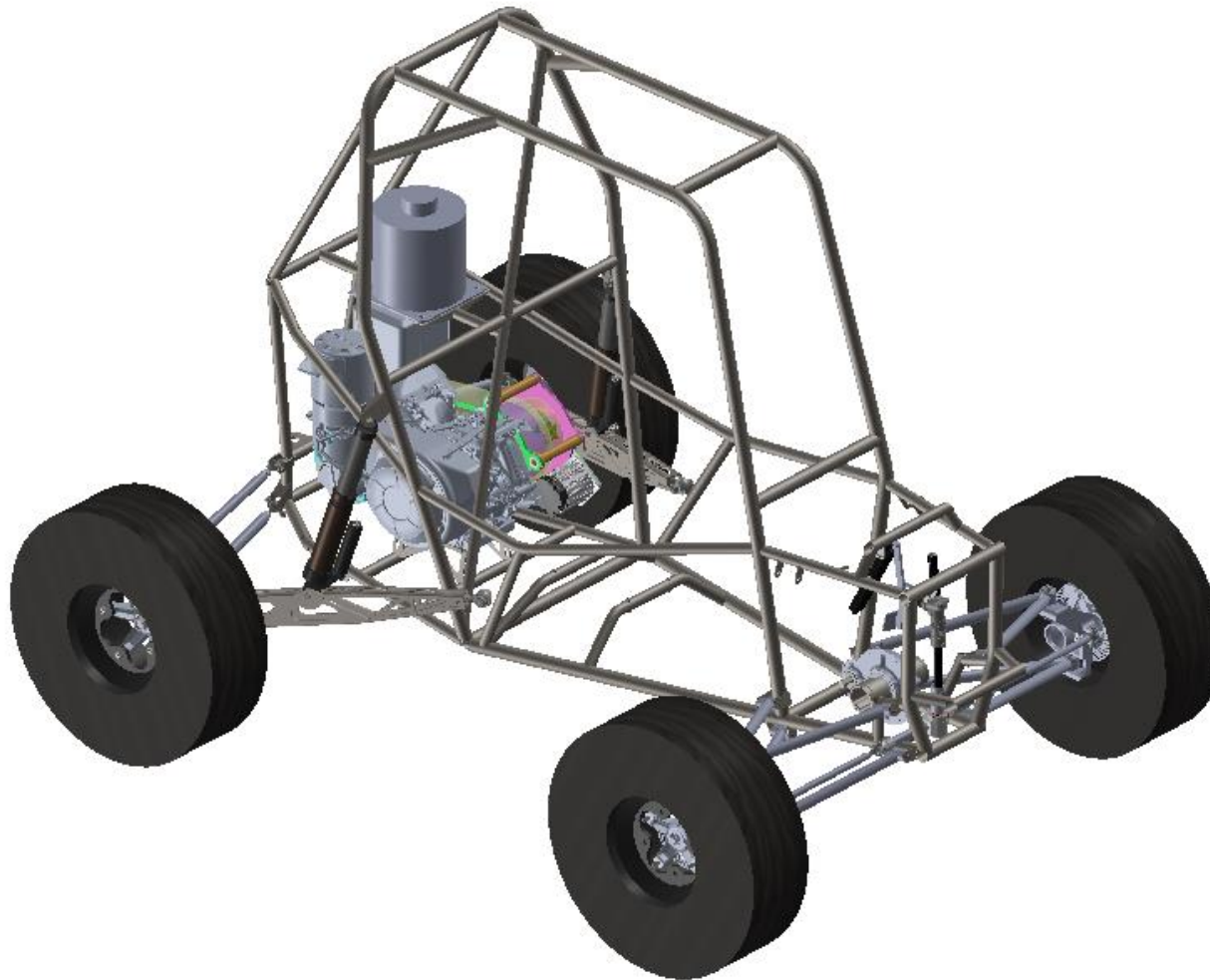


SAE Baja '24 Drivetrain

100% Hardware Check

Henry Van Zuyle, Ryan Fitzpatrick, Jarett Berger, Donovan Parker

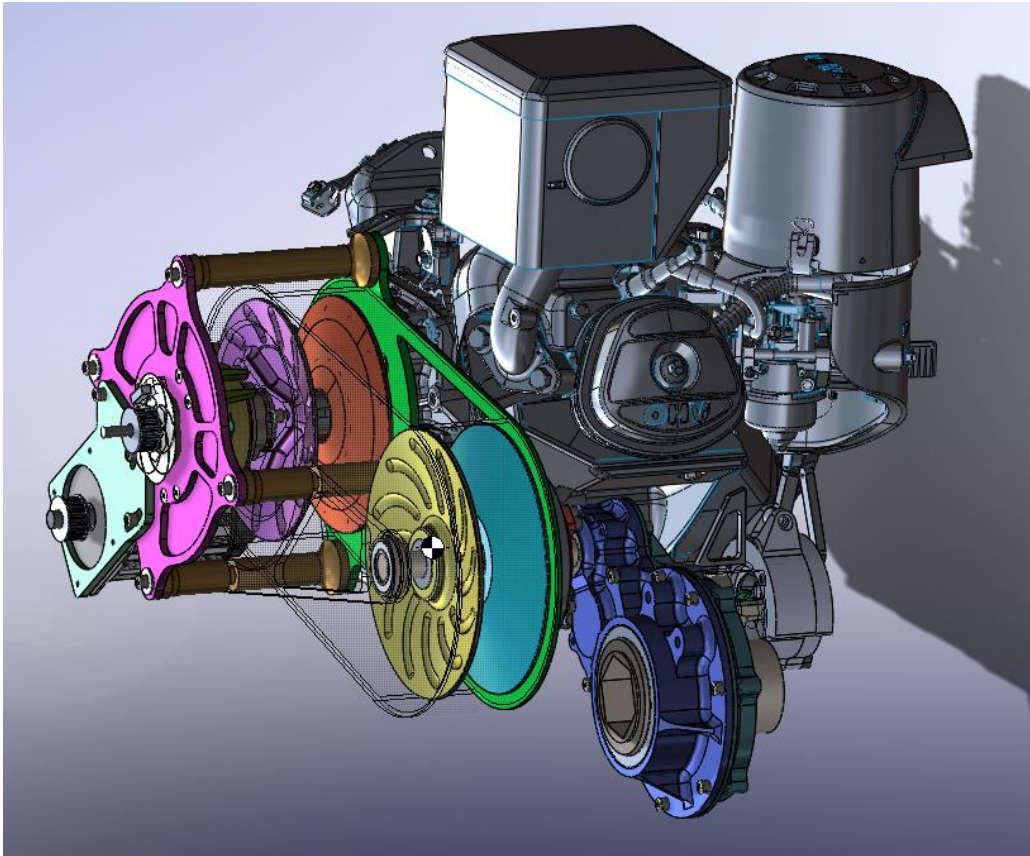
Design Efforts – Drivetrain CAD



Drivetrain “Zones”

1. ECVT
2. Rear Gearbox
3. 4WD System
4. Front Gearbox

Design Efforts – Drivetrain CAD



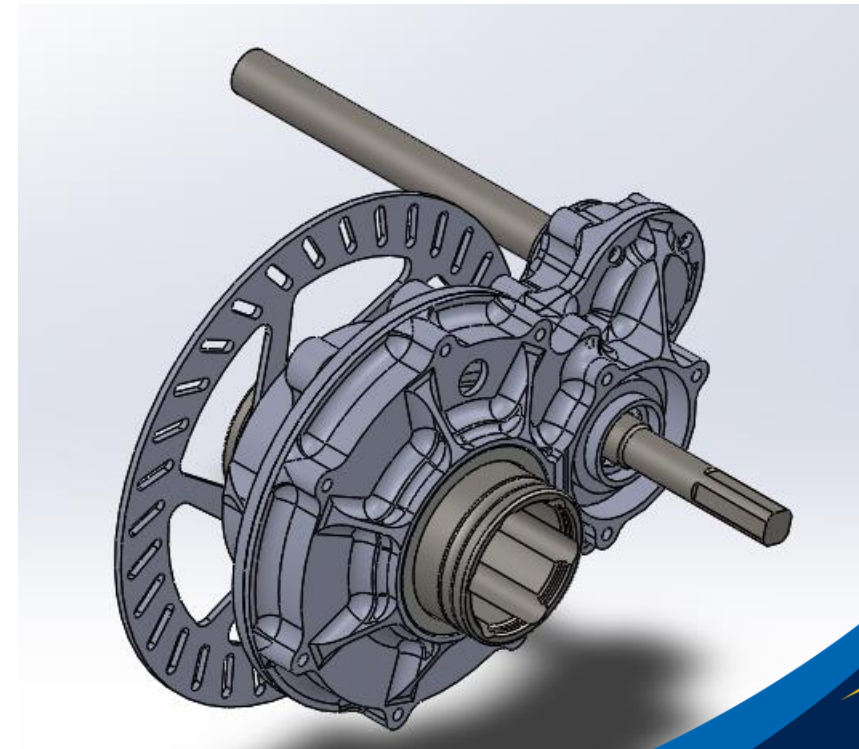
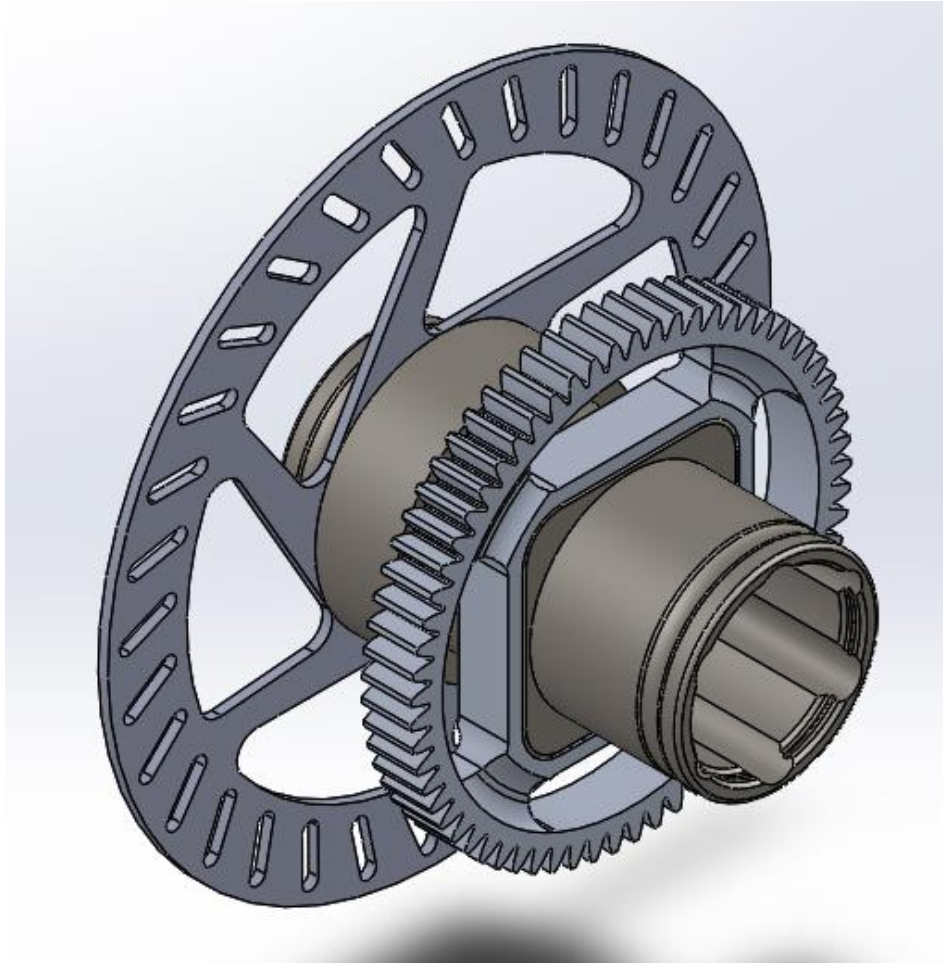
CVT Changes:

- Changed the secondary response spring from a simple compression spring to a compression and torsion spring.

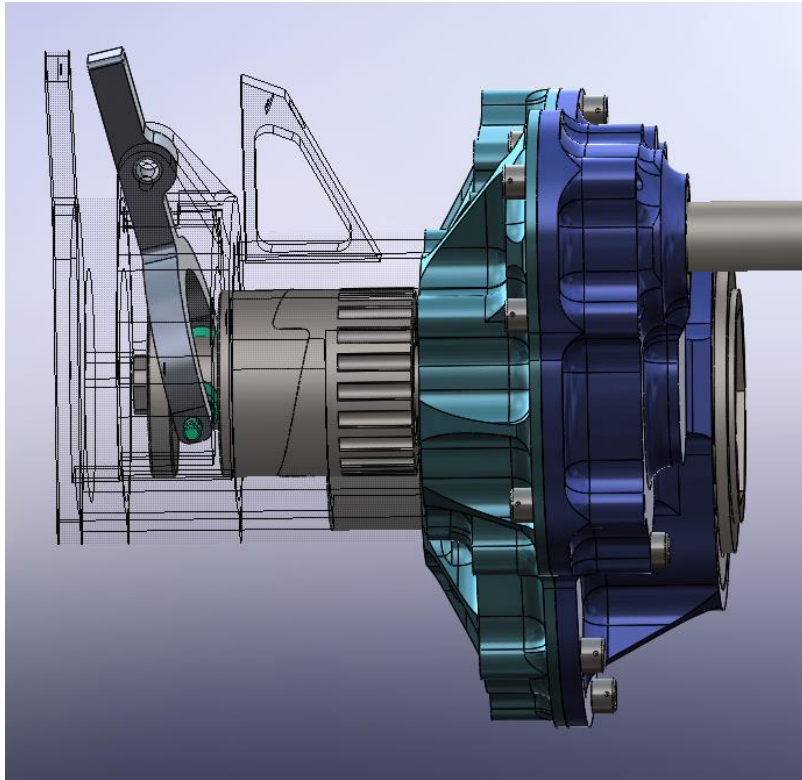
Design Efforts – Drivetrain CAD

Rear Gearbox Changes:

- Added in expansion bladder per Rule B.9.4.
- Split output gear with integrated CV cups into a separate gear and shaft.



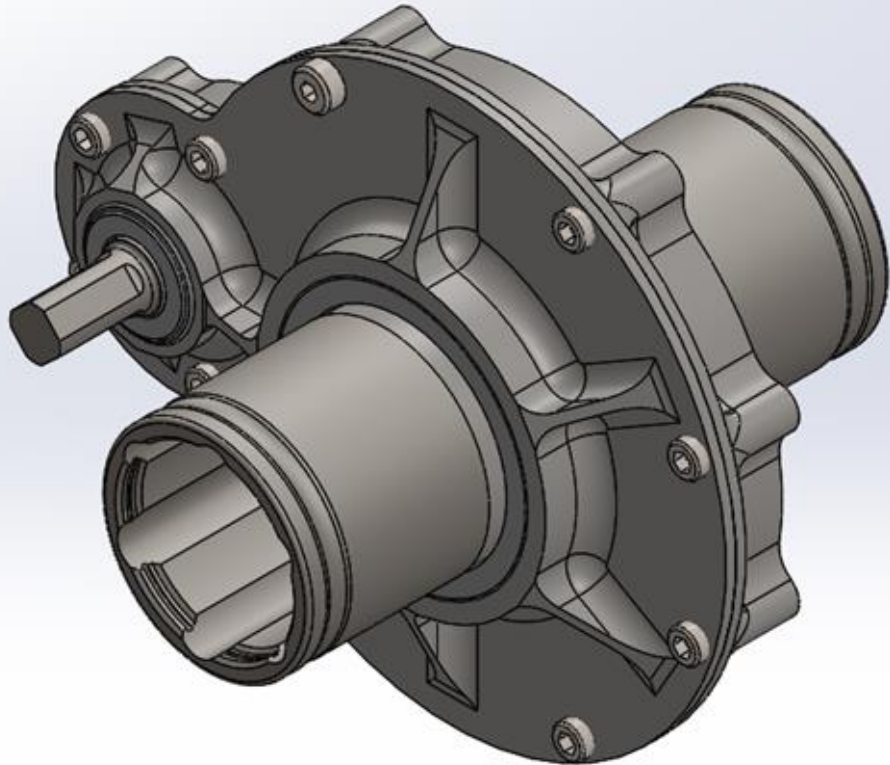
Design Efforts – Drivetrain CAD



4WD Changes:

- Increased front end pulley width for alignment

Design Efforts – Drivetrain CAD



Front Gearbox Changes:

- Changed gear center to center distance

Purchasing Plan - ECVT

Classification	Purchased	On Hand	Part Name	Quantity	Cost	Total Cost	Material	Purchase/Made	Vender	Vender Part Number
CVT			CVT control belt	1	6	6	Rubber	Purchase	Beidlers Belts	160x1037
CVT			CVT power belt	1	50	50	Rubber	Purchase	Xcaliber Motorsports	21g3353
CVT			Cam followers	8	4	32	Steel	Purchase	Amazon	CF4 cam follower
CVT			Oil-Embedded Bronze Sleeve Bearing	3	6.56	19.68	Bronze	Purchase	McMaster-Carr	6391K768
CVT			One-Piece Thrust Ball Bearing	1	48.72	48.72	Steel	Purchase	McMaster-Carr	60715K111
CVT			Ultra-Thin Ball Bearing	1	63.69	63.69	Steel	Purchase	McMaster-Carr	6656K236
CVT			Ball Bearing	1	7.72	7.72	Steel	Purchase	McMaster-Carr	60355K336
CVT			Ball Bearing	1	12.62	12.62	Steel	Purchase	McMaster-Carr	60355K983
CVT			Cast Iron Acme Round Nut	1	39.91	39.91	Cast Iron	Purchase	McMaster-Carr	97014A595
CVT			316 Stainless Steel Acme Lead Screw	1	33.52	33.52	Steel	Purchase	McMaster-Carr	95080A103
CVT			Limit switch	1	5	5	N/A	Purchase	N/A	N/A
CVT			Hall effect	1	13	13	N/A	Purchase	N/A	N/A
CVT			Magnet	2	0.25	0.5	N/A	Purchase	N/A	N/A
CVT			Hudson 343x	1	500	500	N/A	Purchase	N/A	N/A
CVT			Odrive pro	1	300	300	N/A	Purchase	N/A	N/A
CVT			Arduino portena h7 lite	1	80	80	N/A	Purchase	N/A	N/A
CVT			Primary mobile sheave	1	0	0	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Primary fixed sheave	1	0	0	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Secondary mobile sheave	1	0	0	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Secondary fixed sheave	1	0	0	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			CVT standoffs	2	15	30	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			CVT outside partial standoff	2	7	14	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			CVT inside partial standoff	2	7	14	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Control motor pulley	2	20	40	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Primary shaft	1	20	20	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Secondary shaft	1	20	20	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Secondary cam	1	40	40	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Secondary cam mount plate	1	10	10	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Backplate	1	50	50	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Frontplate	1	25	25	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Motor mount plate	1	10	10	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Square bush	1	15	15	Bronze	Purchase	McMaster-Carr	N/A
CVT			Gearbox shaft support	1	10	10	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Anti-rotation forks	3	2	6	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
CVT			Lead screw nut flange	1	45	45	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A

Purchasing Plan – Front & Rear Gearboxes

Classification	Purchased	On Hand	Part Name	Quantity	Cost	Total Cost	Material	Purchase/Made	Vender	Vender Part Number
Gearboxes			60355K178 Ball Bearing -R10	2	7.55	15.1	Steel	Purchase	McMaster-Carr	60355K178
Gearboxes			6656K151 Ultra-Thin Ball Bearing -61813-2RS	3	14.77	44.31	Steel	Purchase	123Bearing	61813-2RS
Gearboxes			GMN FK6205-2RS Sprag	2	0	0	Steel	Own	NAU SAE Baja	N/A
Gearboxes			Circlip CV Cup	2	0	0	Aluminum	Own	NAU SAE Baja	N/A
Gearboxes			Front Input Gear	1	50	50	4340 Steel	Made	OnlineMetals	N/A
Gearboxes			Front Output Gear	1	100	100	4340 Steel	Made	OnlineMetals	N/A
Gearboxes			Front Input Shaft	1	75	75	4340 Steel	Made	OnlineMetals	N/A
Gearboxes			Front Output Shaft	1	75	75	4340 Steel	Made	OnlineMetals	N/A
Gearboxes			CV Cup	2	50	100	4140 Steel	Made	OnlineMetals	N/A
Gearboxes			Front Drive Side Housing	1	50	50	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
Gearboxes			Front Passenger Side Housing	1	50	50	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
Gearboxes			SKF 65X80X8 CRW1 R Seal	3	19.30	57.90	Nitrile Rubber	Purchase	Motion Industries	85311027328
Gearboxes			SKF_80X100X10 CRW1 R Seal	1	19.94	19.94	Nitrile Rubber	Purchase	Motion Industries	85311030847
Gearboxes			SKF 7438 Seal	3	11.36	34.08	Nitrile Rubber	Purchase	Motion Industries	85311005562
Gearboxes			Socket Head Cap Screw	8	0	0	Aluminum	Own	NAU SAE Baja	N/A
Gearboxes			Socket Head Shoulder Screw	2	0	0	Aluminum	Own	NAU SAE Baja	N/A
Gearboxes			60355K185 Ball Bearing - R12	6	8.99	53.94	Steel	Purchase	McMaster-Carr	60355K185
Gearboxes			6656K245 Ball Bearing -61816-2RS	1	21.89	21.89	Steel	Purchase	123Bearing	61816-2RS
Gearboxes			Rear Gearbox Input Shaft	1	35	35	4340 Steel	Made	OnlineMetals	N/A
Gearboxes			Rear Gearbox Intermediate Shaft	1	40	40	4340 Steel	Made	OnlineMetals	N/A
Gearboxes			Rear Gear 2	1	15	15	4340 Steel	Made	OnlineMetals	N/A
Gearboxes			Rear Gear 3	1	15	15	4340 Steel	Made	OnlineMetals	N/A
Gearboxes			Rear Gear 4	1	50	50	4340 Steel	Made	OnlineMetals	N/A
Gearboxes			Rear Gear 5	1	400	400	4340 Steel	Made	OnlineMetals	N/A
Gearboxes			Rear Gearbox Driverside Case	1	125	125	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
Gearboxes			Rear Gearbox Passengerside Case	1	125	125	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
Gearboxes			Rear Gearbox Expansion Chamber	1	36.30	36.30	Plastic	Purchase	Summit Racing	TGI-140207-1-KIT
Gearboxes			Rear Brake Rotor	1	0.00	0.00	A6 Steel	Made	Vroom	N/A
Gearboxes			Bolts 3/8"-16 (Brake Caliper Mounting)	2		0.00				
Gearboxes			Bolts #8-32 (Brake Rotor Mounting)	6		0.00				
Gearboxes			Bolts 1/4-20 (Gearbox Assembly)	22		0.00				

Purchasing Plan – 4WD System

4WD			Driving Side Clutch	1	59	59.00	4140 Steel	Made	OnlineMetals	N/A
4WD			Driven Side Clutch + Pulley	1	59	59.00	4140 Steel	Made	OnlineMetals	N/A
4WD			Front End Pulley	1	10.92	10.92	4140 Steel	Made	OnlineMetals	N/A
4WD			Shifter Lever	1	25.24	25.24	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
4WD			Shifter Lever Housing	1	75	75.00	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
4WD			Shifter Fork	1	21.49	21.49	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
4WD			Swivel Joint	1	8.21	8.21	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
4WD			Gear Box Pulley Shield	1	19.67	19.67	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
4WD			Shift Fork Mount Guard	1	19.67	19.67	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
4WD			Dog Clutch Cap	1	19.67	19.67	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
4WD			Engagement Cable Mount	1	5.35	5.35	Aluminum	Made	Ryan Kedrowskis aluminum vendor	N/A
4WD			Ball Bearings R10-2RS	2	1.68	3.36	Aluminum	Purchase	Amazon (Maple Ace)	R10-2RS
4WD			Idler Pulley Bearings	11	0.78	8.58	Aluminum	Purchase	Amazon (Maple Ace)	R8-2RS
4WD			Idler Pulley Rollers	11	97.75	97.75	Delrin	Made	McMaster-Carr	8576K27
4WD			Linkage Cable	1	78.74	78.74	Steel, etc.	Purchase	N/A	N/A
4WD			1460T Threaded Black-Oxide Steel Track Roller	2	34	68.00	Steel	Purchase	McMaster-Carr	N/A
4WD			Circlips	2	2	4.00	Copper	Purchase	N/A	N/A
4WD			1/4-20 Screw	3	0		Aluminum	Purchase		
4WD			#10-24 Screw	2	0		Aluminum	Purchase		
4WD			4WD belt	1	76	76	Rubber	Purchase	Bolton	3280-8M-20 Optibelt OMEGA HTD Tim

Purchasing Plan – Engine

Engine			Motor	1	900	900	N/A	Purchase	Kohler	CH440-3302
Engine			Flywheel, Assembly Electric Start	1	157.12	157.12	N/A	Purchase	Kohler	17 025 44
Engine			Stator Assembly, 18 AMP	1	144.6	144.6	N/A	Purchase	Kohler	17 085 14
Engine			Screw, Stator Mounting	4	13.36	13.36	N/A	Purchase	Kohler	25 086 373
Engine			Bracket Stator Mounting	1	6.2	6.2	N/A	Purchase	Kohler	17 126 69
Engine			Screw Coil Bracket	1	3.26	3.26	N/A	Purchase	Kohler	25 086 301
Engine			Harness Regulator Wiring Assembly	1	19.44	19.44	N/A	Purchase	Kohler	17 176 03
Engine			Regulator 18 AMP	1	137.42	137.42	N/A	Purchase	Kohler	17 403 07
Engine			Bracket Assembly Control System	1	22.6	22.6	N/A	Purchase	Kohler	17 126 231
Engine			Lever Control Assembly	1	27.17	27.17	N/A	Purchase	Kohler	17 090 22
Engine			Linkage, Remote Control	1	4.92	4.92	N/A	Purchase	Kohler	17 079 29
Engine			Bushing, Linkage Retaining	1	6.11	6.11	N/A	Purchase	Kohler	25 158 11
Engine			Clamp, Cable	2	6.82	6.82	N/A	Purchase	Kohler	17 237 12
Engine			Screw	2	6.4	6.4	N/A	Purchase	Kohler	25 086 244
Engine			Optional High Speed Setting Bracket	1	13.27	13.27	N/A	Purchase	Kohler	17 126 157

Purchasing Plan Percentages

Purchased

$$\frac{209 \text{ items}}{209 \text{ items}} = 100\%$$

On-Hand

$$\frac{209 \text{ items}}{209 \text{ items}} = 100\%$$

Manufacturing Plan - Hours

CVT – 70 Hours Completed / 70 Hours Total

Gearboxes – 86 Hours Completed / 86 Hours Total

4WD System – 15 Hours Completed / 15 Hours Total

TOTAL: 171 Hours Completed / 171 Hours Total
100% Completed

Manufacturing Plan - ECVT

ECVT					
Primary mobile sheave	Henry	100%	3/11/24	3/11/24	
Primary fixed sheave	Henry	100%	1/22/24	3/11/24	
Secondary mobile sheave	Henry	100%	1/31/24	3/11/24	
Secondary fixed sheave	Henry	100%	1/22/24	3/11/24	
CVT standoffs	Henry	100%	2/5/24	3/11/24	
CVT outside partial standoff	Henry	100%	2/6/24	3/11/24	
CVT inside partial standoff	Henry	100%	2/6/24	3/11/24	
Control motor pulley	Henry	100%	1/25/24	3/11/24	
Primary shaft	Henry	100%	2/5/24	3/11/24	
Secondary shaft	Henry	100%	1/22/24	3/11/24	
Secondary cam	Henry	100%	1/28/24	3/11/24	
Secondary cam mount plate	Henry	100%	1/22/24	3/11/24	
Backplate	Henry	100%	1/30/24	3/11/24	
Frontplate	Henry	100%	1/31/24	3/11/24	
Motor mount plate	Henry	100%	1/29/24	3/11/24	
Gearbox shaft support	Henry	100%	1/22/24	3/11/24	
Anti-rotation forks	Henry	100%	1/30/24	3/11/24	
Lead screw nut flange	Henry	100%	1/22/24	3/11/24	

Manufacturing Plan – Rear Gearbox

Rear Gearbox				
Casing (Passenger)	Henry	100%	1/30/24	3/8/24
Casing (Driver)	Henry	100%	1/31/24	3/8/24
Gear 2	Henry	100%	2/19/24	3/8/24
Gear 3	Henry	100%	2/7/24	3/8/24
Gear 4	Henry	100%	2/5/24	3/8/24
Gear 5	Henry	100%	2/19/24	3/8/24
Input Shaft	Henry	100%	2/6/24	3/8/24
Intermediate Shaft	Henry	100%	1/23/24	3/8/24
Output Shaft	Henry	100%	2/22/24	3/8/24

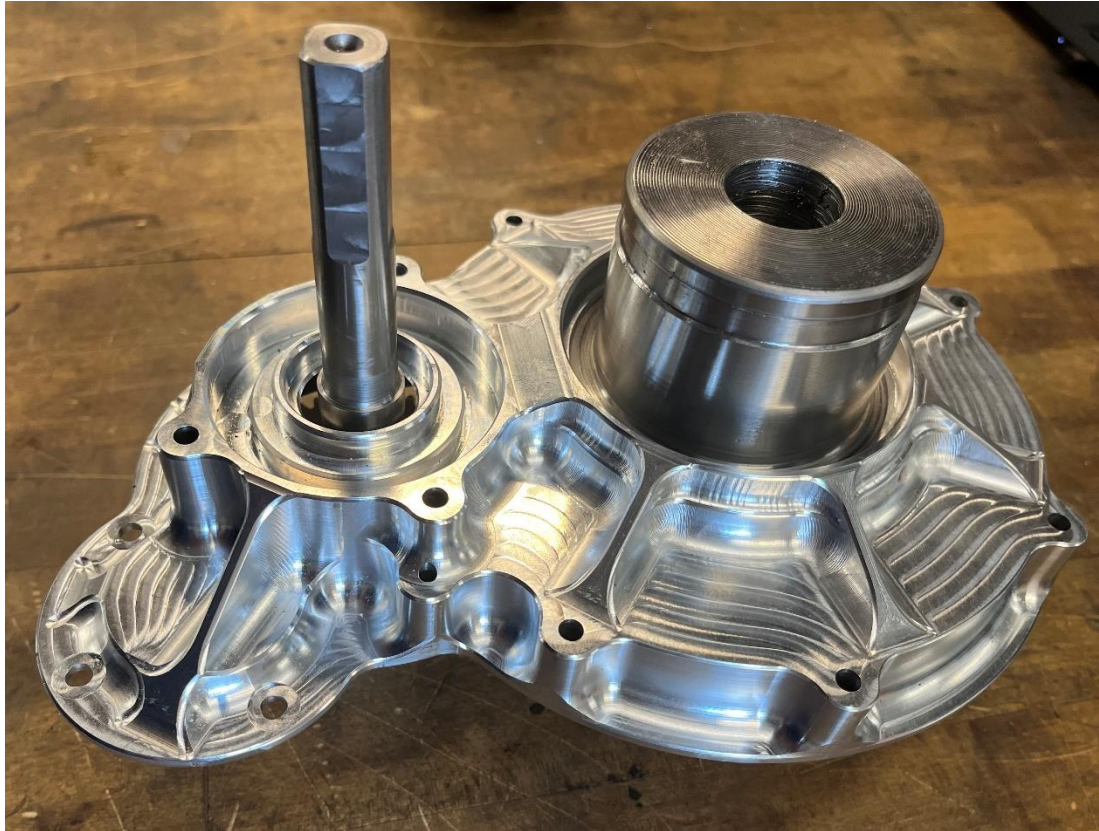
Manufacturing Plan – Front Gearbox

Front Gearbox				
Casing (Passanger)	Brennan	100%	4/2/24	4/10/24
Casing (Driver)	Brennan	100%	4/2/24	4/8/24
Gear 2	Henry	100%	2/12/24	3/8/24
Gear 3	Henry	100%	2/12/24	3/8/24
Input Shaft	Henry	100%	2/12/24	3/8/24
Output Shaft	Henry	100%	2/12/24	3/8/24
CV Cups	Henry	100%	4/4/24	4/11/24

Manufacturing Plan – 4WD System

4WD					
Clutch / Pulley	Donovan	100%	4/4/24	4/12/24	
Driven Clutch	Donovan	100%	4/2/24	4/12/24	
Front End Pulley	Donovan	100%	4/4/24	4/12/24	
Clutch Casing	Bryce	100%	3/26/24	4/12/24	
Front End Casing	Henry	100%	3/26/24	4/12/24	

Project Demo (Cool Stuff)

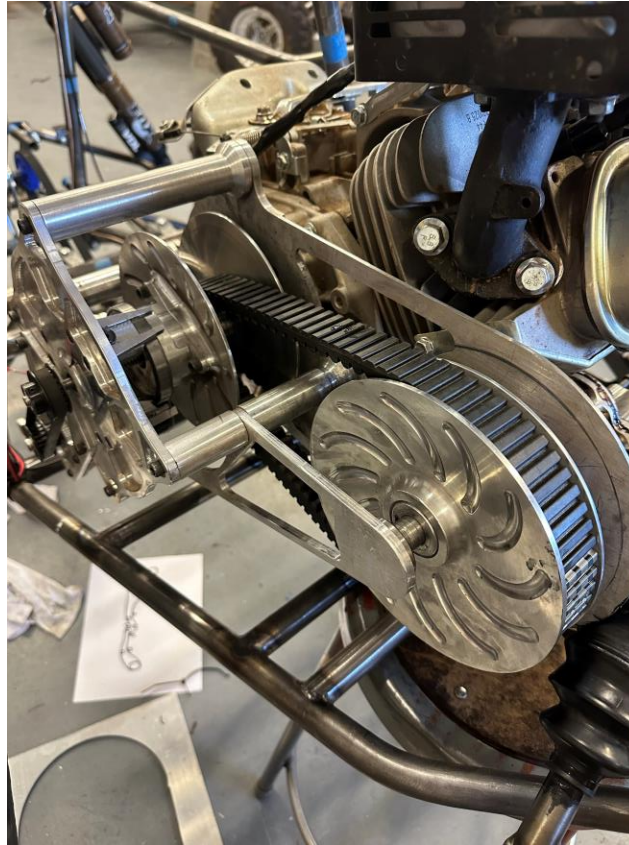


Manufactured Drivetrain Components:

Left Image - Rear Gearbox Passenger Casing with Intermediate and Output Shafts Visible

Right Image - Front Gearbox Driver Casing Assembly

Project Demo (Cool Stuff)



Front & Rear Gearbox and eCVT Assembled in Vehicle,
Dog Clutch Housing Bolted on to Rear Gearbox

Project Demo (Cool Stuff)



Vehicle Demonstrations:
Left Video – Vehicle in an Unofficial Speed Test, Middle Video- eCVT Testing Setup,
Right Image- Testing the Vehicle's Crawling Ability

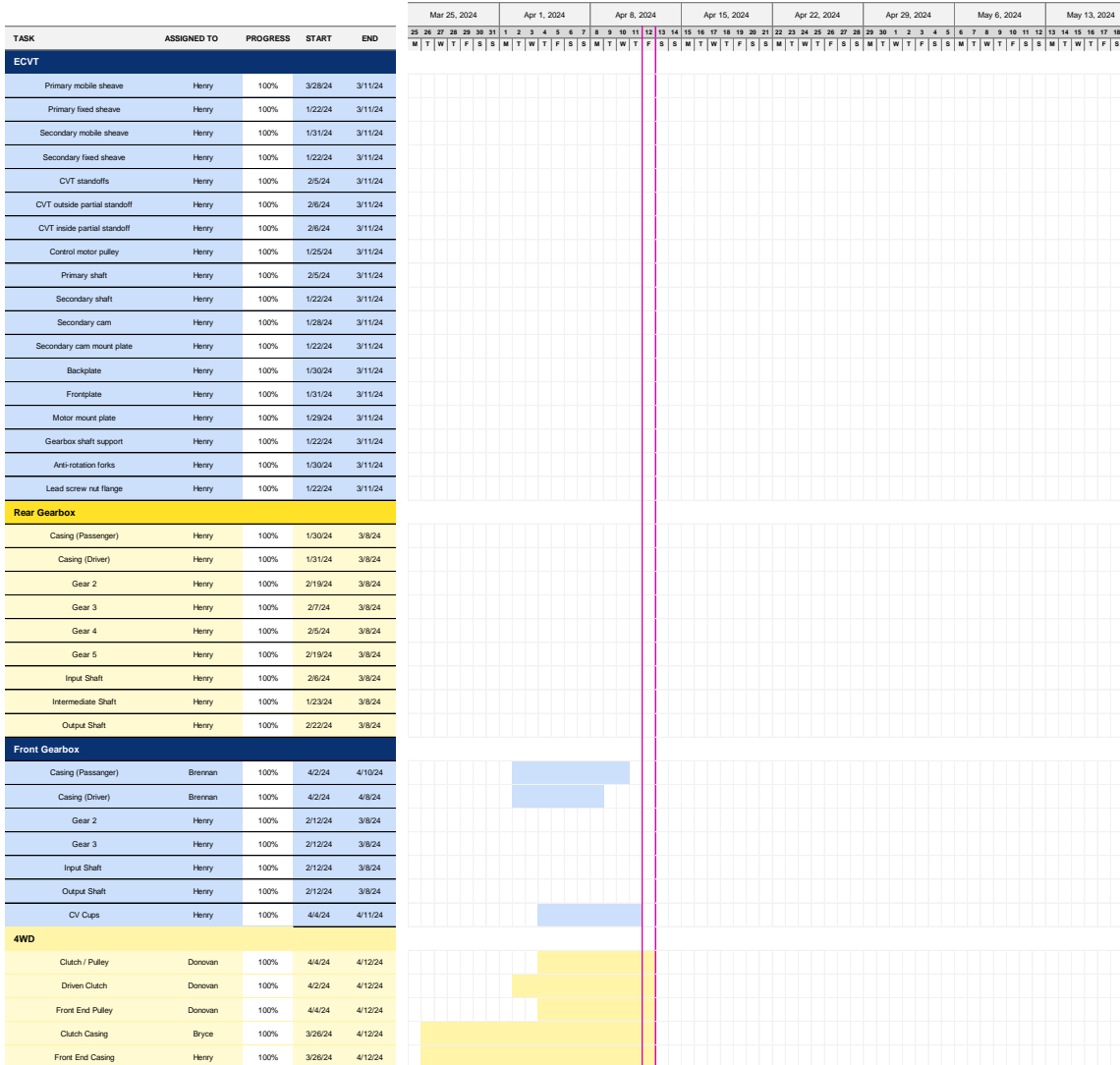
Gantt Chart Updates

SAE Baja

NAU Capstone Drivetrain

Project start: **3/28/24**

Display week: **1**



Updates:

- Integration for all drivetrain components
- Initial Testing Experiments