

P11: Robotic Shoulder Exoskeleton

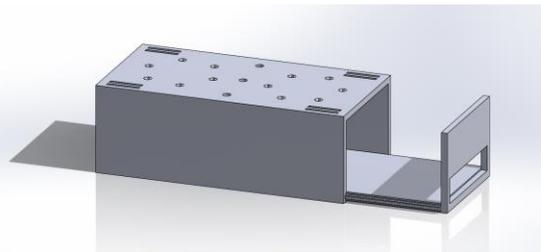
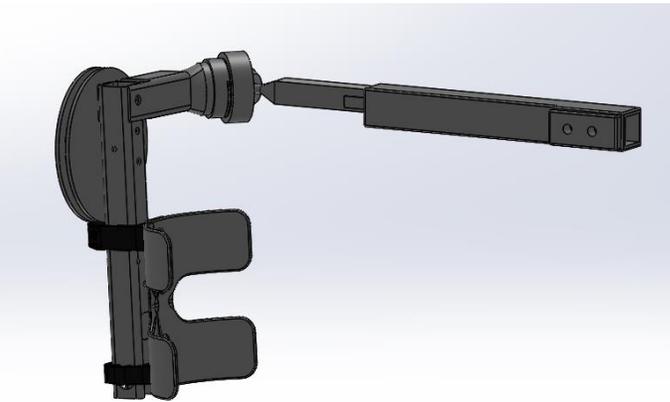
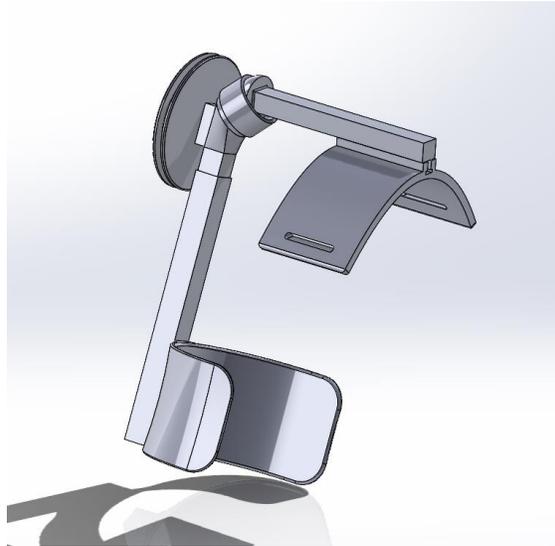
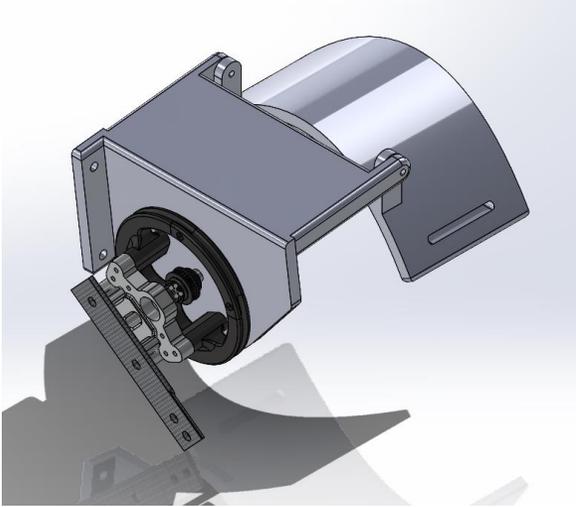
Colin Cipolla

Dylan Kurz

Jordan Finger

Michael George

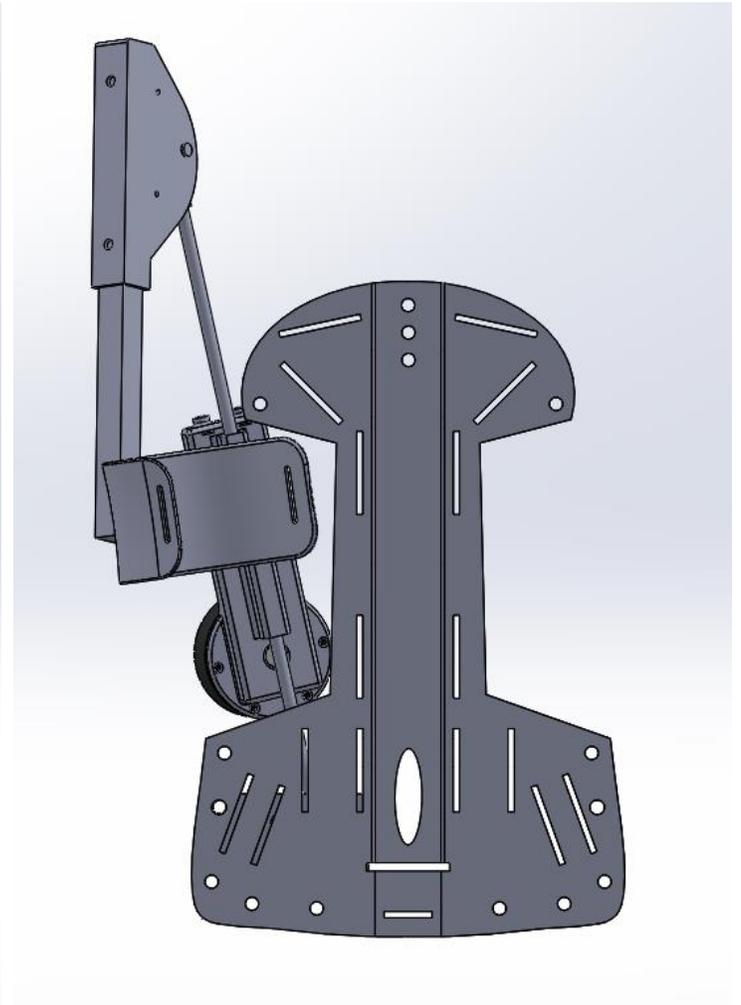
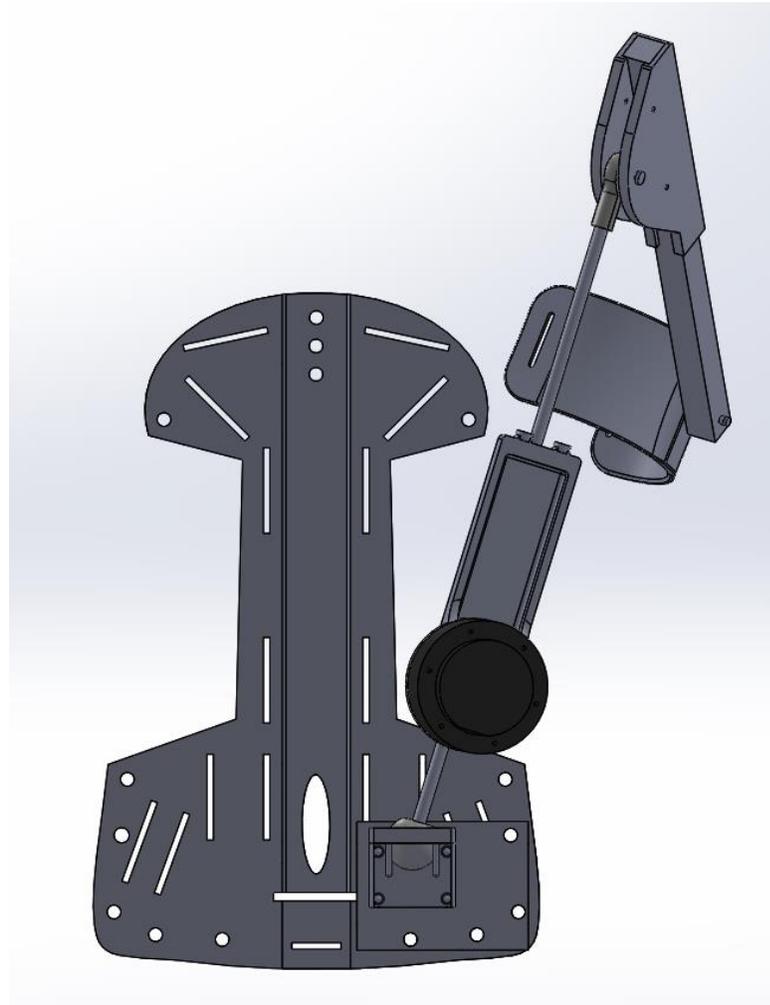
Michael Marchica



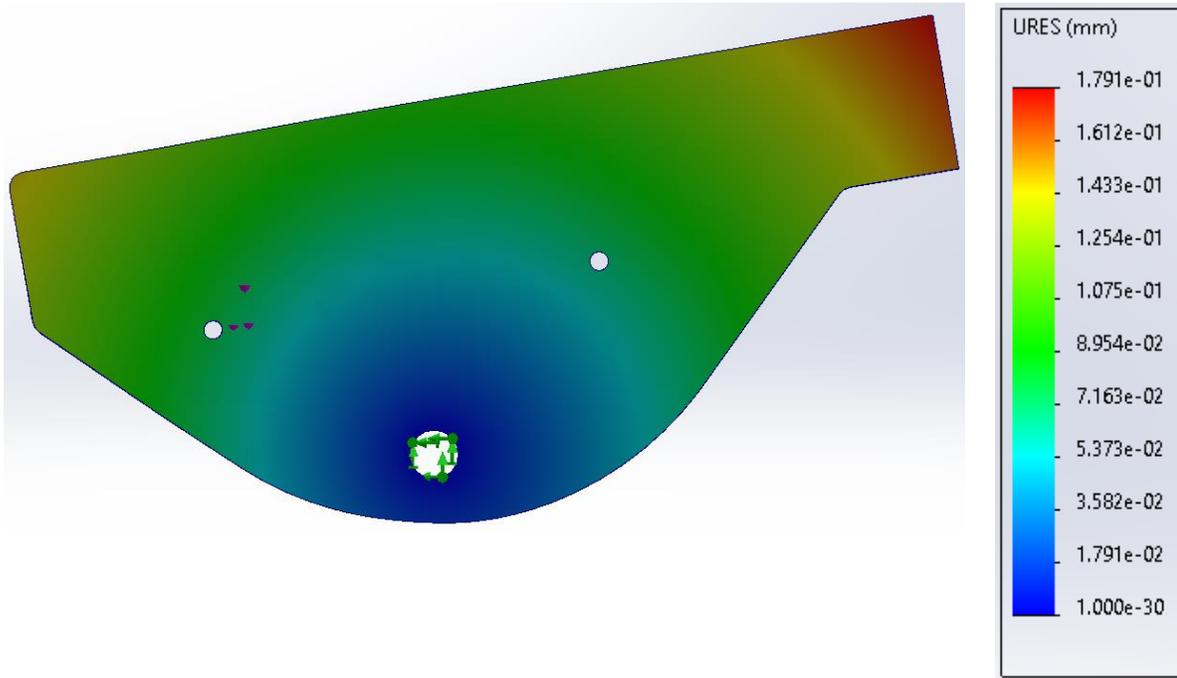
CAD Iterations

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

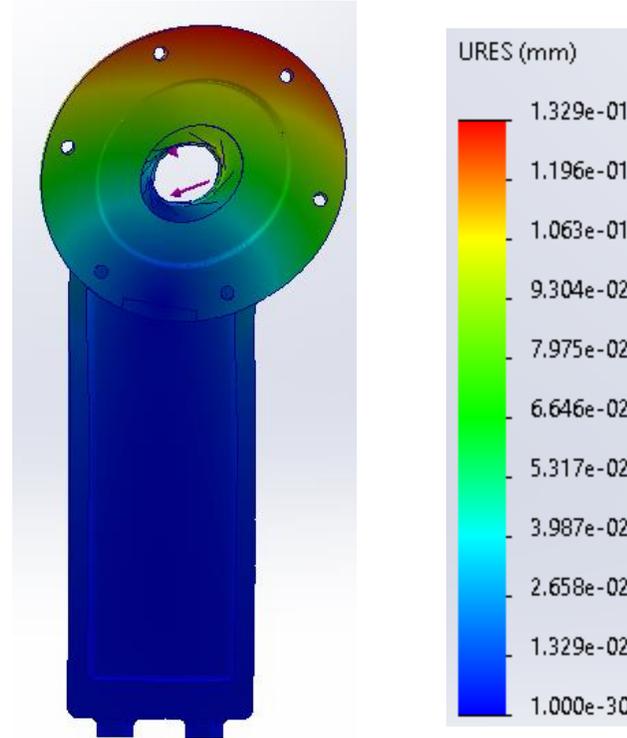
Current CAD



FEA



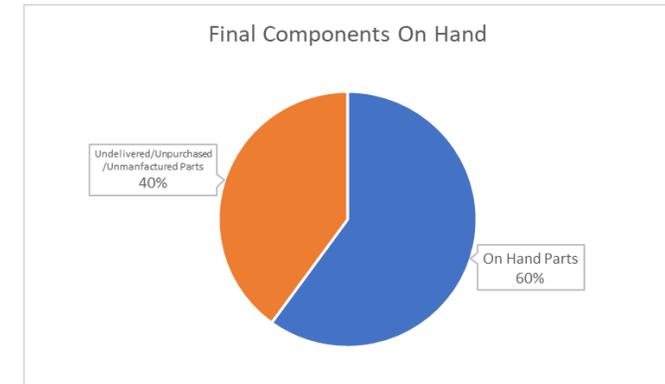
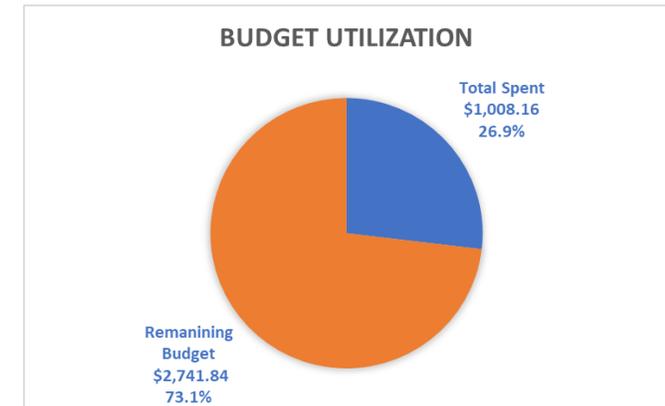
The pivot point experiences less than a millimeter of deformation assuming all the force coming from the motor goes into the pivot.



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
Bicep 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 Cost 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 –

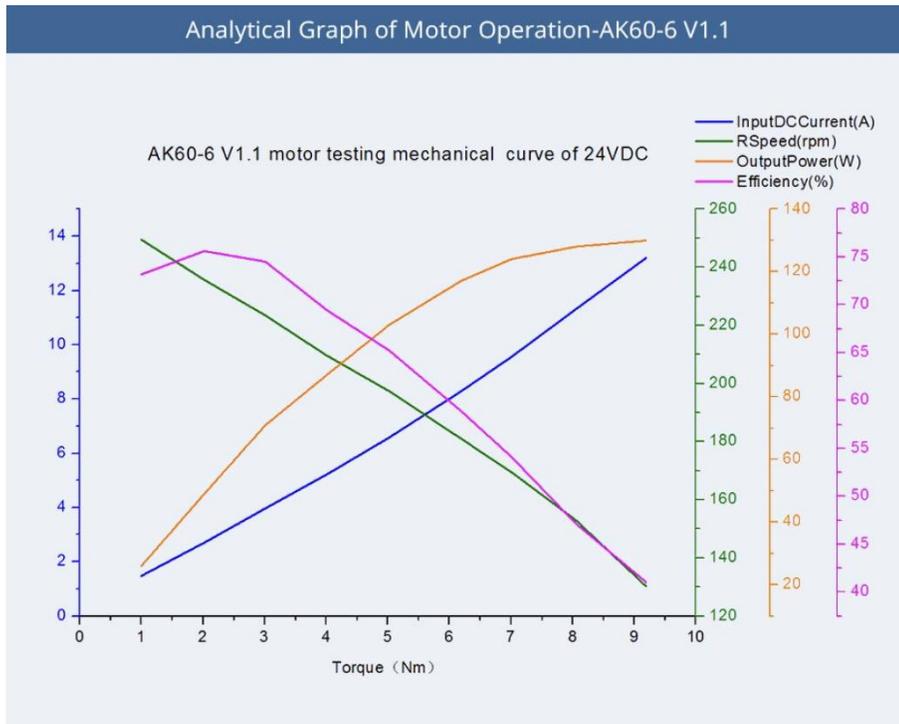
Manufacturing Plan

Manufactured –

Battery Selection

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

Analytical Graph of Motor Operation-AK60-6 V1.1



Specifications-AK60-6 V1.1

Weight(g)	368	Ke(V/rpm)	0.012
Voltage(V)	24	Km(Nm/√w)	0.15
Rated Torque(Nm)	3	Number of Pole-Pair	14
Peak Torque(Nm)	9	Resistance Phase to Phase(mΩ)	605±5
Max Speed@Rated Torque(rpm)	220 (Output)	Inductance Phase to Phase(uH)	415±10
Rated Current(A)	4.5	OD(mm)	Φ79
Peak Current(A)	13.5	Height(mm)	39.5
Kt(Nm/A)	0.113	Max torque weight ratio(Nm/kg)	24.46
Kv(RPM/V)	80	Reduction ratio	6:1



Demonstration
