

# Flying Squirrel

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# Design Progress

- Our final iteration of the *Flying Squirrel* design
- One lead screw and two supports
- Divot in the bottom assembly to accommodate user's hand

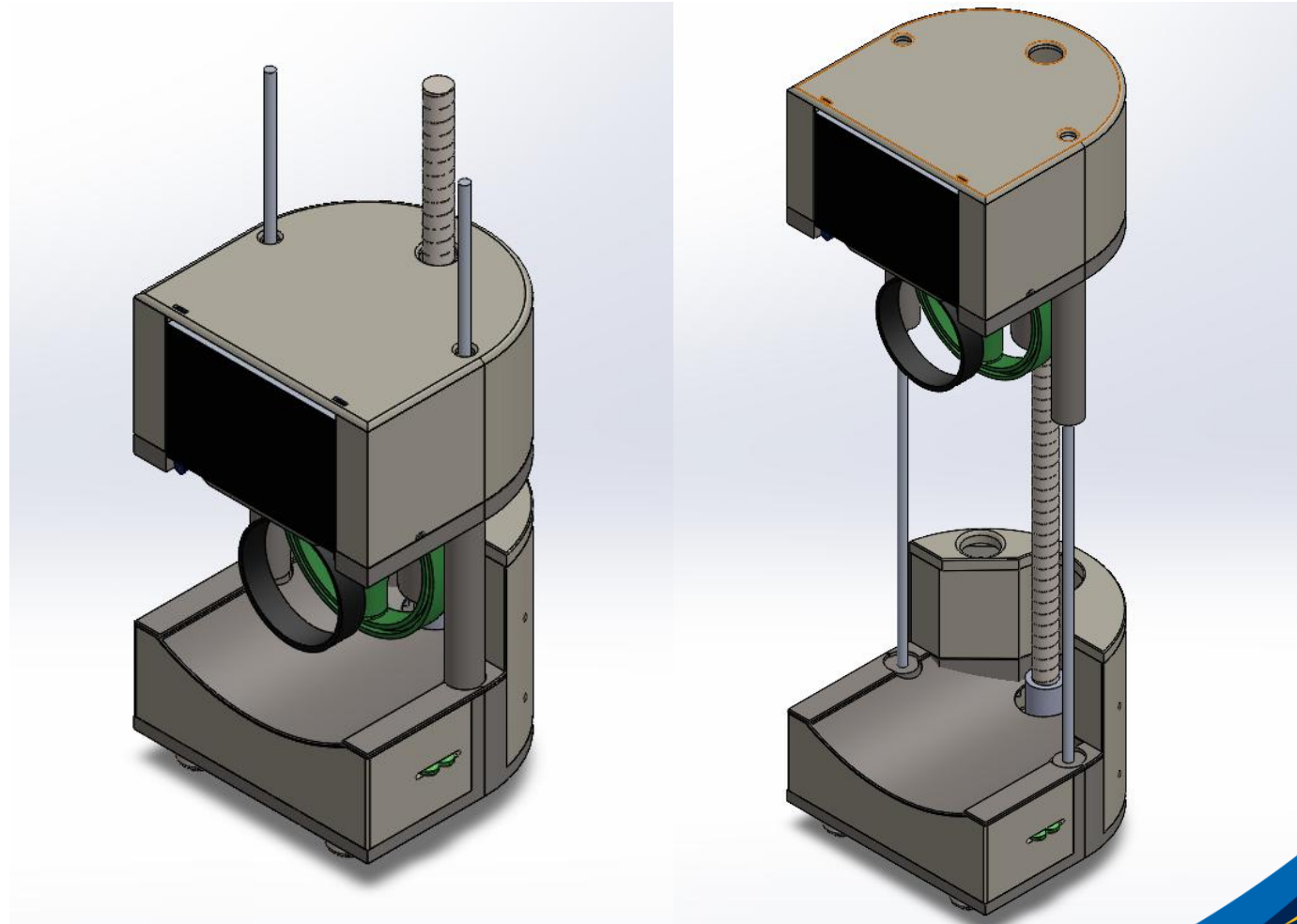


Figure 1: Retracted and Extended CAD Model

# CAD Assembly

- Components are separated into two sections
- Upper section includes battery, Raspberry Pi, Arduino, and force sensor
- Lower section includes motors, encoders, and motor controllers.
- Lower section also includes pulley guides for cables.

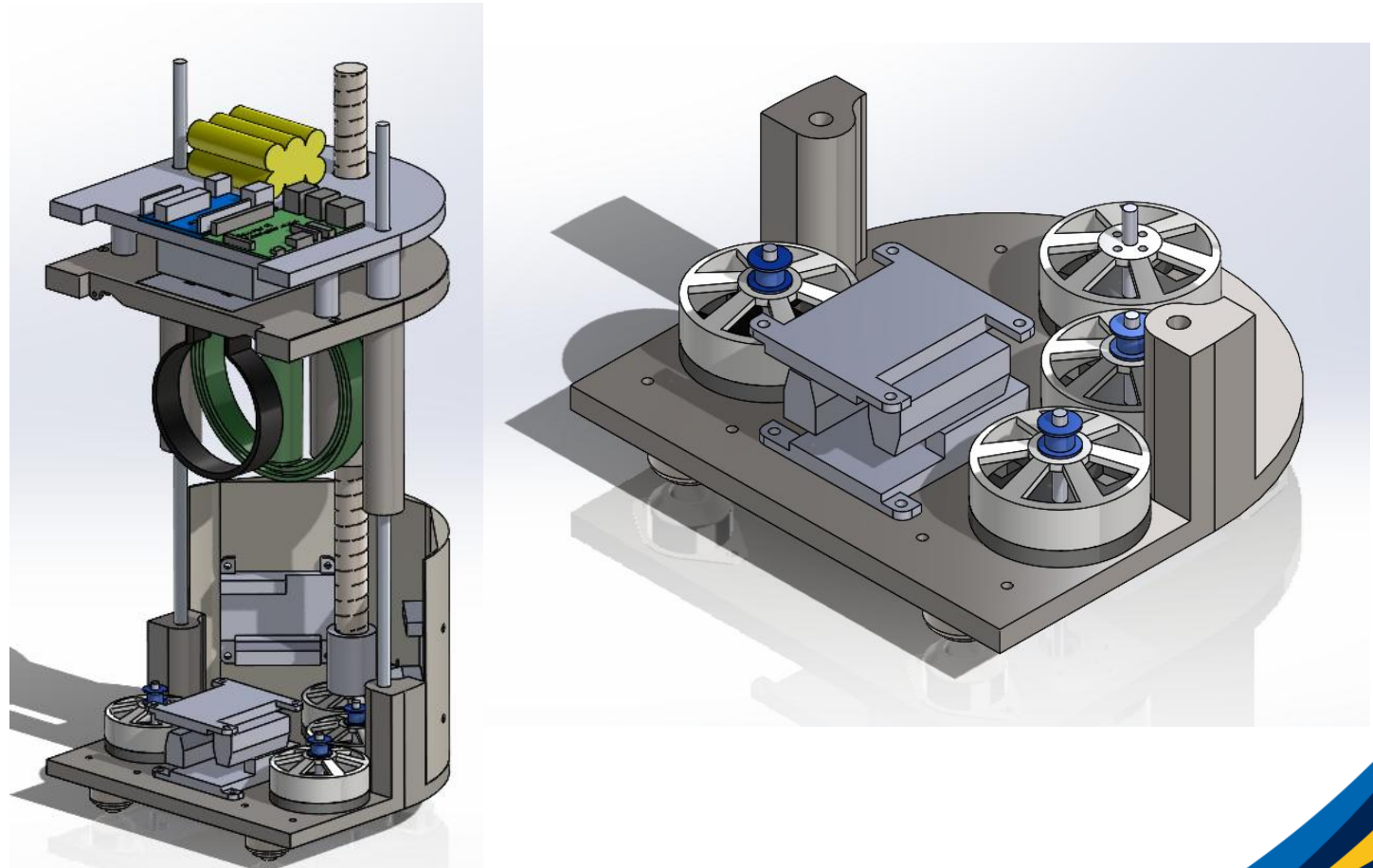


Figure 2: Stripped-Down Model with Internal Components



# Purchasing Plan/BOM

	Raw Materials, Parts or Components	(\$ Unit Cost	make/buy	Primary vender	Manufacturer	Lead time	Part Status	QTY	(\$ Total cost
1	3 Axis force sensor	320.57	buy	zhimin	zhimin	Arrived	on hand	1	320.57
2	ODrive S1	59.00	buy	Odriverrobotics	Odriverrobotics	2 week	on hand	4	236
3	16384 CPR Absolute RS485 Encoder with Cable for ODrive Pro or S1	149	buy	Odriverrobotics	Odriverrobotics	2 week	on hand	4	596
4	Heat Spreader Plate	12	buy	Odriverrobotics	Odriverrobotics	3 week	9/20/2025	3	36
5	Harness Build Kit	9	buy	Odriverrobotics	Odriverrobotics	4 week	9/21/2025	4	36
6	Dual Shaft Motor - D5312s 330KV	59.00	buy	Odriverrobotics	Odriverrobotics	2 week	on hand	4	236
7	PLA (3Kg)	49.71	buy	Amazon	creality	2 days	on hand	1	49.71
8	drylin® lead screw, dryspin® high helix thread, right-hand thread, 1.4301 (304) stainless steel	64.8	buy	Roton	Roton	1.5 weeks	8/28/2025	1	64.8
9	dryspin® lead screw nut, high helix thre	48.02	buy	Roton	Roton	1.5 weeks	8/28/2025	1	48.02
10	2x OVONIC 3S Lipo Battery 15000 mAh 130C 11.1V LIPO battery with EC5 plug for 1/8 RC truck	138.38	buy	ovonic	ovonic	1 week	8/28/2025	1	138.38
11	Raspberry Pi 5 8GB	80	buy	electromaker	raspberrypi	Arrived	on hand	1	80
12	Arduino UNO R4	27.5	buy	Amazon	ELEGOO	Arrived	on hand	1	27.5
13	Strap	8.99	buy	industrialsafety	industrialsafety	1 week	10/16/2025	1	8.99
14	6.5x3 touch LED screen	0	buy	waveshare	waveshare	2 weeks	Donated	1	0
15	Ball bearings	8.99	buy	harborfreight	harborfreight	3 days	8/28/2025	1	8.99
16	DC power supply	33.94	buy	Amazon	Nice-Power	3days	Purchased	1	33.94
17	Suction cup	12	buy	Amazon	Airhead	3 days	10/16/2025	3	36
18	Fishing line	10.98	buy	Amazon	Beyond Braid Braided	3 days	10/16/2025	1	10.98
19	C-Clamp	5	buy	Home depot	Amerella	3 days	10/16/2025	3	15
20	screws	18.98	buy	Home depot	Amerella	3 days	8/28/2025	1	18.98
21	linear ball bearings	5.83	buy	misumi	misumi	1 week	10/16/2025	1	5.83
22	Amplifier Load cell	6.99	buy	Amazon	amazon	3 days	10/17/2025	1	6.99
23	Uxcell 10mm OD 8mm Inner Dia 400mm Length 6063 Aluminum Tube	6.22	manufactured	harfington	harfington	1 week	8/28/2025	2	12.44
24	terminal block distribution	12.99	buy	Amazon	OOMO	3 days	10/17/2025	1	12.99
25	Breadboard	9.99	buy	Amazon	amazon	Arrived	on hand	1	9.99

Figure 3: Bill of Materials

# Manufacturing Plan

## Aspects

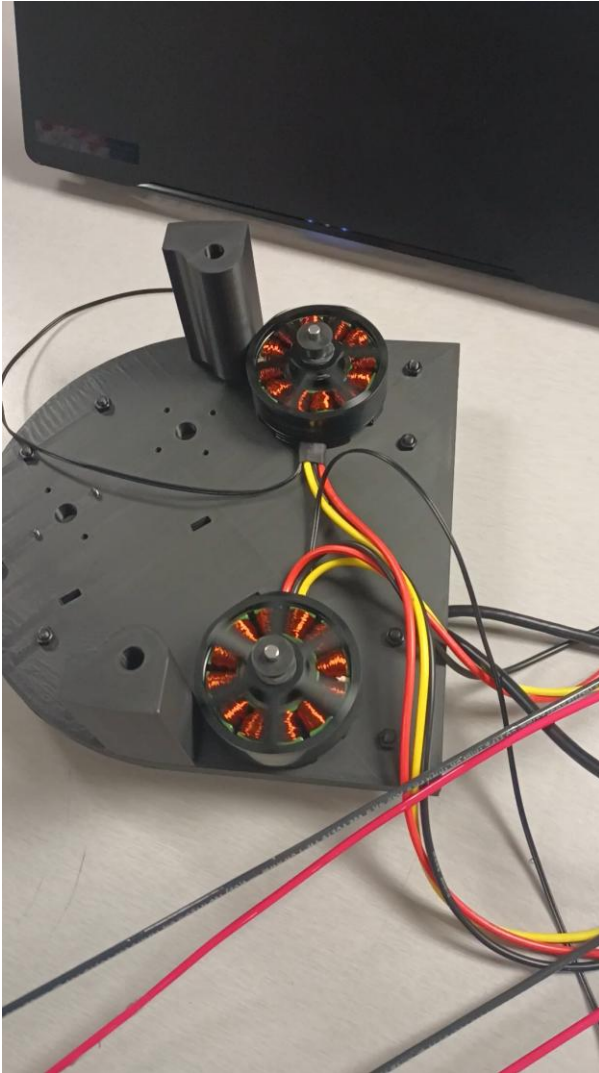
- Most or all custom components will be 3D printed
- Skeletal components were originally going to be machined aluminum, but our client recommended sticking to PLA
- Ryan Donnellan is handling most 3D manufacturing
- All other components will be purchased
- Bottom section of the robot will be assembled first
- Upper section will be assembled in time for the final build check and demonstration

# Manufacturing Plan

Part	Time (hours)	Manufacturing Method	Filament Used (grams)	Progress Percent (%)
Base Plate	16.5	3D Printed	350	100
Back Wall	7.5	3D Printed	270	0
Base Wall Front	5	3D Printed	200	0
Base Wall Middle	2	3D Printed	77	0
Bottom Back Ceiling	1.75	3D Printed	77	0
Bottom Front Ceiling	4	3D Printed	137	0
Handle Plate	2	3D Printed	89	0
Handle	4	3D Printed	151	0
Handle Track	0.25	3D Printed	7	0
Top Shell Ceiling	4.5	3D Printed	220	0
Top Shell Wall	3.25	3D Printed	137	0
Top Mounting Plate	10.25	3D Printed	461	0
Motor Mounting Bracket x 4	1	3D Printed	28	100
Pulley x 3	0.25	3D Printed	4.5	67
Total	62.25	All manufactured parts are 3D printed	2208.5	19.07142857

Figure 4: Manufacturing Plan

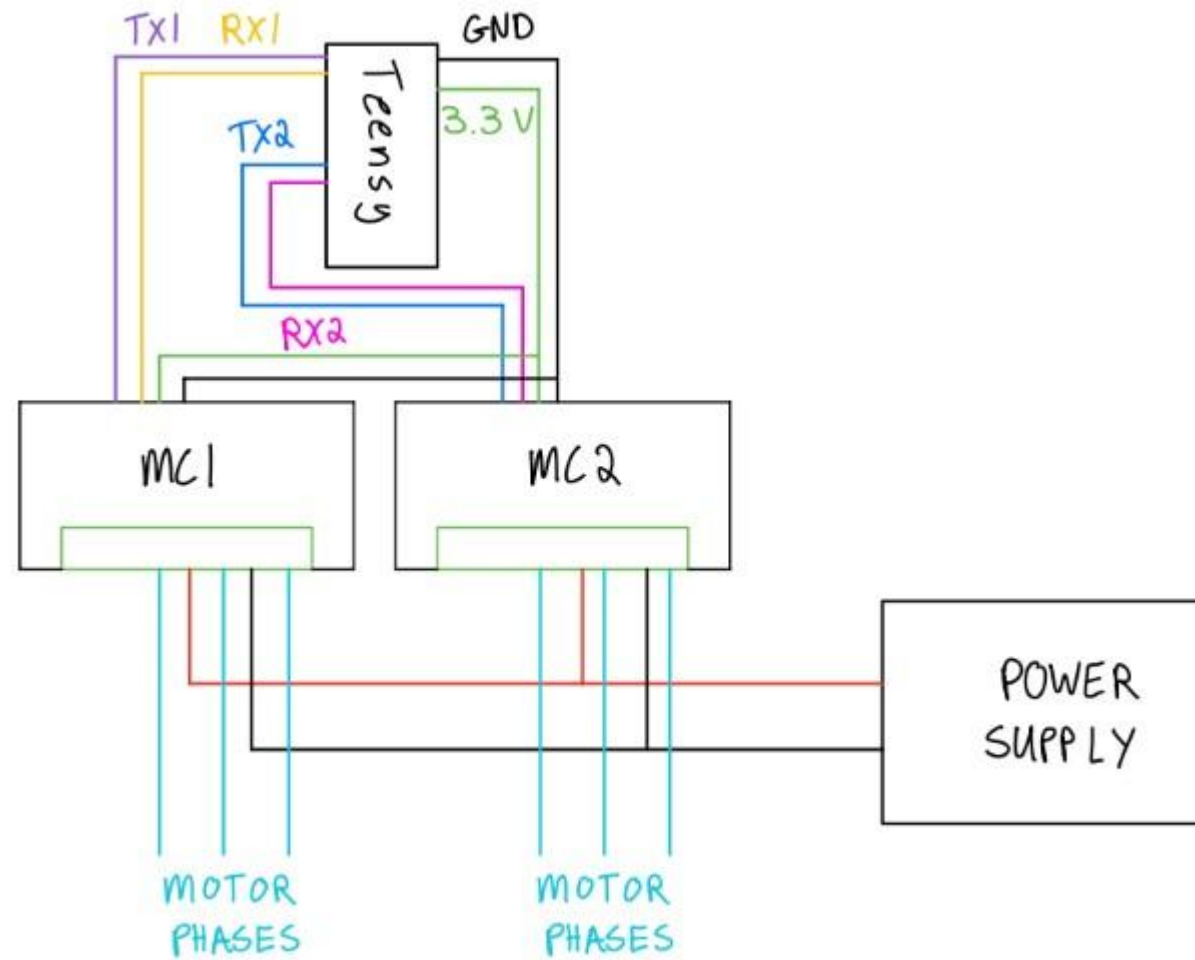
# Demonstration



Video 1: Motor Control Demonstration

- Motor controllers operate as intended
- Motors controllable through online GUI and Arduino
- Motors and encoders properly mounted to bottom plate assembly
- Successfully controlled both motors through Teensy (Arduino Uno lacks necessary connection ports)
- Independent control of motors (Motors spin opposite directions)
- Unfortunately, the assembly is very cumbersome, and takes a great deal of time to set up

# Control Diagram





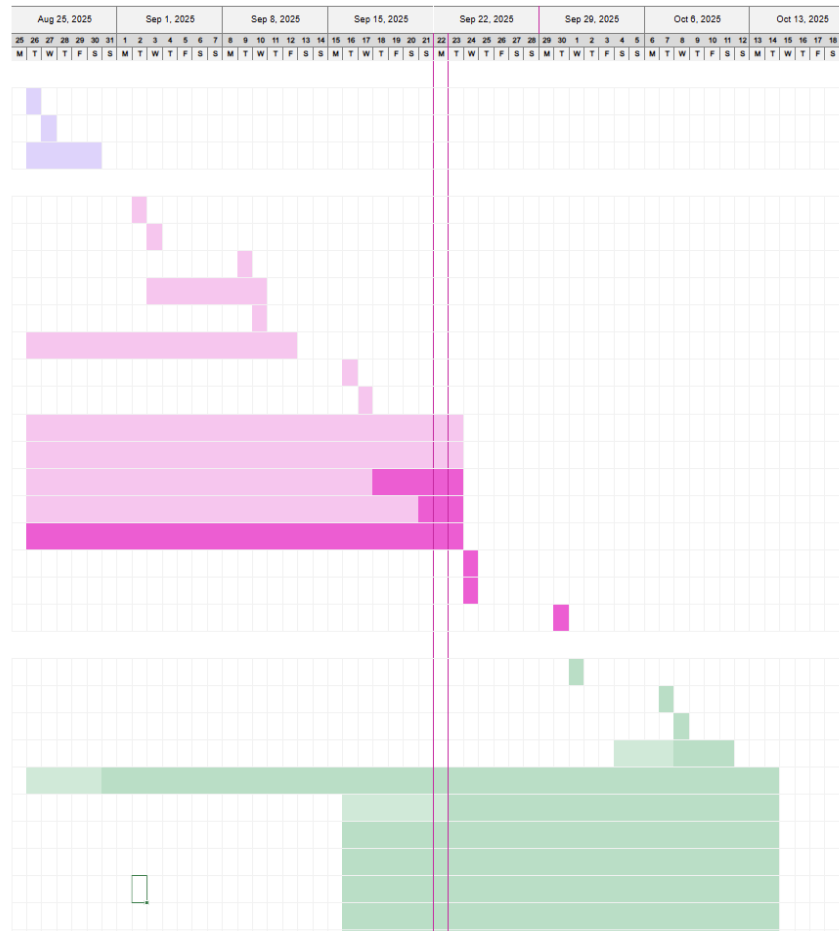
# Gantt Chart

## Flying Squirrel

SIMPLE GANTT CHART by Vertex42.com  
<https://www.vertex42.com/ExcelTemplates/simple-gantt-chart.html>

TASK	ASSIGNED TO	PROGRESS	START	END
<b>August</b>				
Kickoff Meeting	All	100%	8/26/25	8/26/25
Client Meeting	All	100%	8/27/25	8/27/25
Project Management	All	100%	8/26/25	8/30/25
<b>September</b>				
Staff Meeting	All	100%	9/2/25	9/2/25
Client Meeting	All	100%	9/3/25	9/3/25
Staff Meeting	All	100%	9/9/25	9/9/25
Engineering Model Summa All		100%	9/3/25	9/10/25
Client Meeting	All	100%	9/10/25	9/10/25
Individual Research/Analysis Individual		100%	9/26/25	9/12/25
Staff Meeting	All	100%	9/16/25	9/16/25
Client Meeting	All	100%	9/17/25	9/17/25
Bottom Plate Plastic Assem Ryan Donnellan and J		100%	9/26/25	9/23/25
Two Cable Motors Installed All		100%	8/26/25	9/23/25
Arduino Ready to Control N Ryan Donnellan and C		80%	8/26/25	9/23/25
Purchases Finalized John Avila		90%	8/26/25	9/23/25
Hardware Status Demonstr All		0%	8/26/25	9/23/25
Peer Eval 1 Individual		0%	9/24/25	9/24/25
Client Meeting	All	0%	9/24/25	9/24/25
Staff Meeting	All	0%	9/30/25	9/30/25
<b>October</b>				
Client Meeting	All	0%	10/1/25	10/1/25
Staff Meeting	All	0%	10/7/25	10/7/25
Client Meeting	All	0%	10/8/25	10/8/25
Website Check 1 Joey Mathews		50%	10/4/25	10/11/25
Prerequisite Builds Complete All		10%	8/26/25	10/14/25
Bottom Plate Completed Ryan Donnellan and J		25%	9/16/25	10/14/25
Third Cable Motor Installed All		0%	9/16/25	10/14/25
L/R Mechanism Installed All		0%	9/16/25	10/14/25
Top Plate Plastic Assembly Ryan Donnellan and J		0%	9/16/25	10/14/25
Anchor Prototypes Installed Ryan Donnellan and J		0%	9/16/25	10/14/25

Project start: Tue, 8/26/2025  
 Display week: 1



## Progress

- Individual tasks are on schedule
- Tasks relating to force detection and generation assigned
- Firmly established expectations with client
- Continuing to meet and update with client

# Takeaways/Moving Forward

- Spools will be secured to motor axle by screw rather than clearance fit
- Controllers and code must have same baud rate
- Bottom plate holes for mounting motors must be wider (Mounting screws were threading into the PLA)
- Conducting speed and force tests
- Integrating all four motors with the Teensy
- Next step to build process is integrating the lift mechanism

A close-up photograph of a squirrel with brown and white fur, holding a nut in its paws. The squirrel is looking towards the camera. The background is dark and out of focus. The text "Thank you!" is overlaid in a large, bold, yellow font. The image is framed by blue and yellow curved borders on the left and right sides.

# Thank you!

The Northern Arizona University logo, consisting of the letters "NAU" in a large, stylized, grey font. The text "NORTHERN ARIZONA UNIVERSITY" is written in a smaller, white, sans-serif font across the middle of the "NAU" letters.

NORTHERN ARIZONA UNIVERSITY

# Questions?



None