# P11: Robotic Shoulder Exoskeleton

Colin Cipolla

Dylan Kurz

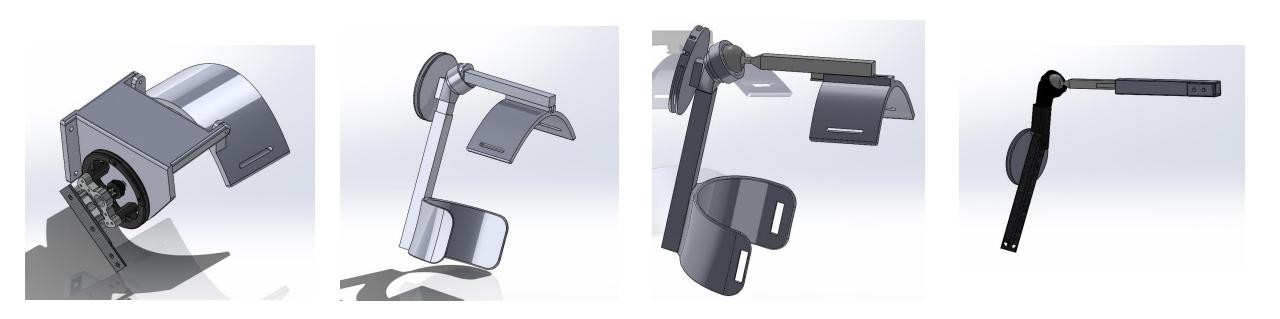
Jordan Finger

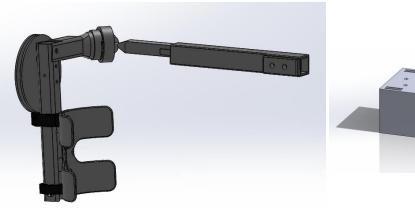
Michael George

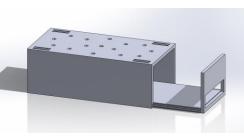
Michael Marchica

## Gantt Chart

		Display Week:	7		Feb 27, 2023	Mar 6, 2023	Mar 13, 2023	Mar 20, 2023	Mar 27, 2023	Apr 3, 2023	Apr 10, 2023
	ASSIGNED						. 12 13 14 15 16 17 18 1				
TASK	то	PROGRESS	START	END	M T W T F S S	M T W T F S	S M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F
33% to 67% Build											
Revise Design, Update CAD	Team	100%	2/14/23	3/5/23							
Client Meeting #3 and #4    Both Meetings Canceled	Team	0%	2/24/23	3/3/23							
Order Parts for 67% Build	Team	100%	2/28/23	2/28/23							
Finalize Redesign, Print Parts	Team	100%	3/3/23	3/6/23							
Test Design For Functionality	Team	100%	3/4/23	3/6/23							
67% Build Complete    Present	Team	100%	2/15/23	3/7/23							
67% to 100% Build											
UGRADS Registration	Team	50%	3/6/23	3/10/23							
Client Meeting #5: Present Design New Pivot Design	Team	0%	3/20/23	3/24/23							
Begin Inlaying 3D Prints with Onyx/Carbon Fiber	Team	0%	3/20/23	3/24/23							
Refine Harness System, Ceramic Ball Drilling, Battery and Electrical Mounting	Team	0%	3/27/23	3/31/23							
100% Build Complete    Present	Team	0%	3/8/23	4/7/23							
Design Testing											
Finalize Testing Plan	Team	50%	3/8/23	3/31/23							
Conduct Design Test	Team	0%	3/31/23	4/12/23							
4% 사망 Report	Team	0%	4/12/23	4/14/23							2

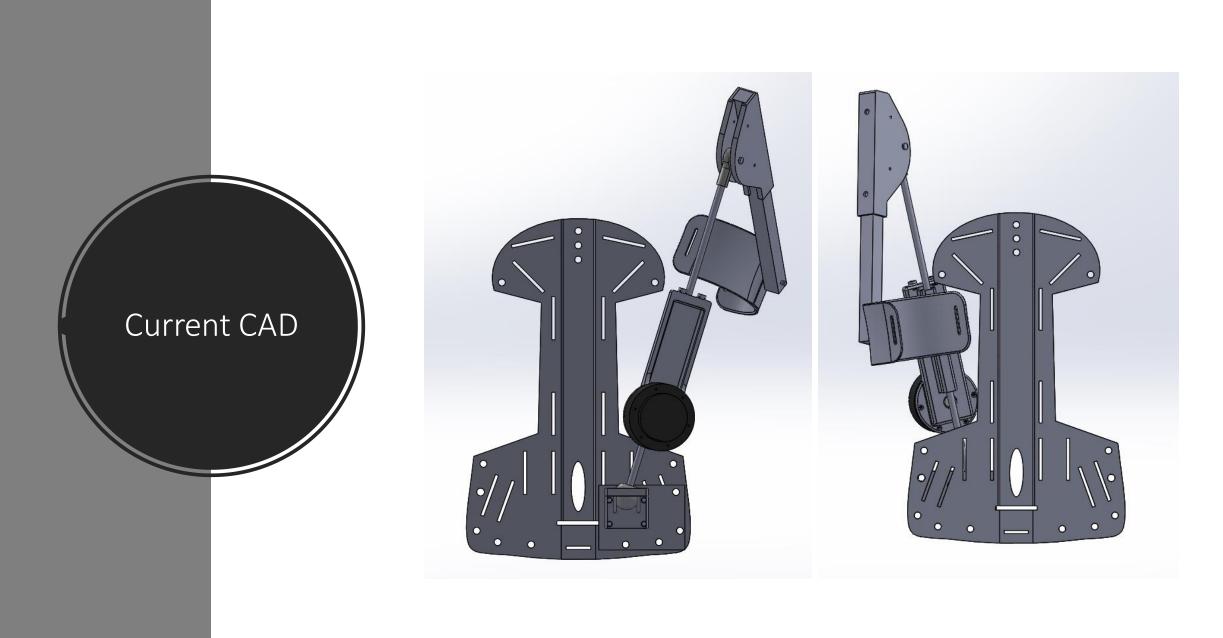




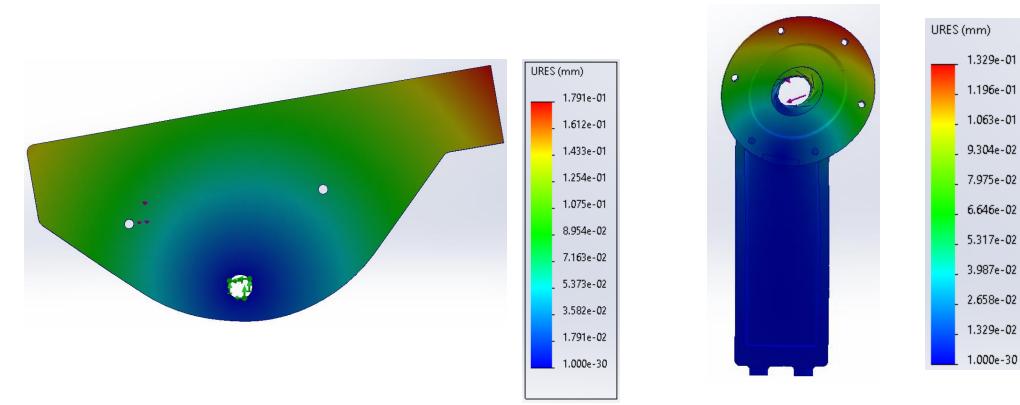


#### CAD Iterations

- From left to right:
  - (1) Initial prototype
  - (2) First ball & socket
  - (3) Second ball & socket
  - (4) and (5) Ball & socket will new revolute joint and mounting & CAD prototype
  - (6) First motor mount



## FEA

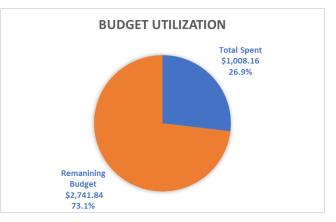


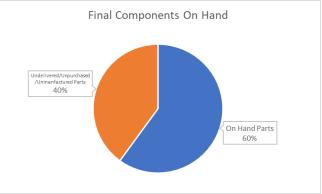
The pivot point experiences less than a millimeter of deformation assuming all the force coming from the motor goes into the pivot.

The total deflection was less than one millimeter assuming all torque is going into deflecting the motor mount

## Purchasing Plan - BOM

Bill of Materials:	Quantity:		Vendor/Manufacturer:	Part Status:	Total Cost:
Heim Joint	1	Manufactured	Team	Finalizing Design	\$18.00
Socket Joint	1	Manufactured	BIO Mechatronics Lab	Finalizing Design	\$41.04
Large Pulley	1	Manufactured	BIO Mechatronics Lab	Finalizing Design	\$8.00
Large Pulley Bridge	1	Manufactured	BIO Mechatronics Lab	Finalizing Design	\$1.00
Ball Joint Bar	1	Manufactured	Team	Redesigning	\$8.39
Ball Joint	1	Manufactured	BIO Mechatronics Lab	Finalizing Design	\$1.34
Motot Mount Box Lid	1	Manufactured	Team	Finalizing Design	\$2.31
Motor Mount Box	1	Manufactured	Team	Completed	\$6.75
Bicep Cuff	1	Manufactured	Team	Completed	\$1.83
Bicep Mount Upper	1	Manufactured	BIO Mechatronics Lab	Waiting on BIO MECI	\$1.00
Blcep Mount Lower	1	Manufactured	BIO Mechatronics Lab	Waiting on BIO MECI	\$1.00
Harness System	1	Modified	Amazon	Delivered	\$34.00
Strapping 10 Yard	1	Modified	Amazon	Delivered	\$12.16
Motors AK 60-6	2	Buy-Out	T-Motor	Delivered	\$599.00
Bowden Cables 5'	4	Buy-Out	Absolute Bikes	Delivered	\$43.00
6-32 x1in Bolts	8	Buy-Out	The Home Depot	Delivered	\$1.38
6-32 Nut	8	Buy-Out	The Home Depot	Delivered	\$1.38
#6 Washers	12	Buy-Out	The Home Depot	Delivered	\$1.38
6-32 Nylock Nuts	4	Buy-Out	The Home Depot	Delivered	\$1.38
4-1 1/2 Sheet Metal Screws	4	Buy-Out	The Home Depot	Delivered	\$1.38
8-32 x 1 1/2 Bolts	8	Buy-Out	The Home Depot	Delivered	\$1.38
8-32 x 1 Bolts	8	Buy-Out	The Home Depot	Delivered	\$1.38
8-32 Nuts	4	Buy-Out	The Home Depot	Delivered	\$1.38
8-32 Nylock	4	Buy-Out	The Home Depot	Delivered	\$1.38
#8 Washers	12	Buy-Out	The Home Depot	Delivered	\$1.38
Shoulder Tube	2	Buy-Out	dragonplate.com	Unpurchased	\$73.54
Scuba Back Plate	1	Buy-Out	PiranhaDiveMFG.com	Purchased	\$122.00
All Thread	1	Buy-Out	NAPA	Delivered	\$10.00
Additional Hardware	1	Buy-Out	The Home Depot	Delivered	\$10.00
		Total C	ost of Prototype:		\$1,008.16





The current stage of the build is around 50% due to many final components not included on the prototype.

# Purchasing Plan

#### Purchased and On-hand –

# Manufacturing Plan

Manufactured –

### **Battery Selection**

- Li-Po
  - Lightweight
  - High power density
  - Efficient

Weight(g)

Voltage(V)

Rated Torque(Nm)

Peak Torque(Nm)

Rated Current(A)

Peak Current(A)

Kt(Nm/A)

Kv(RPM/V)

Max Speed@Rated Torque(rpm)

• High discharge rate

#### Specifications-AK60-6 V1.1

0.012	Ke(V/rpm)	368
0.15	Km(Nm/√w)	24
14	Number of Pole-Pair	3
605±5	Resistance Phase to Phase(m $\Omega$ )	9
415±10	Inductance Phase to Phase(uH)	220 (Output)
Φ79	OD(mm)	4.5
39.5	Height(mm)	13.5
24.46	Max torque weight ratio(Nm/kg)	0.113
6:1	Reduction ratio	80

