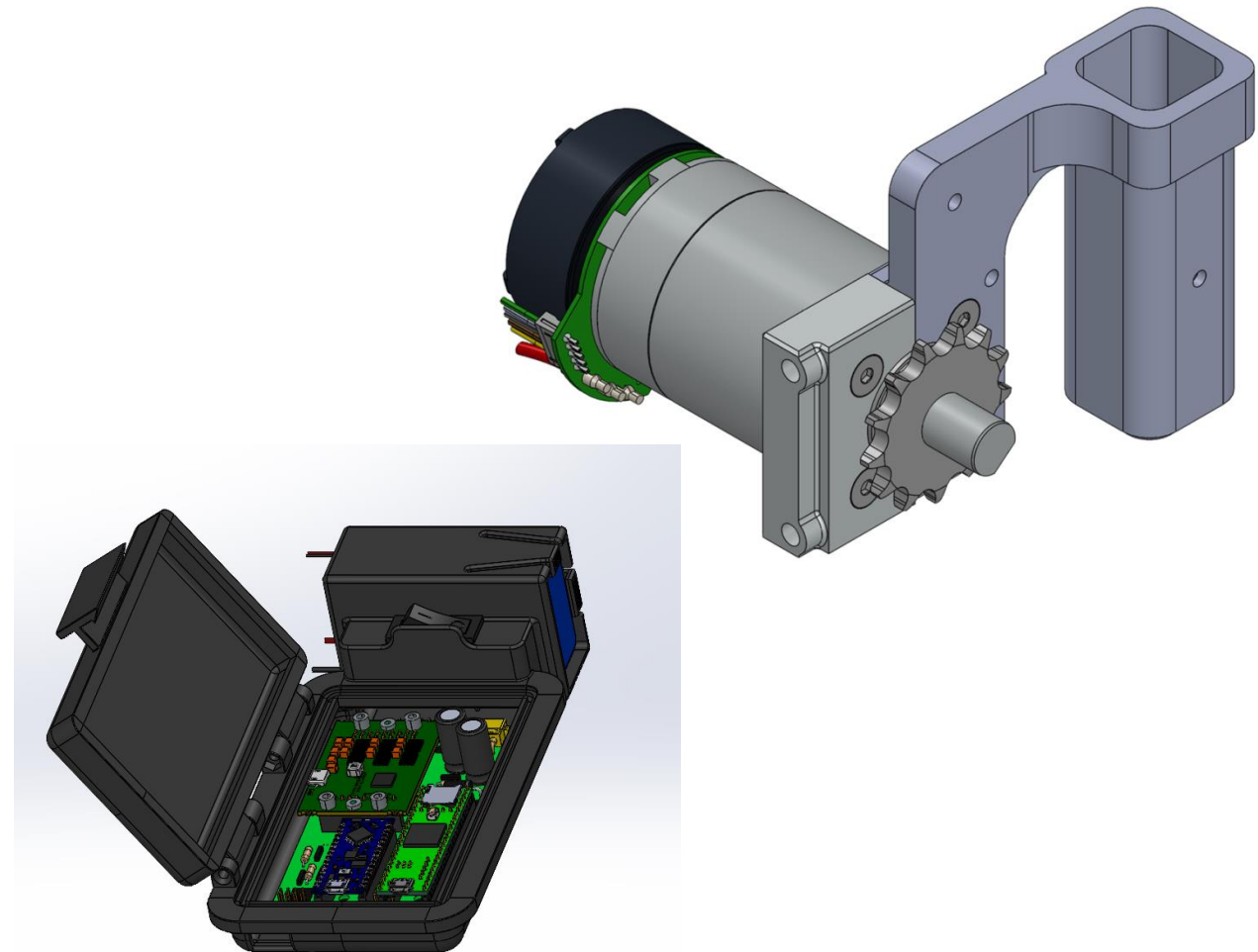


# Below the Knee Exoskeleton

Team:

Ryan Oppel (Budget Lead), Alexandra Schell (Team Lead),  
Nicolas Watkins (Website and CAD Lead)

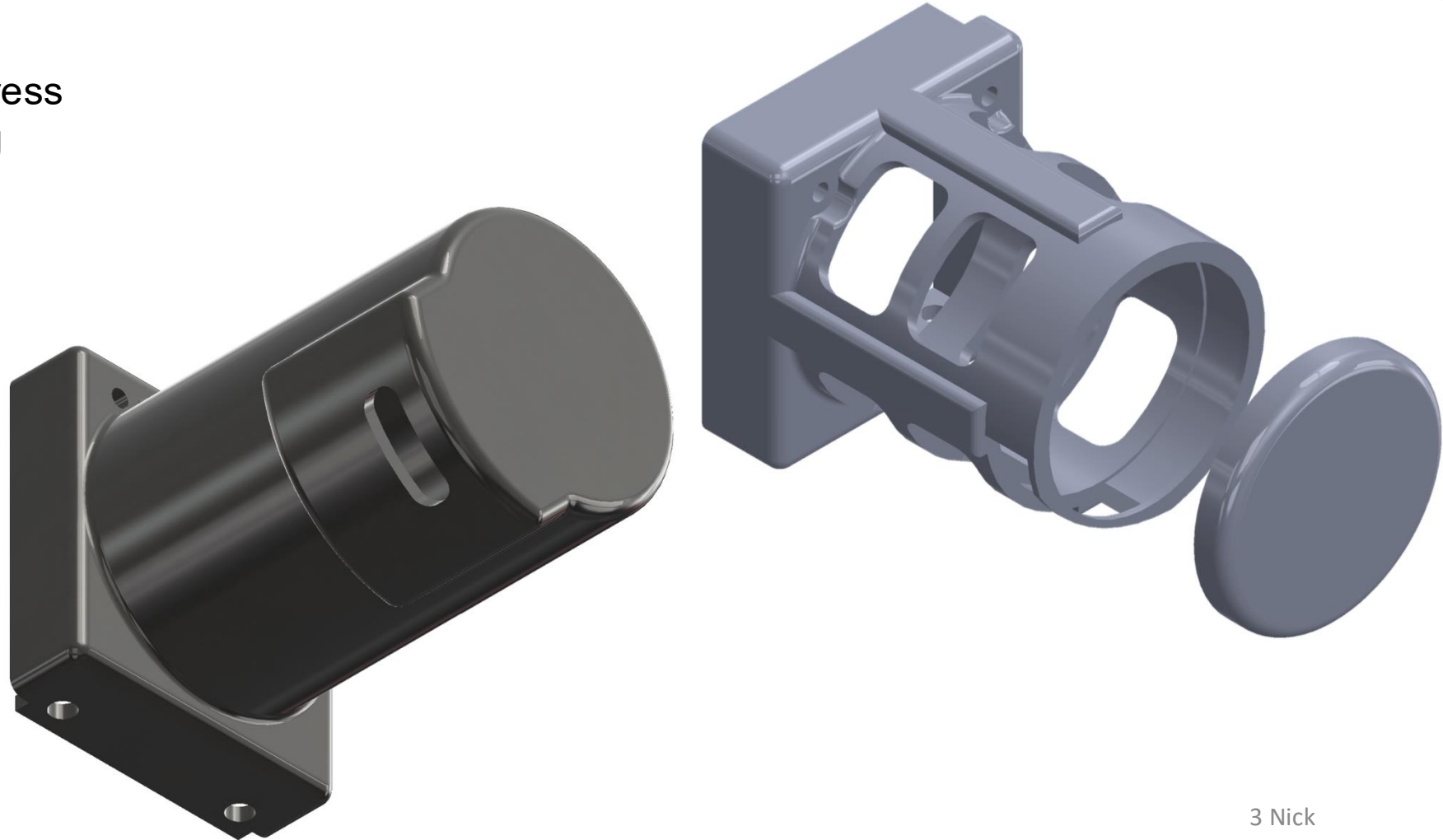
# Design Efforts



# Design Efforts

## Final Designs

- Test heat dissipation vs ingress protection for motor housing
- 99% designed



# Purchasing Plan

- We had an original Budget of \$4000, we have purchased \$3,577 worth of parts so far.
- Total Assembly had 59 parts/pieces.
- 12 parts have been purchased
- 36 parts have been donated
- 11 have been manufactured or are in the process of being manufactured
- 88.12% of the purchased is on hand

Purchased Items:	Price
800cc Onyx Filament Spool	254.97
150cc Carbon Fiber CFF Spool	518.5
E-Flite 22.2v 910mAh li-po battery	53.29
ECXFL32L motor with a 1:35 Gear Ratio X2	599.51
Fluorine Rubber O-Rings, 42mm OD 38mm ID 2mm Width (pack of 10)	16.9
10 PCS O Rings Nitrile Rubber Round O-Rings Seal Grommets 185mm OD 181mm ID 2mm Width	16.91
SUNLU PLA 3D Printer Filament PLA Filament 1.75mm	27.27
Creality PLA Carbon Fiber Filament 1.75mm	39.28
Aluminum Brackets	-
Aluminum Mount	-
Aluminum Ratchet and Picket	-
Aluminum Spacer	2049.99
Total:	\$3,576.62

# Purchasing Plan

- 100% of parts have Been Purchased
- 100% of the quintessential Design has been complete
- 72.7% of parts have been manufactured
- We have spent approximately 4 days (96 hours) on printing parts, and we expect to spend 15 hours in future 3-D printing, 2 hours in manufacturing, and 8 more hours in assembly.
- By our calculations we have completed 79.33% of our manufacturing time.

Parts:	Part#:
Roller Chain sprocket	Manufactured
Big Gear modified Koge	Manufactured
Foot plate	Manufactured
Pully Quick connect	Manufactured
Bridge pulley	Manufactured
PCB sensor case	Manufactured
Calf Cuff adjuster	Manufactured
Cable Cover	Manufactured
Motor Bearing Case	Manufactured
Battery Box Cover	Manufactured
C.F. Upright	Manufactured

Parts:	Column1
Bondable Flex Circuit	Donated
Cable Chain Linker	Donated
Carbon Fiber square tubing	Donated
Quick Connect torque sensor	Donated
Calibration Magnet	Donated
Sensor cable	Donated
Strain Gage	Donated
Torque Sensor Wires	Donated

Parts:	Part #	Price
6mm ball bearing	49DD43	Donated
35 mm button head screw	38DA12	Donated
flanged ball bearing	49DD88	Donated
M8 Steel locknut	38DH71	Donated
M8 steel button head bolt	811X86	Donated
socket head screw	5GUD5	Donated
Hex Head drive screw	5KY28	Donated
M8 bracket bolt	808A65	Donated
Cable Crimp	16X825	Donated
6M Cuff Locknut	38DH70	Donated
FSR	FSR01CE	Donated
small linkage chain.	B1293497	Donated
M3 Nut	4EFZ9	Donated
M3 hex flat screw	811YK3	Donated
Clearance Cable	2TAA1	Donated
Pogo Pin Connector	3RWL9	Donated
M2 flat head screw	6HB56	Donated
M2 nut	6CA66	Donated
M3 sealing socket head screw	6CE47	Donated
M5 button head screw	811X87	Donated
M5 lock washer	826K20	Donated
6mm M5 shoulder screw	38CZ28	Donated
Thermal Pads	1MVP8	Donated
M3 25mm flathead screw	38DE72	Donated
M5 12mm torque screw	26LG26	Donated
M8 bolt	808A65	Donated
6mm Washer	38CV95	Donated
Total:		Donated

# Manufacturing Plan

## Current Plan:

- PCB Housing
- Welding Jig
- Upright Shaft

## What's Left:

- Milling Sprockets
- 3D print with final material
- Assemble overall design

Part:	Cost:	Materials:	Manufacturing:	Manufacturer:	Part #:
Motor Cover	Undetermined	7075 Aluminum Alloy	Machined	NAU CNC	N/A
PCB Housing	518.5	PLA Carbon Fiber Filament	3D Printed	Biomechatronics 3D Printer	F-FG-0005
Motor - Mount Upright	Undetermined	7075 Aluminum Alloy	Machined	Ordered	N/A
Motor Mount - leaf	Undetermined	7075 Aluminum Alloy	Machined	Ordered	N/A
Upright	173.99	Carbon Fiber	Milled	Rock West Composites	25502
Front Cover	518.5	PLA Carbon Fiber Filament	3D Printed	Biomechatronics 3D Printer	F-FG-0005



# Design Progress



Arduino thermocouple  
DAQ assembled for  
testing motor housing  
thermals



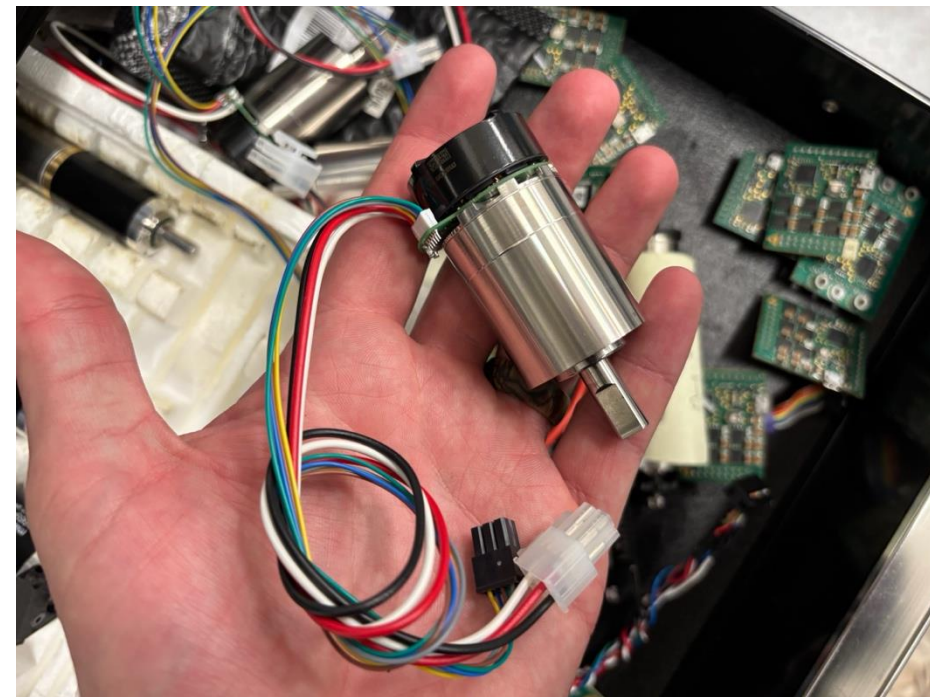
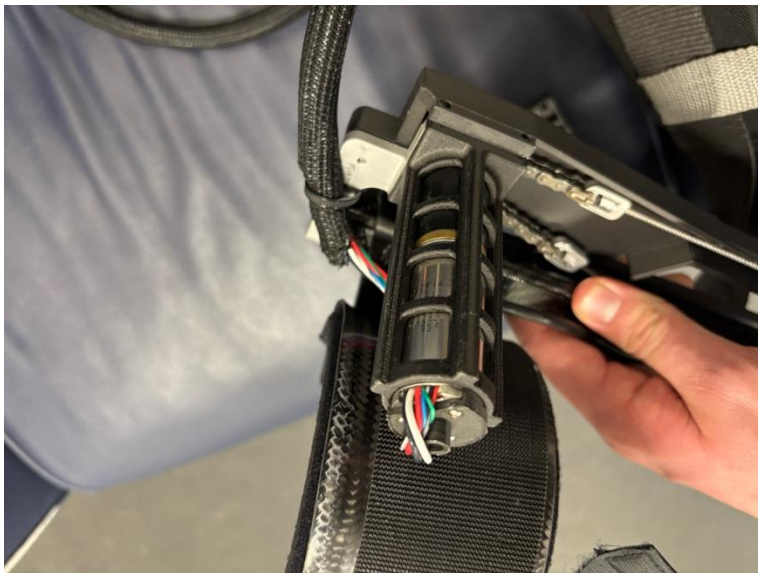
O-rings for motor mount and PCB & battery housing



Upgraded LiPo battery

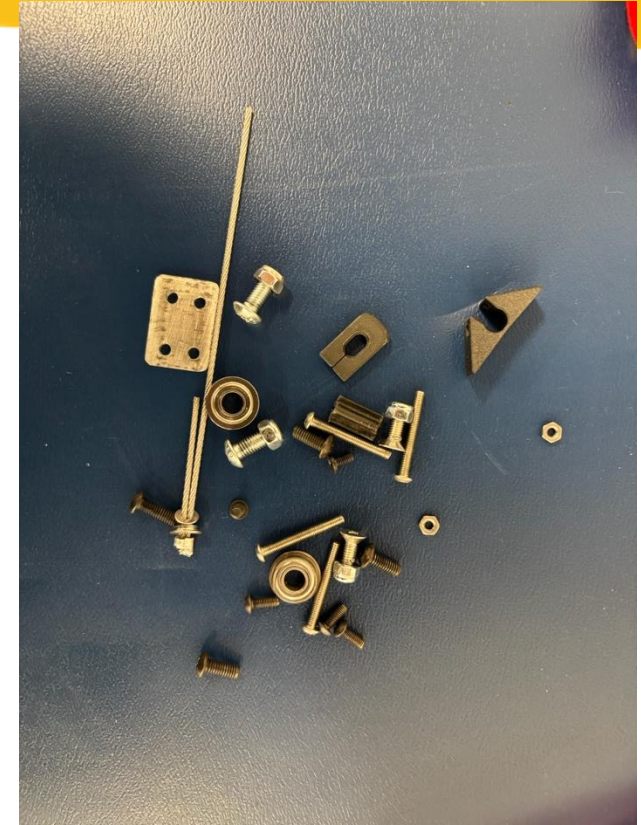
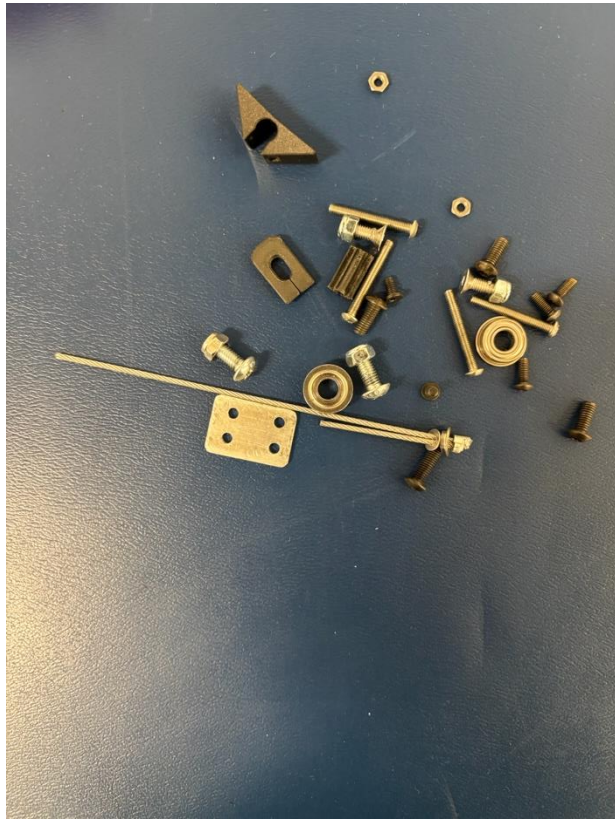


# Demonstration

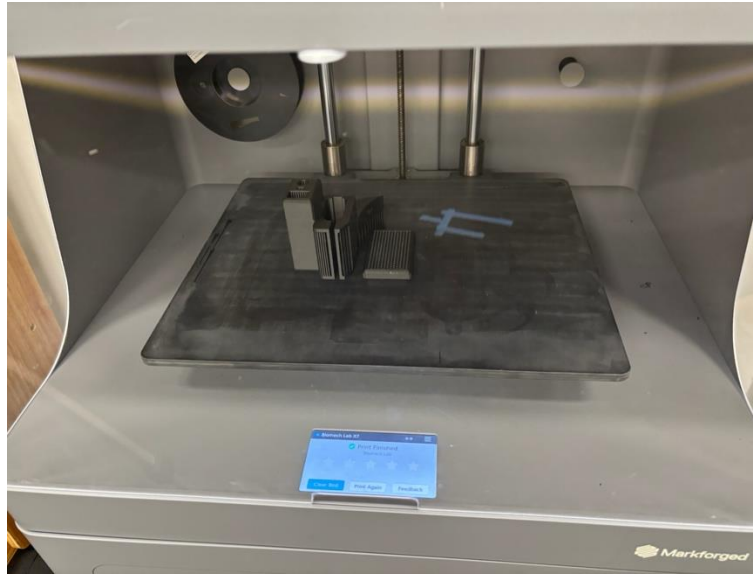




# Demonstration



# Demonstration





# Demonstration



# Demonstration



**Lerner's Ankle Exo-Skeleton:**  
Here is a view of an Ankle Exo-skeleton we will be working with. Our team will be building off this exoskeleton and be modifying some parts and changing the design. As per Lerner's instruction this Exo-skeleton will stay with him in his lab.





# Gantt Chart

## Status:

- Currently slightly ahead schedule on track to be complete once machined parts come in
- Currently only have the 3D printed parts left to be manufactured with the good quality carbon fiber and one or two things left to be milled.

3 Major Deadlines 2nd Semester							1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
WBS Number	Task Title	Task Owner	Start Date	End Date	Duration	% Done															
3.1	Engineering Model	Team	1/13/25	1/23/25	10	100%															
3.2	Test 2nd Prototype	Alex S	12/13/24	1/20/25	37	100%															
3.3	Analysis of 2nd Prototype	Alex S	1/13/25	2/1/25	18	90%															
3.4	Hardware Status Check 1	Team	1/13/25	2/13/25	30	100%															
3.5	Order all parts	Ryan O	1/13/25	2/13/25	30	98%															
3.6	Website check	Nick W	1/13/25	2/27/25	44	100%															
3.7	Testing Plan	Ryan O	3/1/25	3/27/25	26	50%															
3.8	Hardware Status Check 2	Team	2/13/25	3/6/25	23	75%															
3.9	Final CAD	Ryan O	3/6/25	4/3/25	27	98%															
4	Final Hardware Status and Prototype	Team	3/6/25	4/3/25	27	40%															
4.1	Website check	Nick W	2/28/25	4/17/25	47	20%															
4.2	Test and Analyze Prototype	Alex S	4/3/25	4/17/25	14	10%															
4.3	Final Report	Team	4/1/25	4/17/25	16	0%															

# Overall Percents

Task	Percent Complete	Percent on Hand
Design Efforts	99%	
Purchasing Plan	100%	88.12%
Manufacturing Plan	79.33% time	
Demonstration	72.7% of parts	

# Thank You!