CWC Generator

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NAU NORTHERN ARIZONA UNIVERSITY

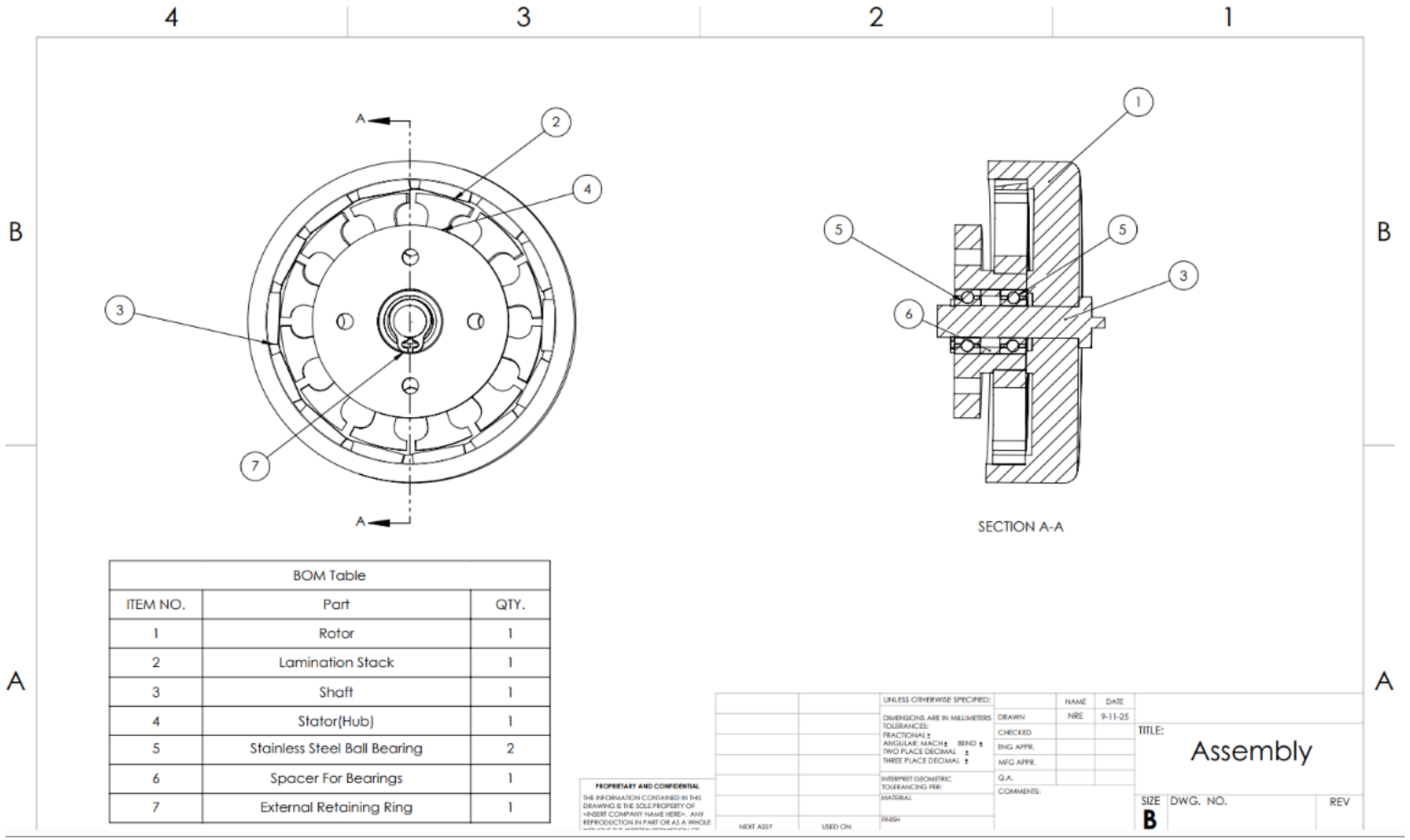
And Dynamometer

NAU NORTHERN ARIZONA UNIVERSITY

Project Description

- Goal: Create a small-scale generator for the NAU CWC team
  - Helps save time and resources
  - Improves performance of the turbine
- Client and Advisor: Professor Willy
  - 20+ years experience in industry
- Wind Energy is growing nationwide
  - Wind Energy in US [1]: 2014 - 4% VS 2023 - 10%

Design Efforts



BOM Table		
ITEM NO.	Part	QTY.
1	Rotor	1
2	Lamination Stack	1
3	Shaft	1
4	Stator(Hub)	1
5	Stainless Steel Ball Bearing	2
6	Spacer For Bearings	1
7	External Retaining Ring	1

	NAME	DATE
DRAWN	NRE	9-11-25
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

TITLE: Assembly

SIZE B | DWG. NO. | REV

Figure 1: Rev D Assembly CAD

Design Efforts

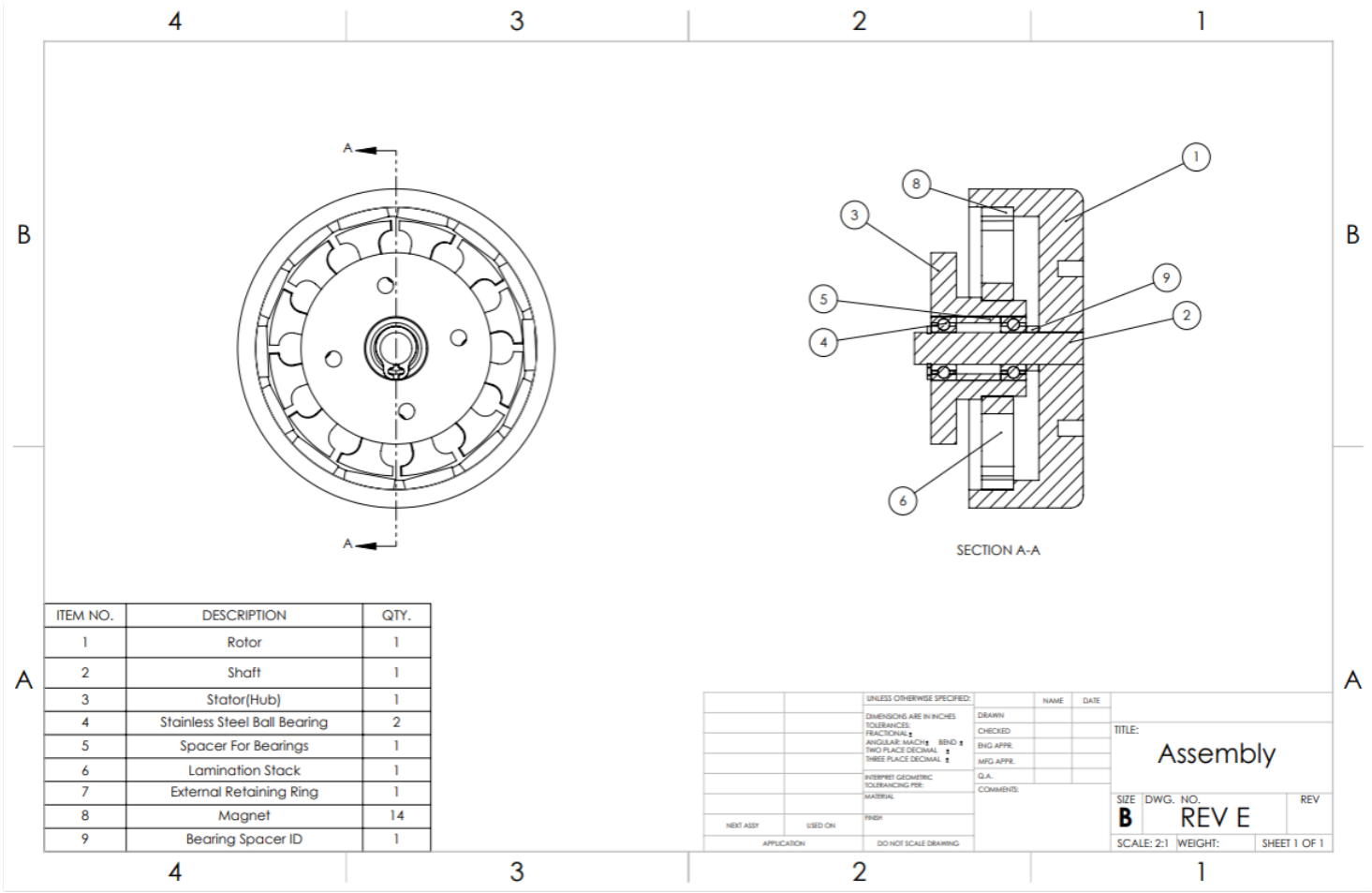


Figure 2: Rev E Assembly CAD

Purchasing Plan

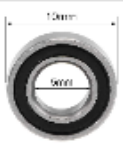
ITEM NO.	PART	DESCRIPTION	PURCHASE QUAN	Price $	Total Price $	PART STATUS	PRIMARY VENDER	LINK	NOTES	IMAGE
1	Magnet Wire	1pc Magnet Wire, 23 AW	1	$ 31.36	$ 31.36	Received	Remington Industries	https://www	More wiring	
2	Aluminum Rod	1pc - 2 1/2 inch diamete	1	$ 116.00	$ 116.00	Received	McMaster-Carr	Tight-Toleran	Manufacturing Casing and Hub	
3	Retaining Ring	100pc - External Retaini	100	$ 6.71	$ 6.71	Received	McMaster-Carr	External Ret	Only need 1	
4	Steel Rod	1pc - 2 1/2 inch diamete	1	$ 53.96	$ 53.96	Received	McMaster-Carr	Low-Carbon	For making the shaft of the generator	
5	Epoxy Glue	EFT Epoxy Glue	1	9.14	$ 9.14	Received	Harbor Feight	Quick-Settin	Appling to magnets to casing	
6	Ball Bearings	4pc Ball Bearings Bore 4	4	7.64	$ 7.64	Received	Amazon	uxcell MR10	Only need 2	
7	Magnet Wire	1pc Magnet Wire, 23 AW	1	19.09	$ 19.09	Received	Remington Industries	https://www	First wire purchase with donation	
8	Magnets	14pc Magnets	14	0	$ -	Received	Elemental Motor	-	Donation	
9	Silicon Steel	1pc Silicon Steel Sheet	1	0	$ -	Received	Elemental Motor	-	Donation	
10	Power/Battery Conr	240pc - Smeace 15/30/4	1	30.12	$ 30.12	Received	Amazon	Amazon.con	Power kit for dyno	
11	Reamer Tool	1pc - High-speed Steel F	1	51.28	$51.28	In Progress	McMaster-Carr	https://www.mcm	Used cash funding	
			Total Parts Need	25	Total Parts Receiv	24				
			Total Spent	$ 325.30	Parts Required (%	96%				
					Assembled (%)	67%				

Figure 3: Bill of materials

33% Recap

- Lamination Stack
- Coil Windings
  - 3-phases
- Hi-pot Testing
- Total hours to manufacture > 37 hours

Figure 4: 33% Built

67% Demonstration- Hub

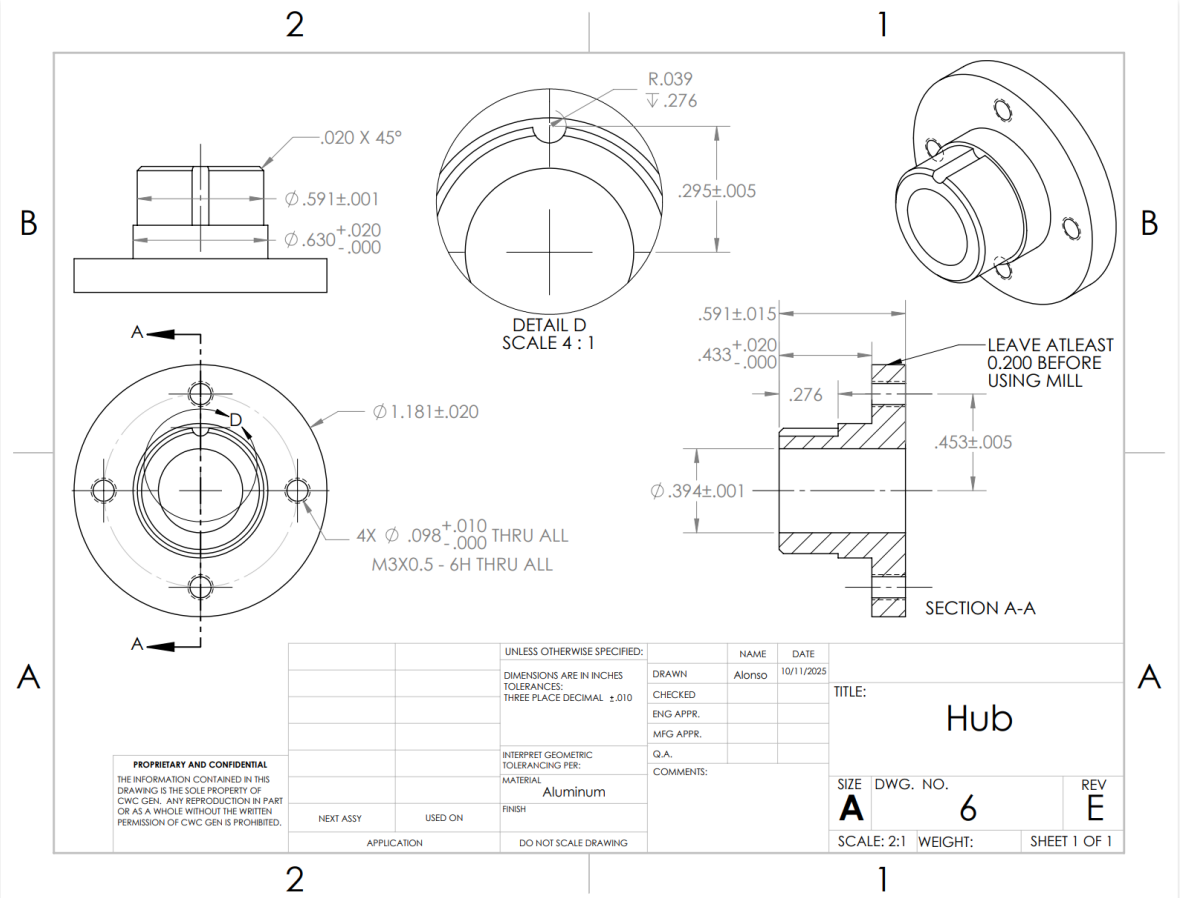


Figure 5: Hub CAD

Figure 6: Machined Hub 1st Attempt

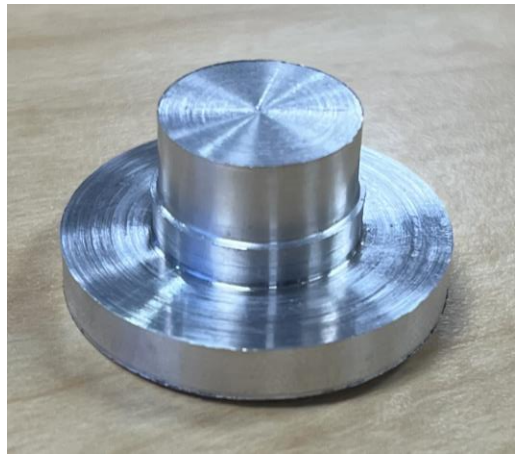


Figure 7: Machined Hub 2nd Attempt

67% Demonstration- Shaft

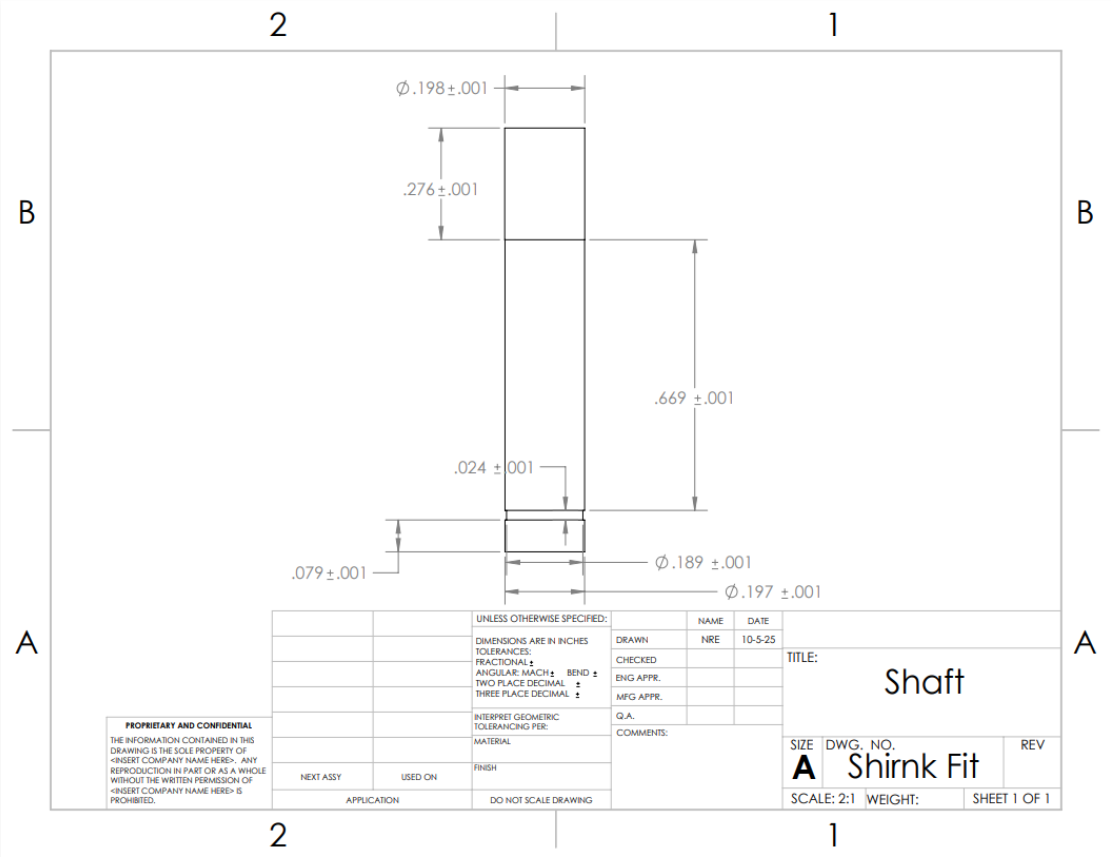


Figure 8: Shaft CAD

Figure 9: Machined Shaft

67% Demonstration- Rotor

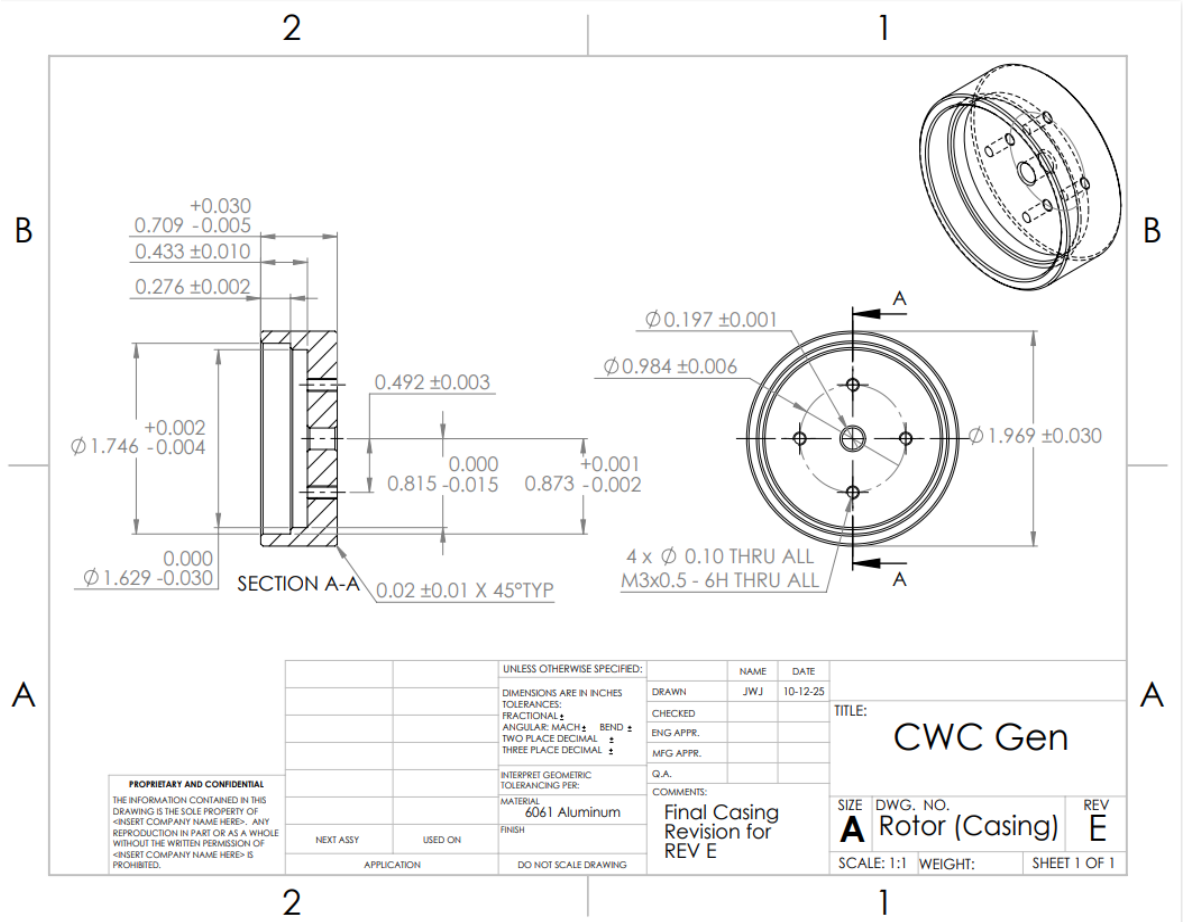


Figure 10: Rotor CAD

Figure 11: Machined Rotor

67% Demonstration- Coupler

- Coupler for Melon Motor
  - Vibrates
  - Possible destructive outcome
- Looking into removing the coupler
  - Forces concentricity

Figure 12: Dyno Testing

Test Method

- Sweeps: Quasi-static data collection of full rpm range
  - Constant resistance
  - Constant current

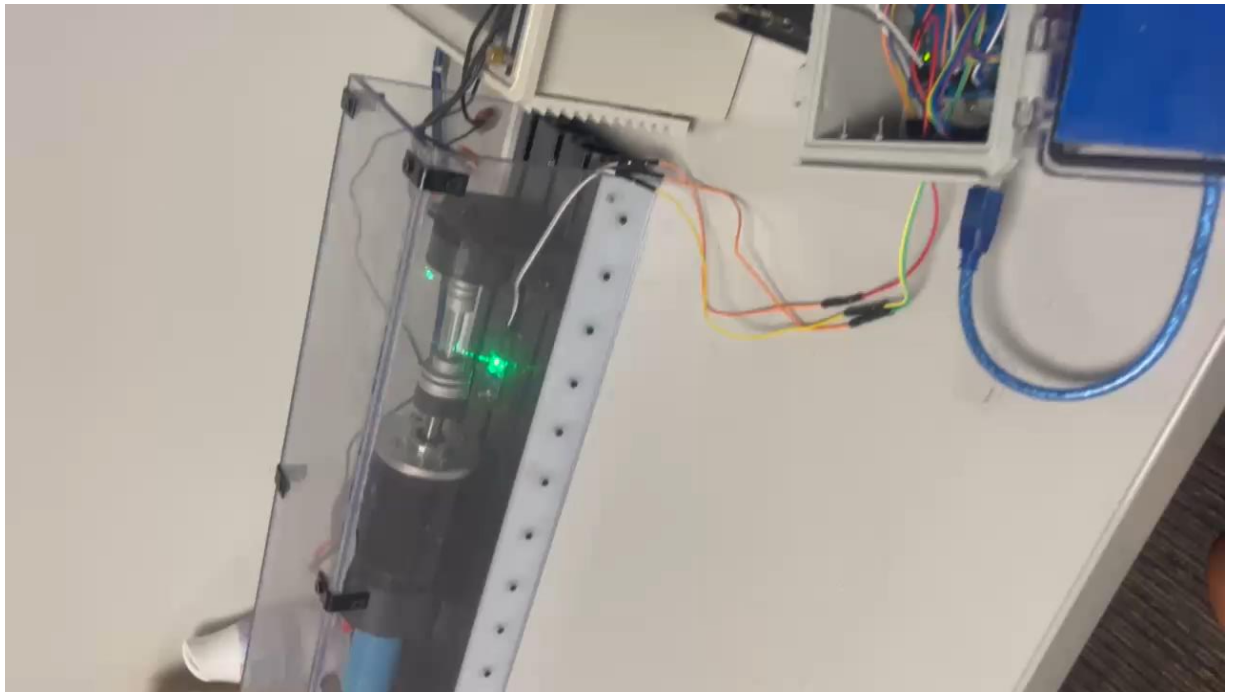


Figure 13: More Dyno Testing

Dyno Results

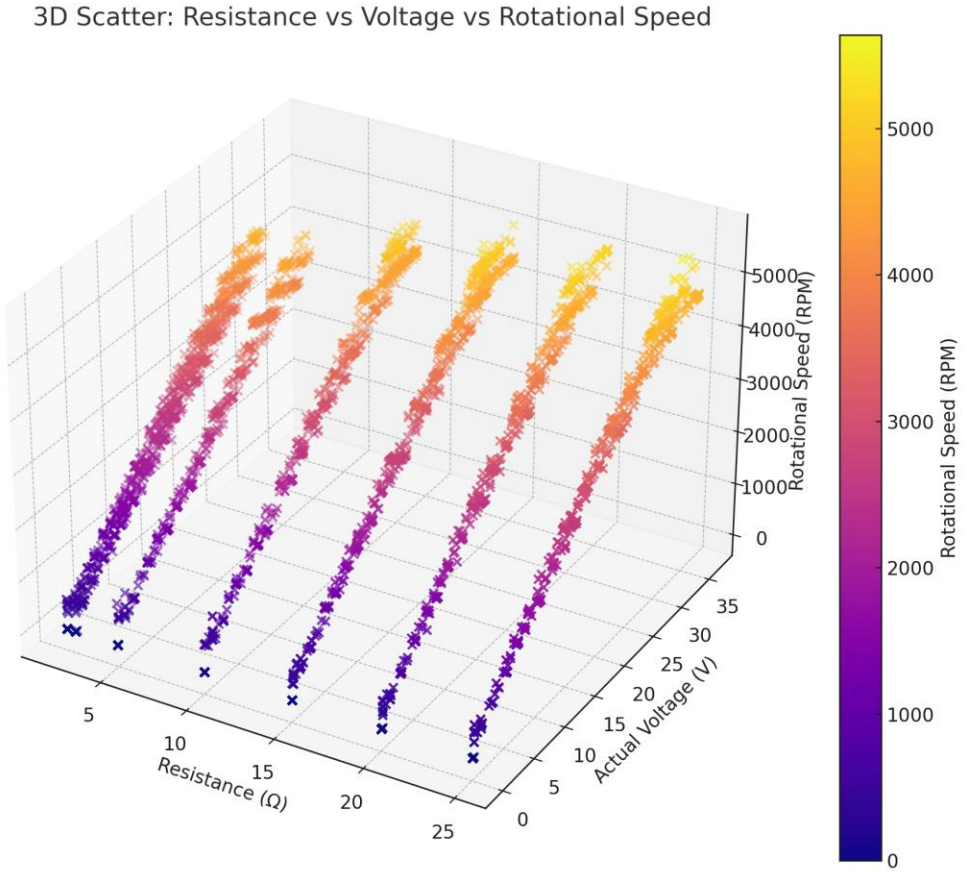


Figure 14: 3D Scatter Plot

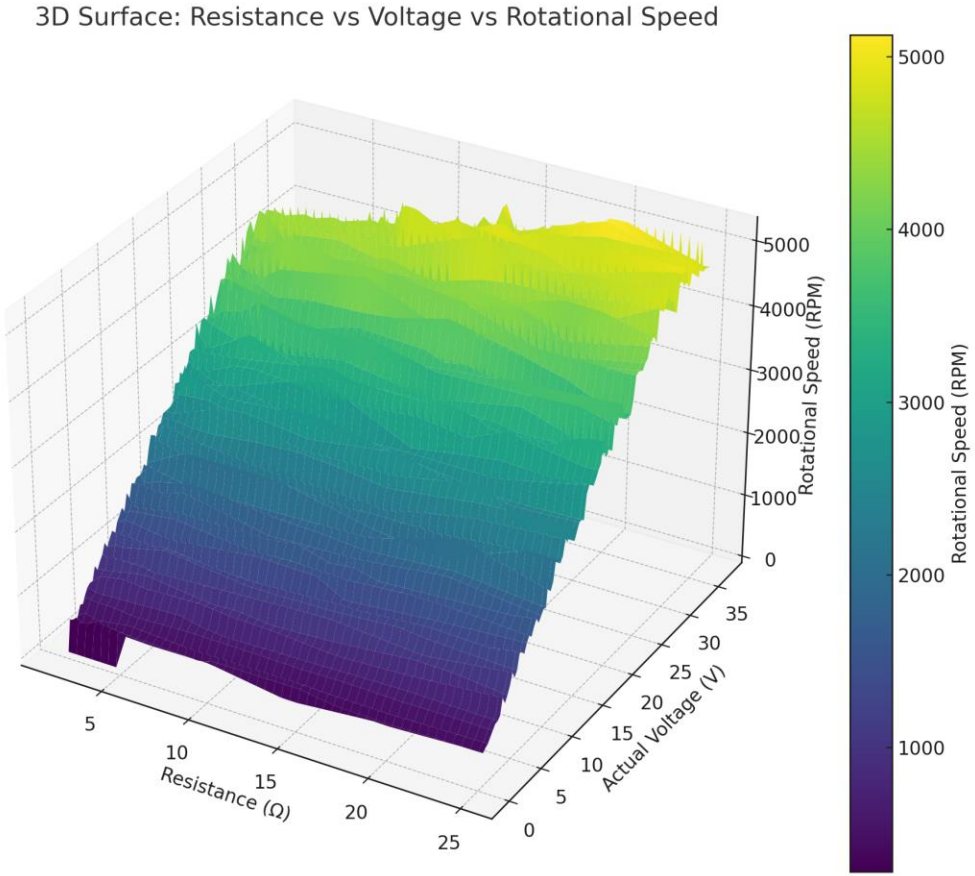


Figure 15: 3D Contour Plot

Dyno Results

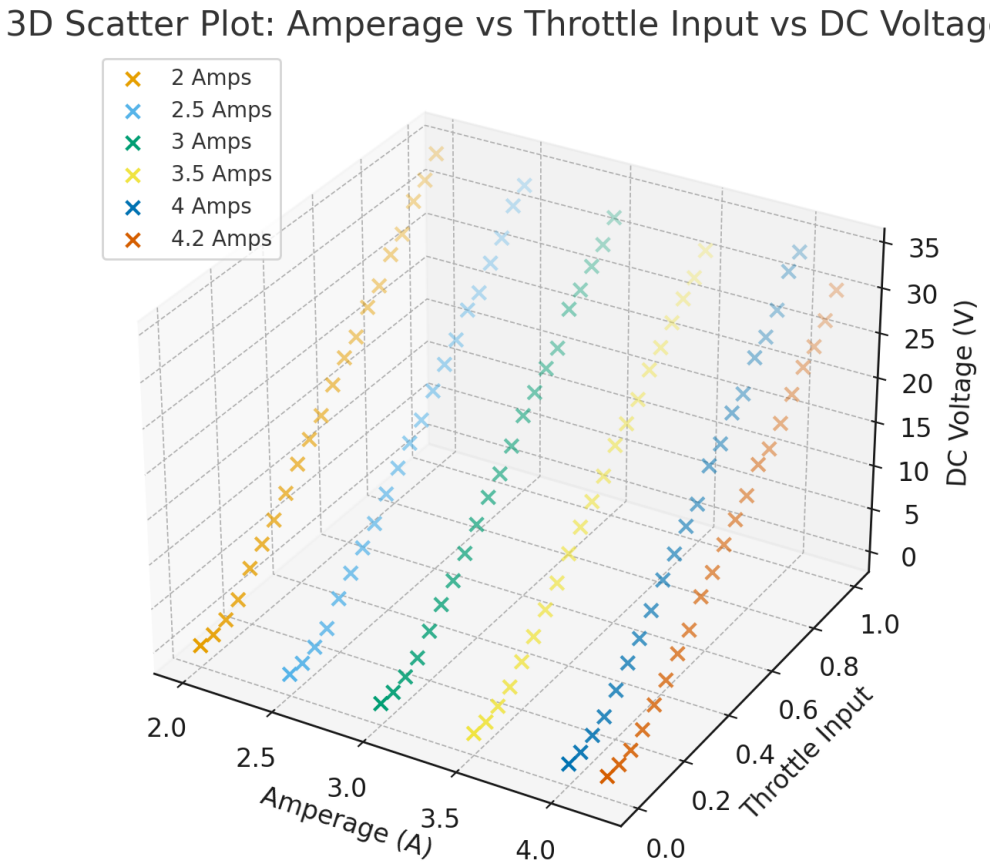


Figure 16: 3D Scatter Plot DC

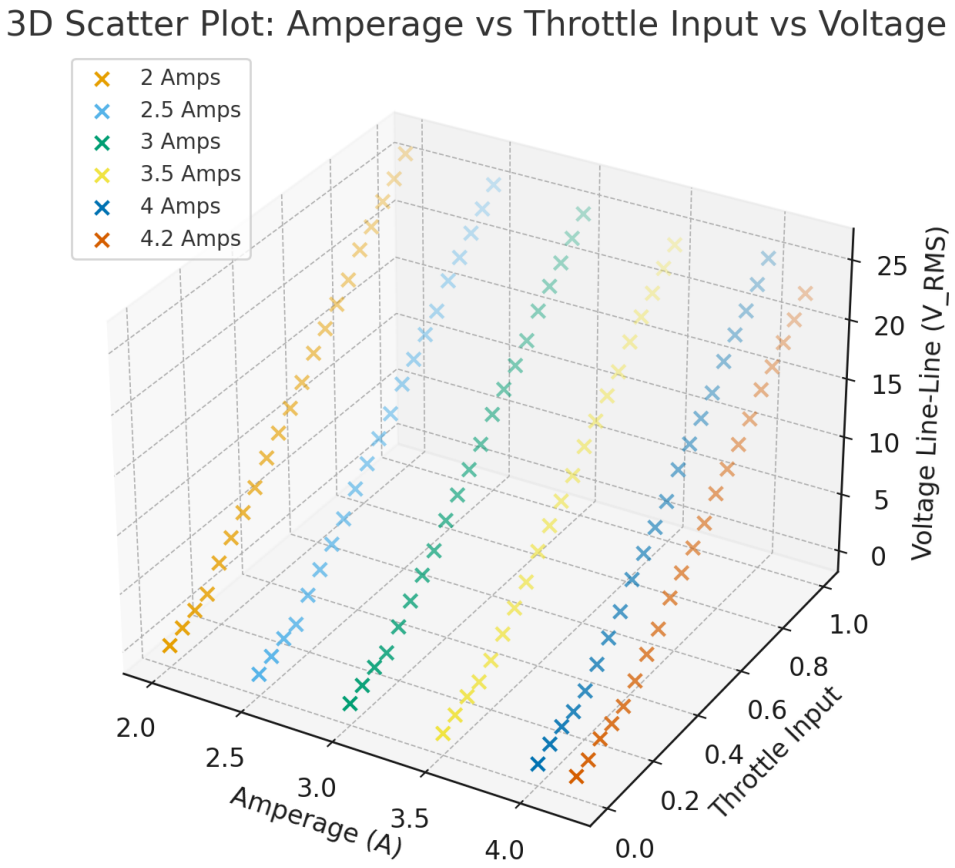


Figure 17: 3D Scatter Plot L-L

Dyno Results

3D Scatter Overlay: Line-Line (Blue) vs DC Voltage (Red)

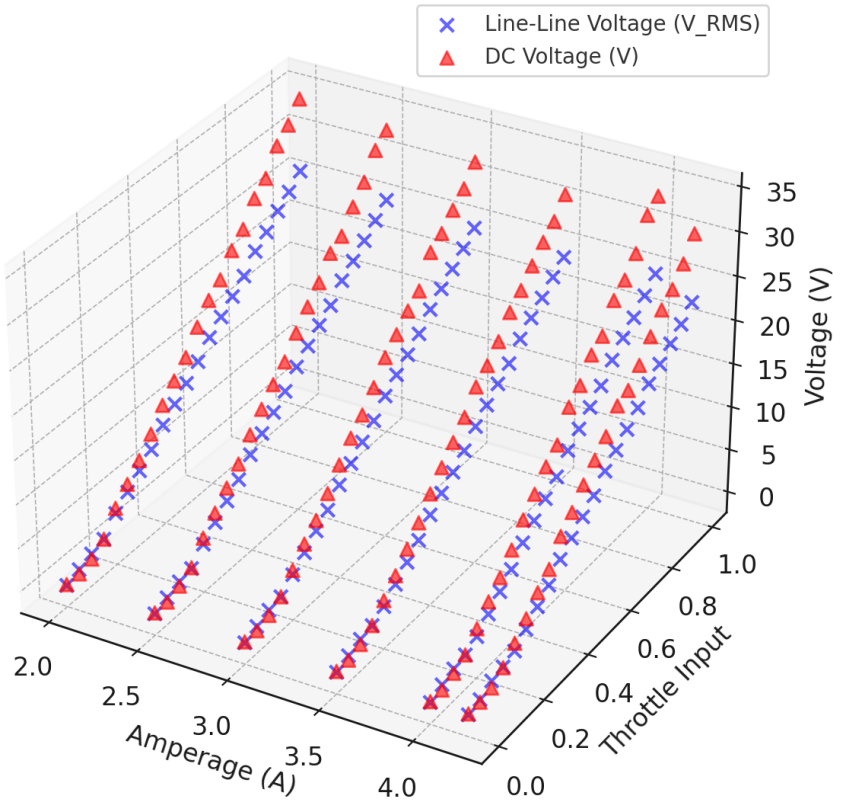


Figure 18: 3D Scatter Plot DC vs L-L

Positive Voltage Difference Map: DC Voltage minus Line-Line Voltage

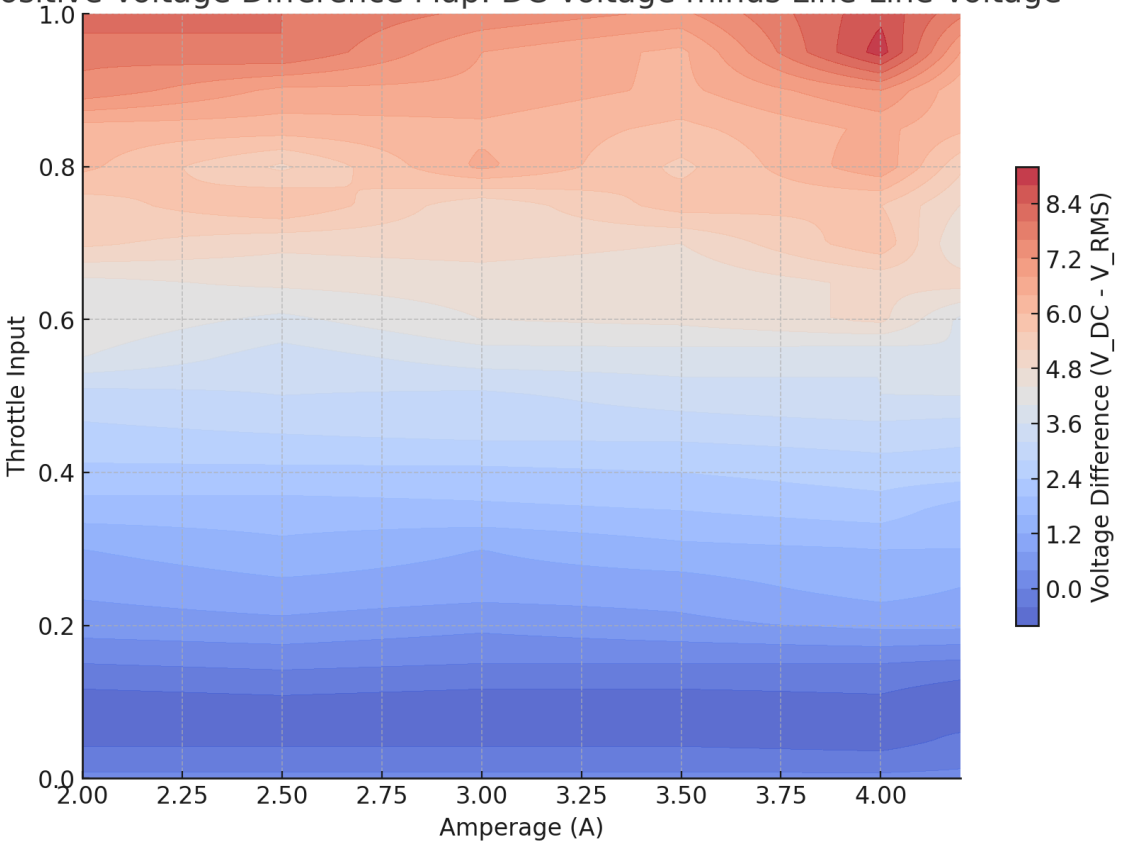


Figure 19: Heat Map DC vs L-L

Looking Ahead

- Next in the Manufacturing Process:
  - Finish Machining
    - ID of Hub
  - Assembly
    - Fits and magnets
- Next in Testing
  - Power curves and Melon Motor

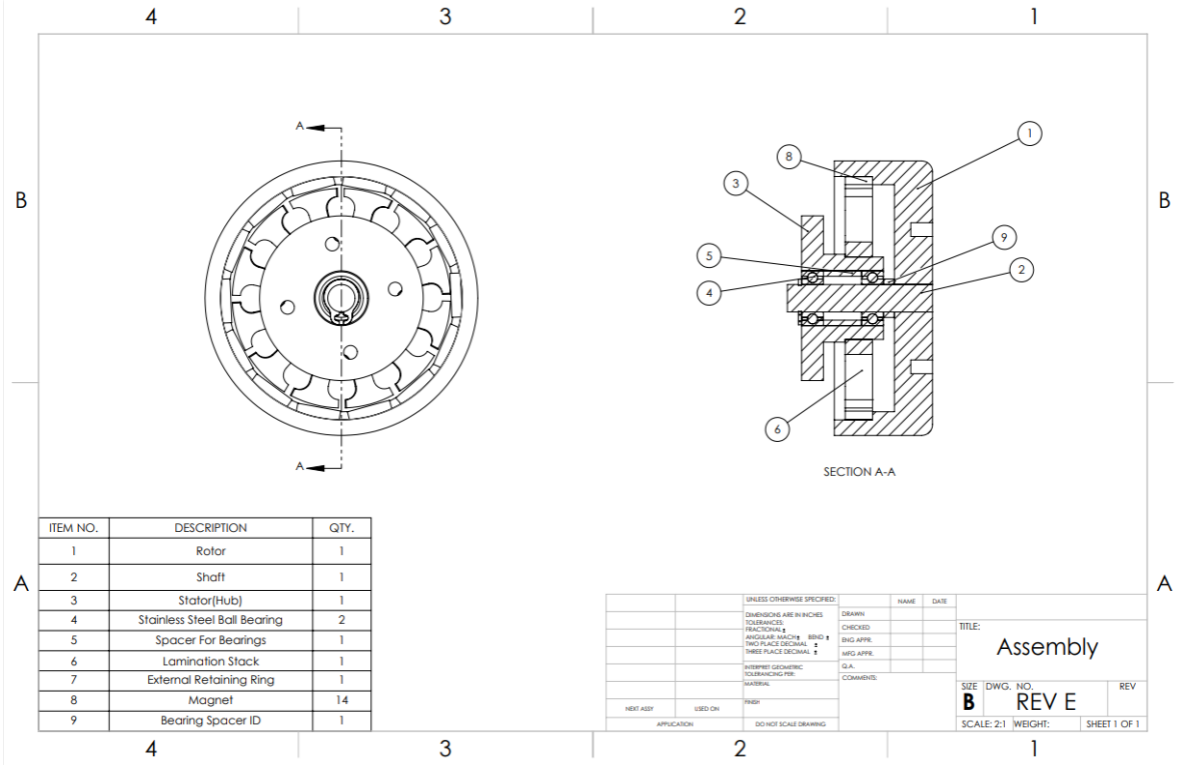


Figure 20: Full CAD

Gantt Chart

Evaluation/Deliverables				
HW 00	Everyone (Individual)	100%	8/25/25	8/31/25
Project Management	Everyone	100%	8/25/25	8/30/25
Engineering Calculations	Everyone	100%	8/31/25	9/6/25
Self-Learning or Individual Analysis	Everyone (Individual)	100%	9/1/25	9/14/25
Peer Evaluations 1	Everyone (Individual)	100%	9/22/25	9/28/25
Machine Shop Training	J.J., A.G.	100%	8/26/25	9/14/25
Create Winding Process	K.R.	100%	8/31/25	9/20/25
Lazer Lamination Stack	N.E.	100%	8/30/25	9/10/25
Assemble Lamination Stack	N.E.	100%	9/10/25	9/20/25
Wind Coil Around Lamination Stack	K.R.	100%	9/14/25	9/21/25
Machine Case	Machine Shop/A.G.	100%	9/21/25	10/12/25
Machine Hub	J.J., A.G.	90%	9/21/25	10/12/25
Assemble Generator	Everyone	0%	10/12/25	11/2/25
Website Check #1	AG	100%	10/6/25	10/12/25
Testing Plan	C.B., A.G., K.R.	33%	10/13/25	11/2/25
Peer Evaluations 2	Everyone (Individual)	0%	10/20/25	10/26/25
Peer Evaluations 3	Everyone (Individual)	0%	11/10/25	11/16/25
Final CAD Packet	Everyone	0%	11/17/25	11/23/25
Final Report	Everyone	20%	11/24/25	11/30/25

Figure 21: Gantt Chart

Thank you
Any questions?

References

[1] Climate Central, “A Decade of Growth in Solar and Wind Power: Trends Across the U.S. | Climate Central,” *www.climatecentral.org*, Apr. 03, 2024. https://www.climatecentral.org/report/solar-and-wind-power-2024
[2] “Moteur / Alternateur 3 phases,” Letmeknow, https://letmeknow.fr/fr/moteurs-et-servo-moteurs/1828-moteur-alternateur-3-phases-652733948892.html (accessed Sep. 22, 2025).

Appendix