Project: Far from Over

Group 1.3: Mobility Maestros

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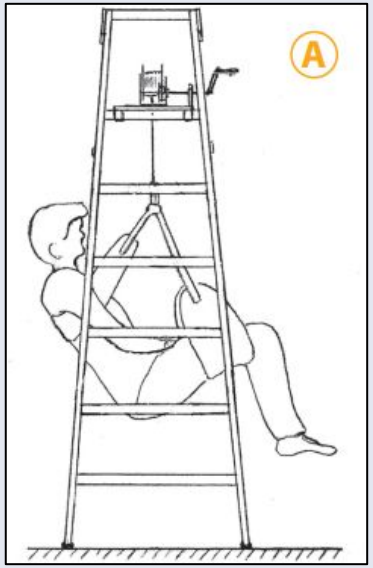
Define

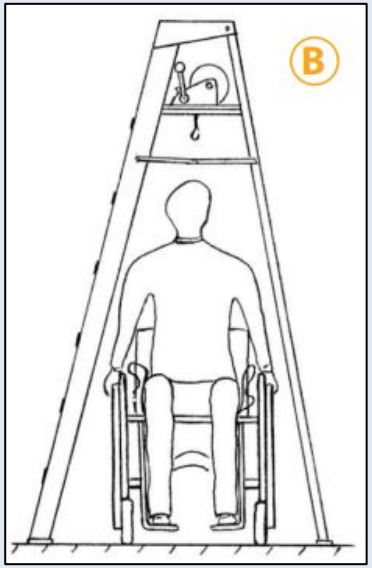
Problem Summary

The LaddaLift

- Lifts someone off the ground
- Requires an able-bodied person to help set up the device and user
- Multi-functional as ladder and lift

→ We need to improve on this design or create a different concept





Project Summary

Problem Definition

Our client wants us to create a user friendly device for individuals who fell out of their wheelchair to help them get back on it.

Client Needs

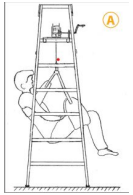
Easily compatible and portable	4
Easy to use by individual using the wheelchair and caregivers	4
Low cost and affordable to everyone	2
Safe and reliable.	5
Offers independence or requires minimal help	5
Works with different disabilities	3

02

Ideate

Research and Information

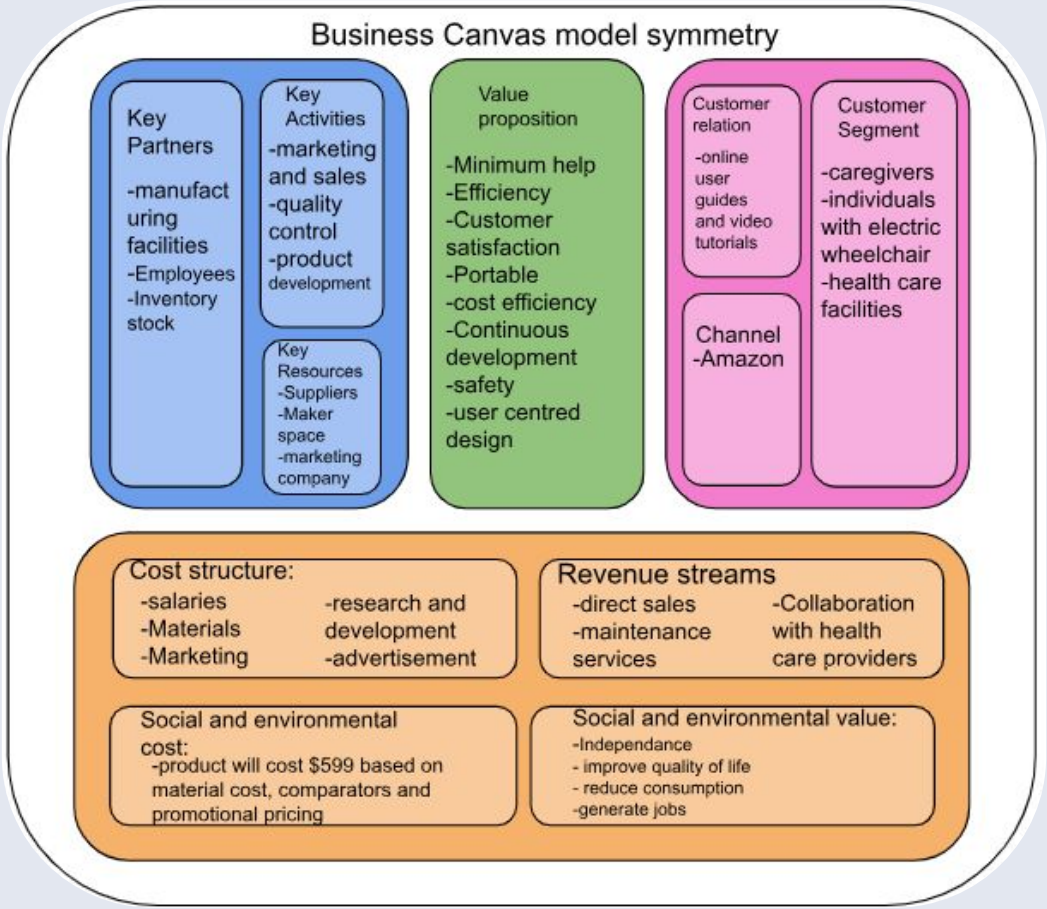
Benchmarking

Client Needs					
	LaddaLift	**The Assist Handle**	**LEVANTAR**	**IndeeLift HFL 400**	**Camel Lifting Cushion**
Company	KPC	RESENA	Drive medical	IndeeLift	Mangar
Cost	3	3	1	1	1
Weight	3	2	3	3	3
Portability	1	3	2	3	3
Size	2	3	2	2	3
Ease of use	1	2	1	3	3
Independence	1	1	1	2	2
Total	32	49	32	51	**54**

Target specifications

	Metrics	Relation (>, <, =)	Value	Units	Explanation
1.	Dimensions	<	24	inches	Appropriate size that can fit between doors
2.	Weight capacity	<=	250	lbs	Reasonable weight device that can support most users
3.	Power	=	12	volts	Reasonable energy requirement to use device (power source from wheelchair)
4.	Mass	<	22	lbs	Appropriate mass of device that can be handled by large audience
5.	Manufacturing cost	<=	200	$ (CAD)	Device to be within budget
6.	Lifting Height	<=	19	inches	Maximum height that lifting device raises the user
7.	Emergency Safety Feature	<=	1	sec	Mechanism to immediately stop movement of device within a short time
8.	Movement Control	=	0.25	m/s	Speed and time required in order to safely lift the user.

Business Model Canvas

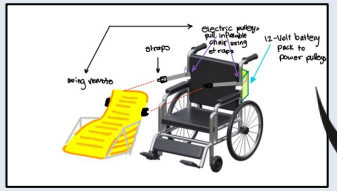


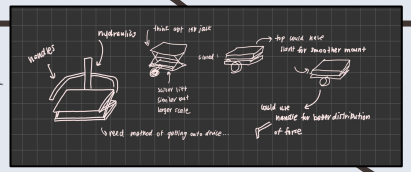
03

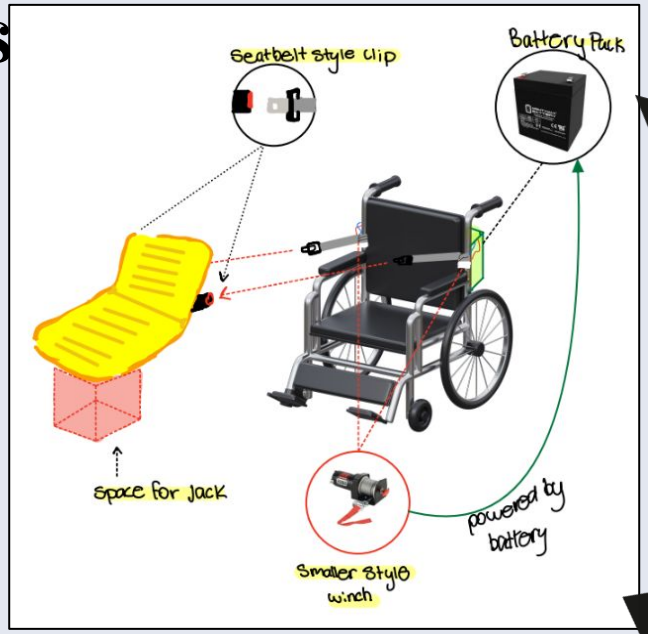
Our Concepts' Story

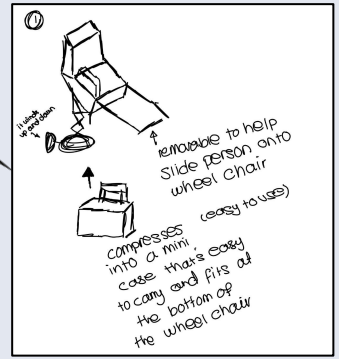
The ups and the downs

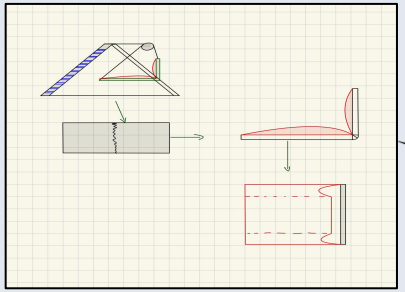
Initial Concepts

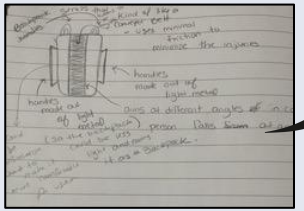


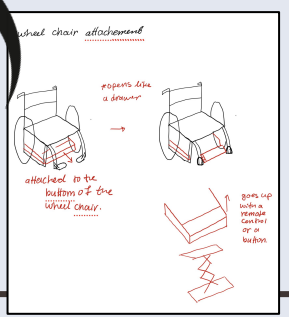








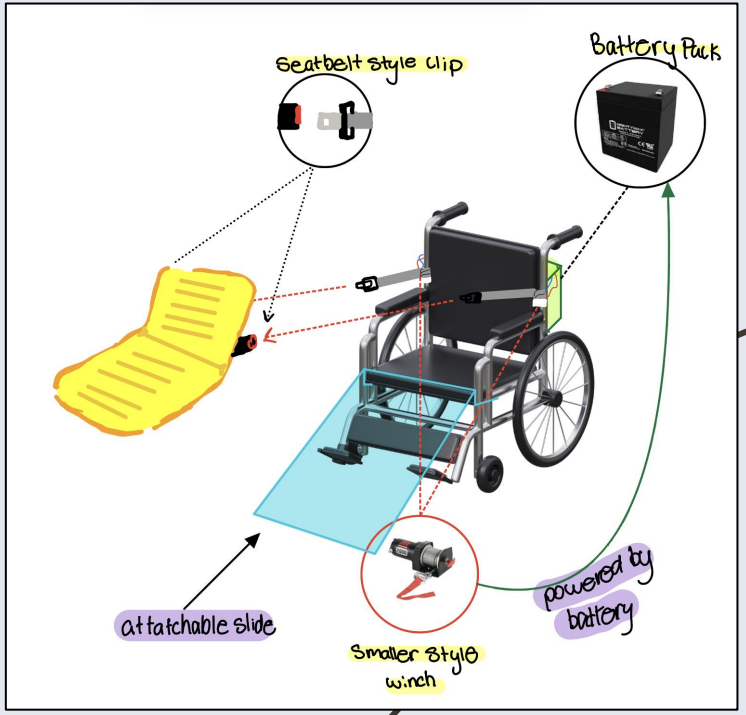




Client feedback on design

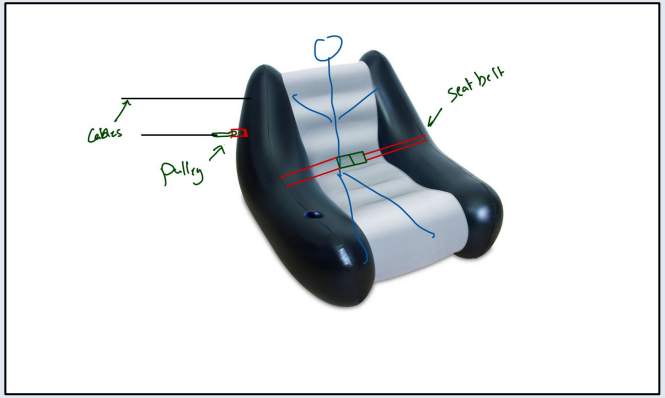
- **Inflatability:** Clients concerned about stability and how chair deflates
- **Mobility:** The jack is hard for user to mount and requires physical strength

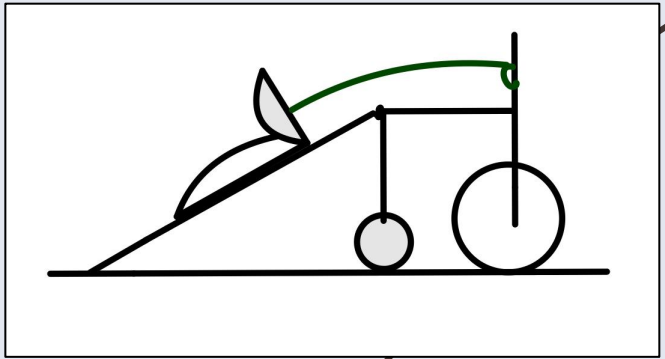
Improved design



Updated Design

- **Straps** for safety & to attach to pulleys
- **Slide** and deflated **chair** placed in front of **electric wheelchair**
- User to be rolled onto deflated chair, safely strapped, then inflated
- **Pulleys** attached to the top of handle bar to pull chair up slide
- Chair deflates once user is up





Main Issue with the Design

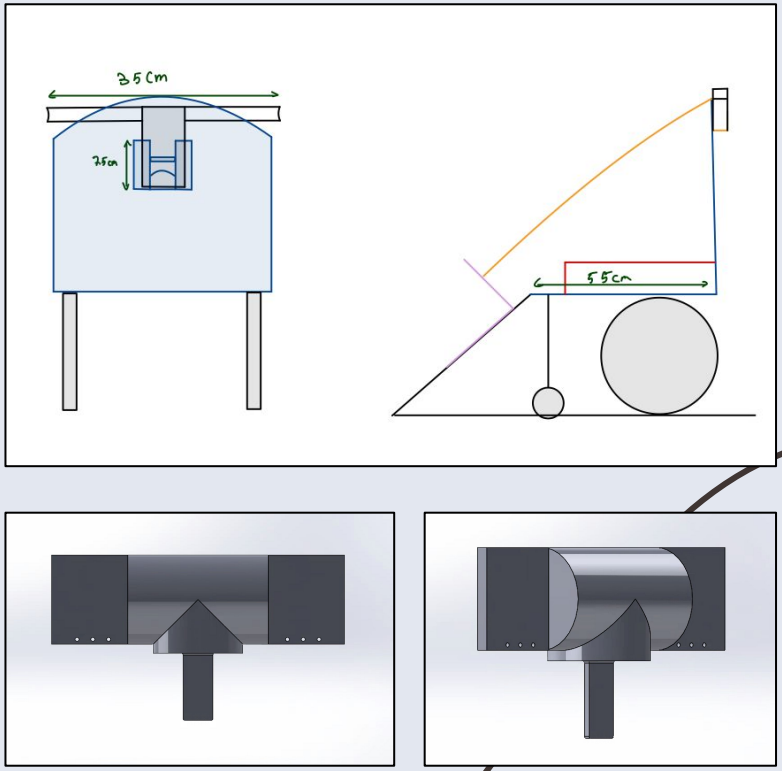
Discovered during design review we **cannot make any permanent changes to the wheelchair** or user will lose warranty on the chair.

We were not aware from the beginning so we had to change the design.

Also, **not every wheelchair has a sturdy handlebar** to attach the winch on.

Design Change (1):

- New design uses wheelchair **headrest slot** (because most chairs have one)
- **Headrest connects to winch attachment:** solving the problem of modifying the chair permanently
- Headrest should be **easy to insert** and **remove**



Talking to Alex

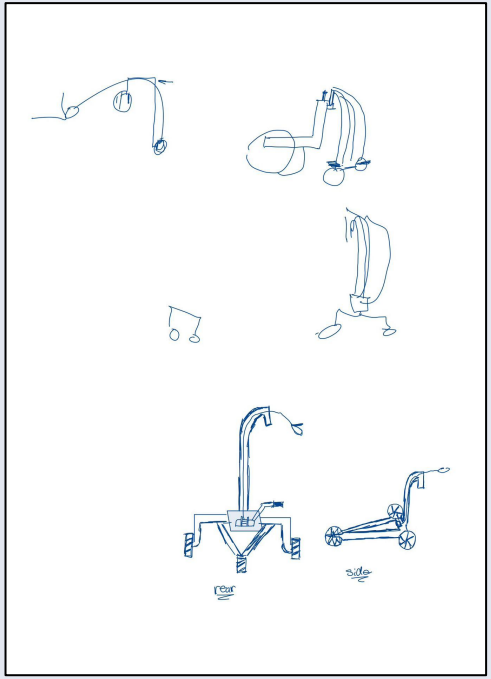
Before building prototype, we talked to Alex about our design.

Alex pointed out 2 important details:

- There is **no need to use 2 winches**
- The headrest attachment will most likely **snap or bend** because all the weight will be on the headrest, **not using chair's weight**

Alex suggested to **lower the winch**, **attach it to the chair** if possible and have the **winch's wire go over the chair**.

Sketches made right after discussion

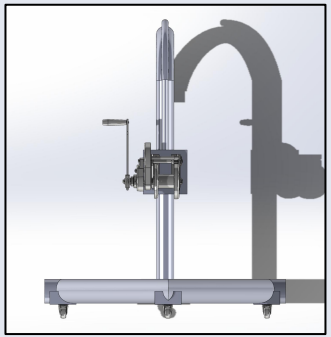


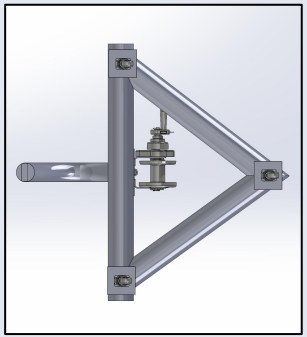
Design change (2):

After Alex's feedback, we had to change the design again.

We decided to use a **metal frame that would sit behind wheelchair** and **strapped** to the wheelchair. That way we **use the chair's weight**.

There will be a steel flange where winch will be attached. By **keeping the weight of the winch at the bottom**, we increase the chances of a more stable mechanism.





Initial BOM

Three main subsystems:

- Slide ~**$57.63**
- Winch attachment ~**$72.41**
- Frame ~**$12.51**

→Total Prototype Cost ~**$144.55**

Sub-System	Item	Description	Quantity	Unit Cost	Total Cost	Link/Where to Obtain
Slide	Wooden Planks	To make slide component of final prototype. Reason for wood bought from home depot is because of recommendation by Alex.	1	$31.98	$36.14	Home Depot
	Vinyl Sheet or Tape	To smooth out and reduce friction on wood. Instead of vinyl sheet, maybe use tape or other cheaper smoothing material.	1	$0.00	$0.00	TBD
	Hinges	Slide will be made compact and foldable using hinges	3	$6.93	$23.49	Home Depot
Winches	Manual Winch	To pull weight up the slide onto wheelchair	1	$22.10	$24.97	Amazon
	Hollow Square Metal Bar 121.92cm x 1.91cm	To connect 3D printed part to the winches and to extend outward on both side for winch. (After consultation with Alex from CEED, he recommended this specific hollow metal bar from Home Depot so that we can create the frame and attach the winch)	1	23.99	$27.11	Canadian Tire
	Hollow Square Metal Bar 91.44cm x 1.91cm		1	17.99	$20.33	Canadian Tire
 **Frame**	Wheels with Locking Mechnaism	To add to the frame of the device to make it portable. The locking mechanism is used to prevent movement when user is using device (comes in a package of 4, will be using 3)	3	$3.69	$12.51	Amazon
SUM OF COST FOR FINAL PROTOTYPE					$144.55	
SUM OF COST FOR ALL ITEMS FOR APPROVAL					$97.11	

Where Everything Went Wrong

After our 3rd client meet where we showed the client the idea, the clients emailed Justine (who we had the meeting with) that they **didn't like the idea**.

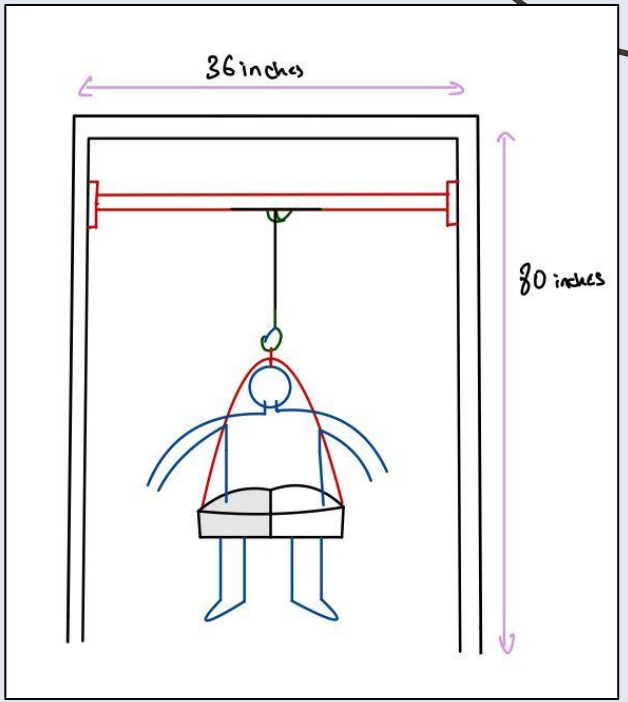
We were informed last Monday and we had to change our idea again.

Design change (3):

- After suggestion from the client to **use the door to support weight** and discussion with the TA:

→Winch is attached to a **pull-up bar** of weight capacity of 200 lb with a welded flange piece

→Winch attached to **transfer chair** to pull and lift user



Updated BOM

Updated subsystems:

- Pull up bar ~$33.89
- Winch ~$24.97
- Chair ~$38.40

→Total Prototype Cost ~$97.26

Item	Description	Quantity	Unit Cost	Total Cost	Link/Where to Obtain
 Pull Up Bar	Due to change in the design of the device and newly defined constraints, the device will now use a pull up bar to lift the user.	1	$29.99	$33.89	Amazon
 Fabric	This would be used to make the chair that the user will be on when being lifted. This is only for demonstration purposes and ideally use the transfer chair that the client recommended.	1	$23.99	$27.11	Amazon
 Strap	This would be added to the chair to add safety measures on the chair	1	$9.99	$11.29	Amazon
Manual Winch	To pull weight up the slide onto wheelchair	1	$22.10	$24.97	Amazon
SUM OF COST FOR FINAL PROTOTYPE				$97.26	
SUM OF COST FOR UNAPPROVED ITEMS				$72.29	

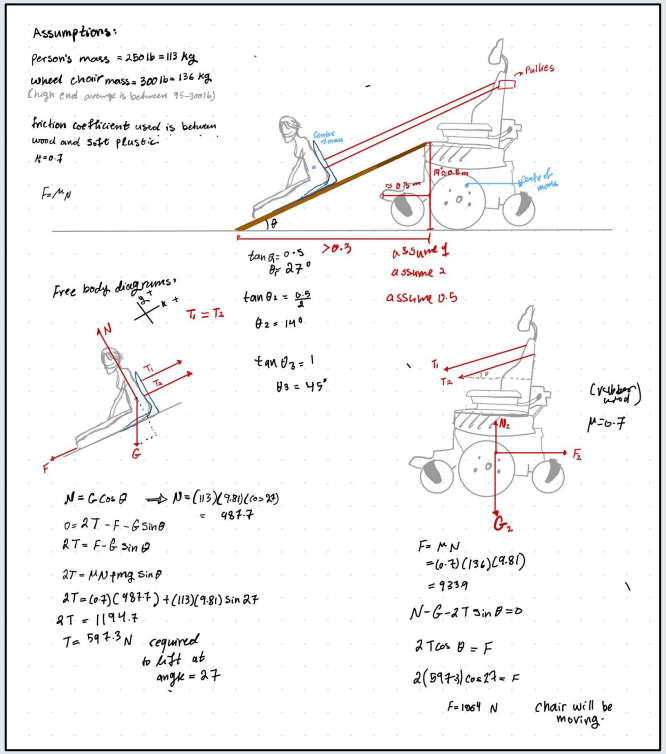
04

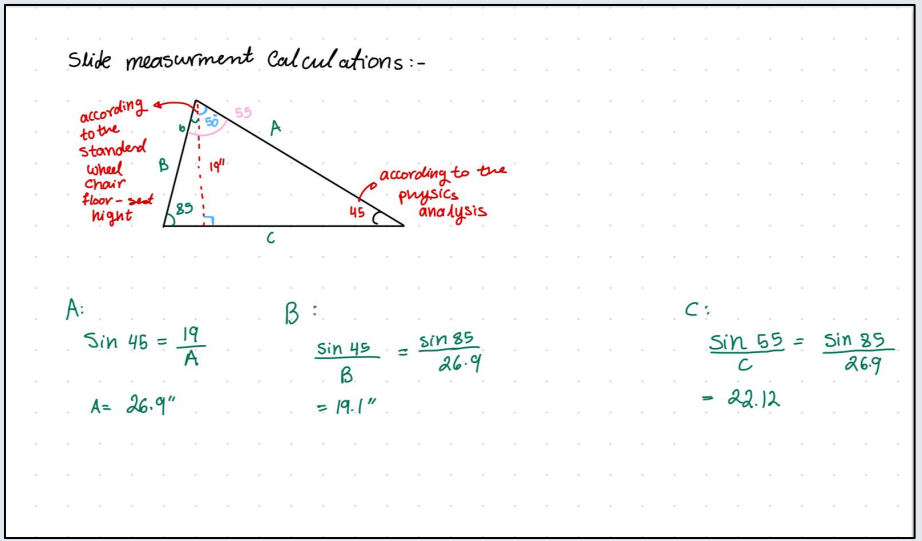
Prototypes and Testing

Focused subsystem prototypes

The Slide

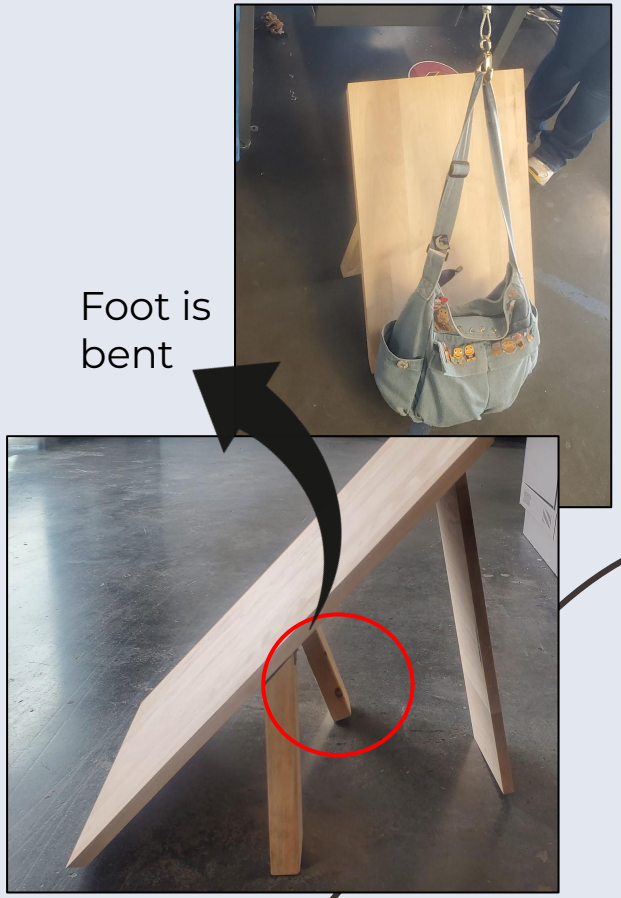
Figuring out measurements



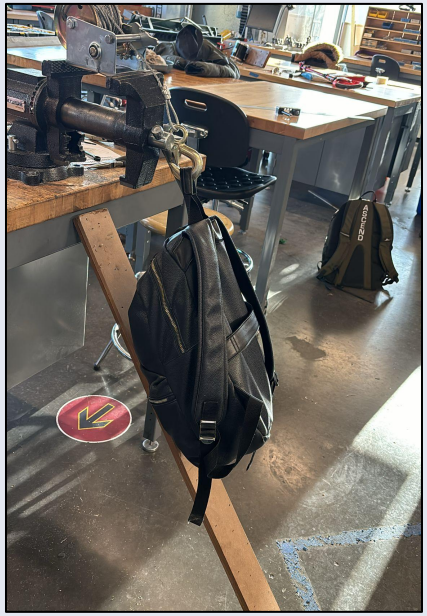


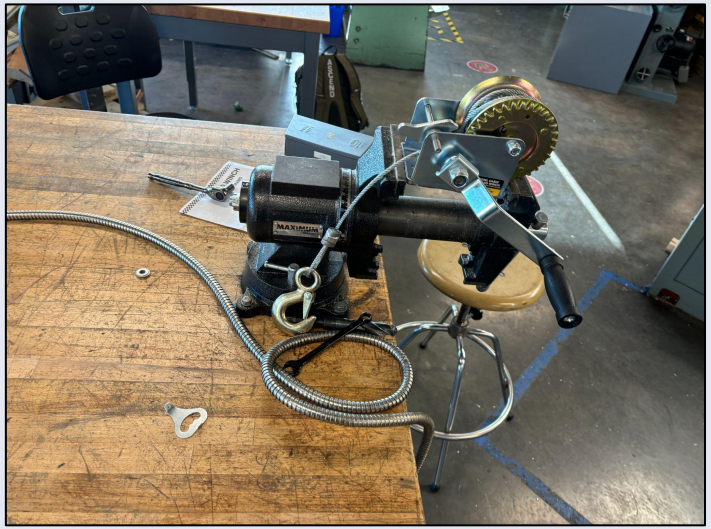
Testing

	The test	Results
Durability	We tested the to see if the slide was able to stand on its own	The slide held up well however it needed more support so we are adding a support piece at the bottom



The Winch Testing





05

Lessons Learned

Design and constraint changes

Lessons learned

- Prioritizing a select few constraints at a time
- Set clear constraints with the client themselves
- Communication is key
- Adaptability

06

Future Work

Next Steps

The Next Steps

- Focus on the design of the pull-up bar for design day
- We will be creating a general idea for the chair subsystem
- Complete a detailed design of the winch pull-up bar attachment
- Conduct testing for the pull-up bar attachment

*Us trying to move forward with the project

Thanks for listening

Any Questions?

Main points to include

- Problem summary + client needs (same slide) (very brief)
- Benchmarking (very brief)
- Target specification (very brief)
- Main concept (very brief)
- Business model (very brief)
- Economics stuff (very brief)
- Solutions and concepts (here we can talk in details about everything happened)
- Decision made (our new/ finale idea)
- Trials and tribulations, lessons learned, future work