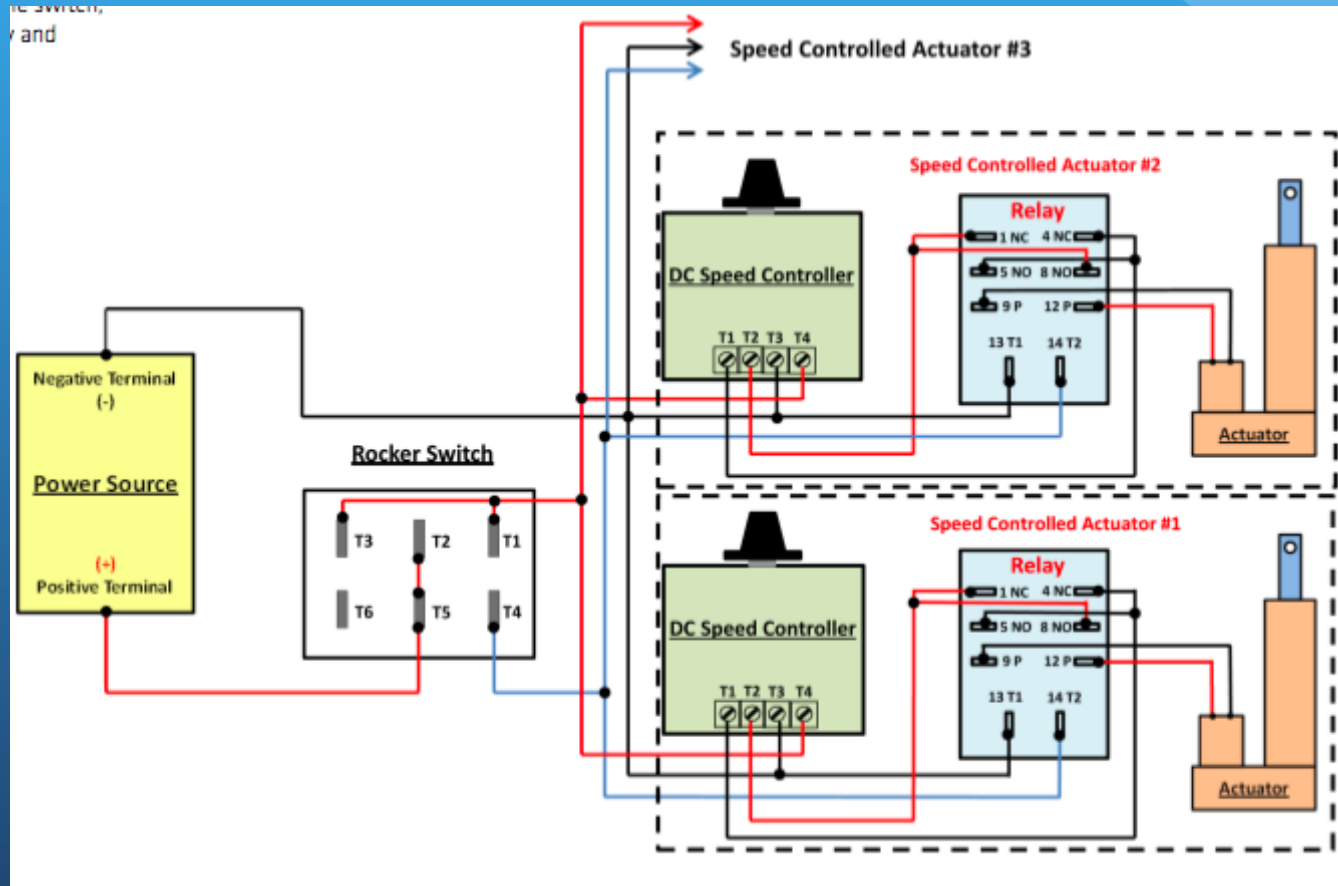
- Material: Aluminum
- Width 4"
- Radius 4.22"
- Thickness .125"



Control Systems

- Sub-components
 - Arduino Uno Microprocessors
 - Track actuators
 - Linear actuators
 - Pressure Sensors

Speed Control



Testing Plans

- Testing must be set up to determine all design specifications have been met.
- Each specification will have a specific set of tests to ensure compatibility with the specifications.
- A Design of Experiment will be set up and each component of the design tested.

dFMEA

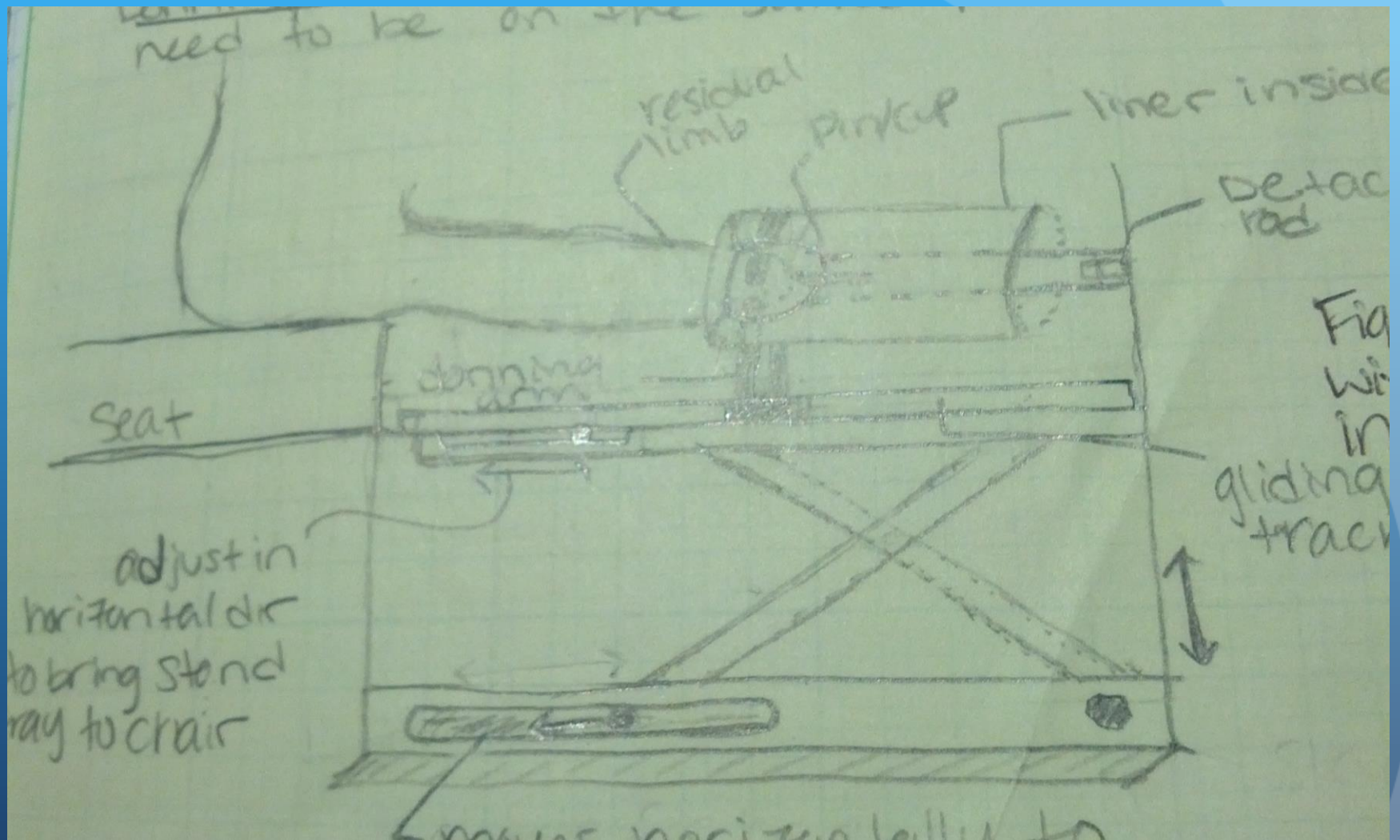
System	Potential Failure Mode	Potential Failure Effects	S E V	Potential Causes of Failure	O C C	Current Controls	D E T	R A N
Liner Loader								0
Pin Locking Mechanism	Pin doesn't lock	Pin will not be properly aligned/improperly donned liner	5	Pin inserted incorrectly by user	1		2	10
	Pin doesn't lock straight	Pin will not be properly aligned/improperly donned liner	5	pin inserted incorrectly by user	1		2	10
	Pin doesn't release	Pin will not be properly aligned/improperly donned liner	5	Pin inserted incorrectly by user/ release failure	1		2	10

The dFMEA requires us to examine our design and consider potential problems and how we can remediate issues.

Design Fit Idea



Donning Process



Project Budget

Linear actuators	2 x 109 =	218
Track actuators	2 x 140 =	240
Control System	1 x 100 =	100*
Liner loader	1 x 100 =	100*
<u>Adjustable stand</u>	<u>1 x 500 =</u>	<u>500**</u>
Total	=	1158

Questions?