

# SAE Baja Design Progress Report Presentation Team Drivetrain

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# Overview

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# Introduction

- Sponsored by SAE
- Project Description: Design and build Baja vehicle
- Participants: over 100 universities
- The engine is provided: common ground
- The Baja competition project in NAU:
  - Frame design
  - Suspension design
  - Drive-train design

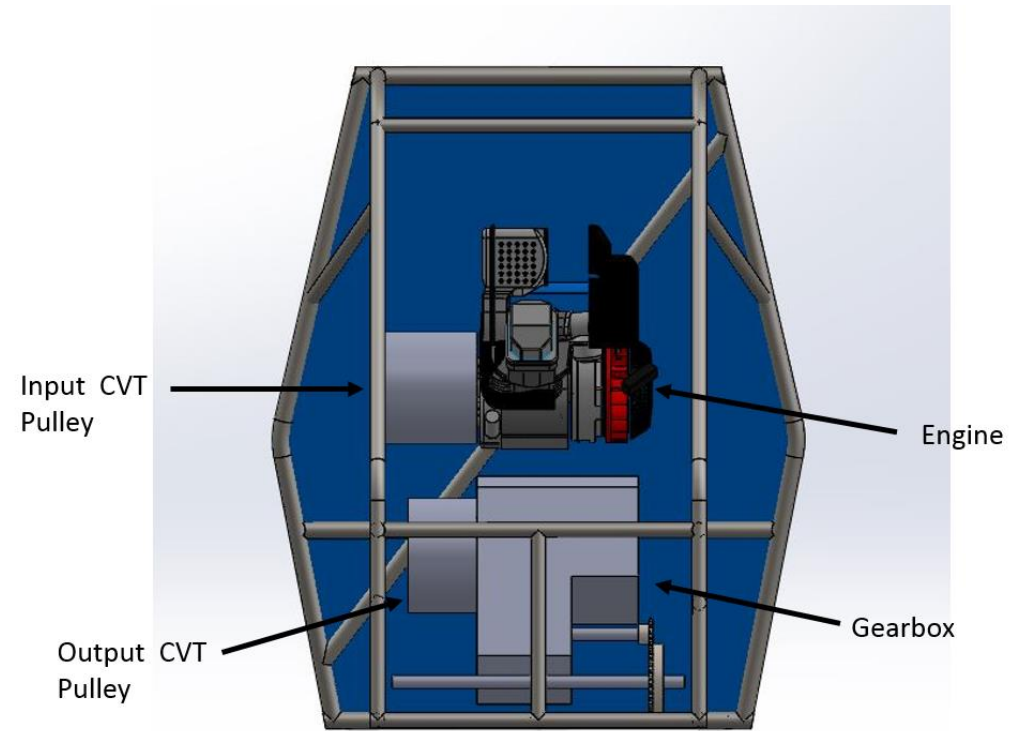
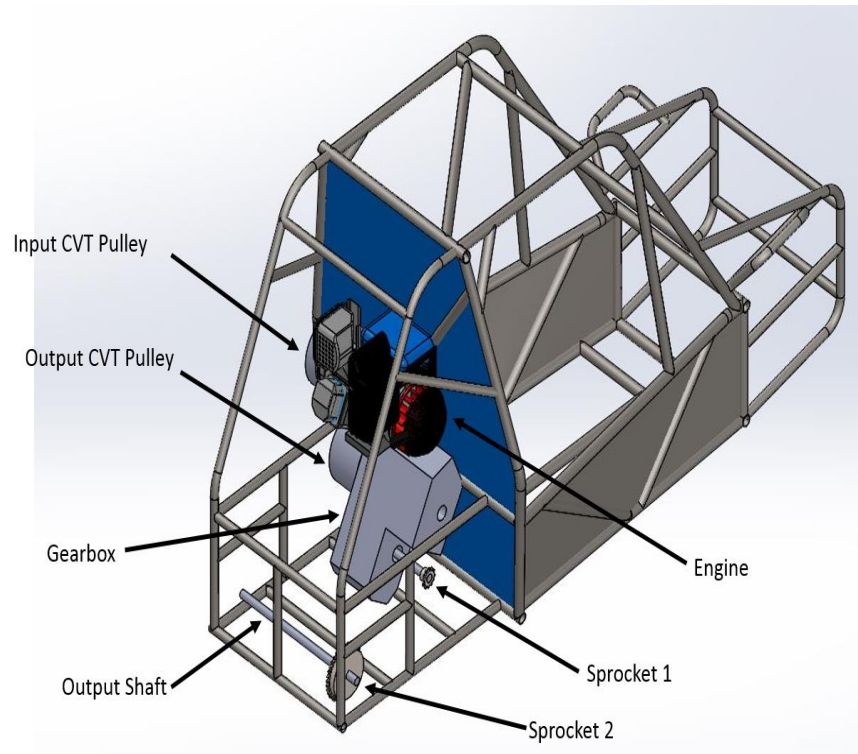
# Goal Statement and Objectives

- To build a rigid and durable Baja vehicle that can successfully complete all of the SAE competition events.
- Satisfy the client and stakeholder needs and requirements.
- Build a drive-train for the Baja vehicle so that it can complete the following tests successfully:
  - Acceleration
  - Traction
  - Maneuverability
  - Specialty
  - Endurance

# Old Parts

- CVT: *PULLEY SERIES 0600 AND DRIVEN PULLEY SERIES 5600* from CVTech-AAB Inc.  
High speed ratio ( $r_{cvt-h}$ ) : 0.45 Low speed ratio ( $r_{cvt-l}$ ) : 3.1
- Gearbox: *ATV/UTV Gearbox T03* from GaoKin Inc.  
High speed ratio ( $r_{gb-h}$ ): 2.734 Low speed ratio ( $r_{gb-l}$ ): 5.682
- Second reduction ratio (Sprockets) ( $r_r$ ): 3

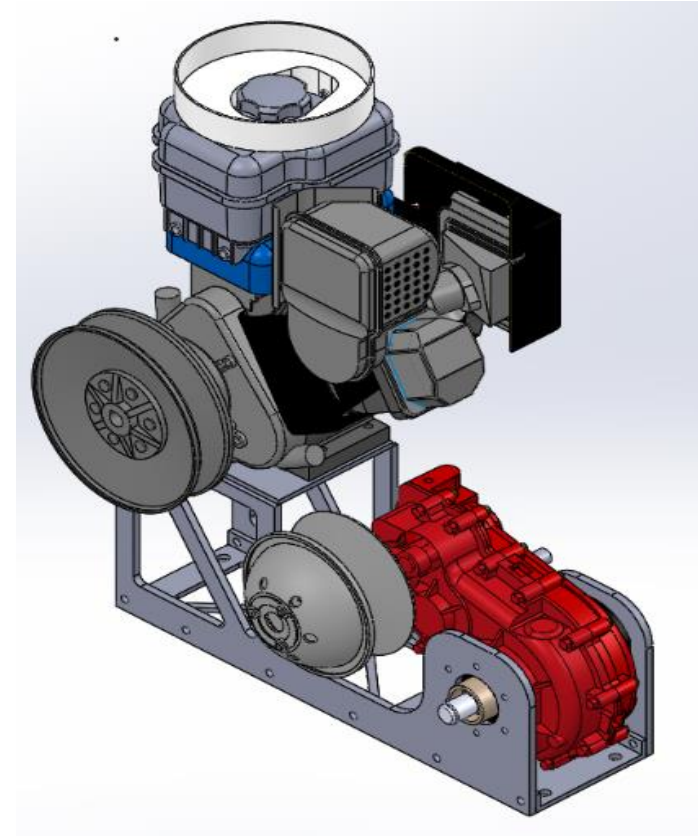
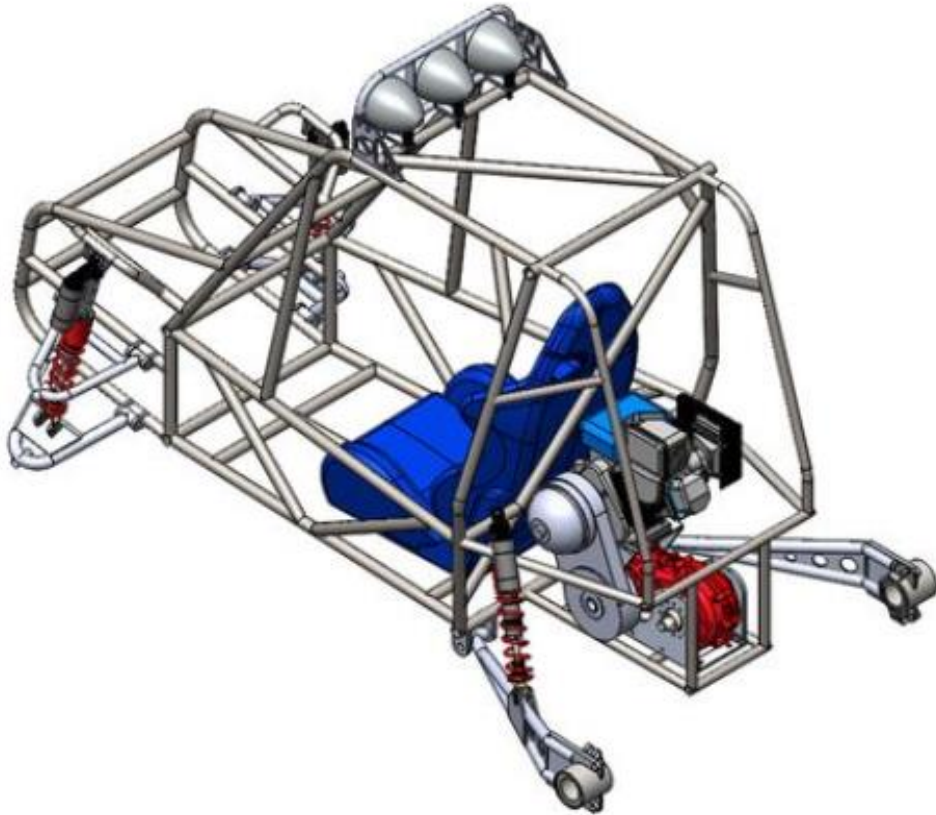
# Old Design(CAD)



# New Design

- Our team members have worked throughout the winter with the Frame team and found a solution to replace the gearbox and shaft.
- This resulted in different parts to be ordered.
- These new parts will provide lighter weight and less cost while still achieving our desired goals.
- The new system will be supported by an aluminum mount creating ease for removal and testing.
- This will also incorporate an SAE specified splash guard and gas over flow system.

# New Design (CAD)





# New Parts

- CVT: *PULLEY SERIES 0600-0021 AND DRIVEN PULLEY SERIES 5600-0171* from CVTech-AAB Inc.

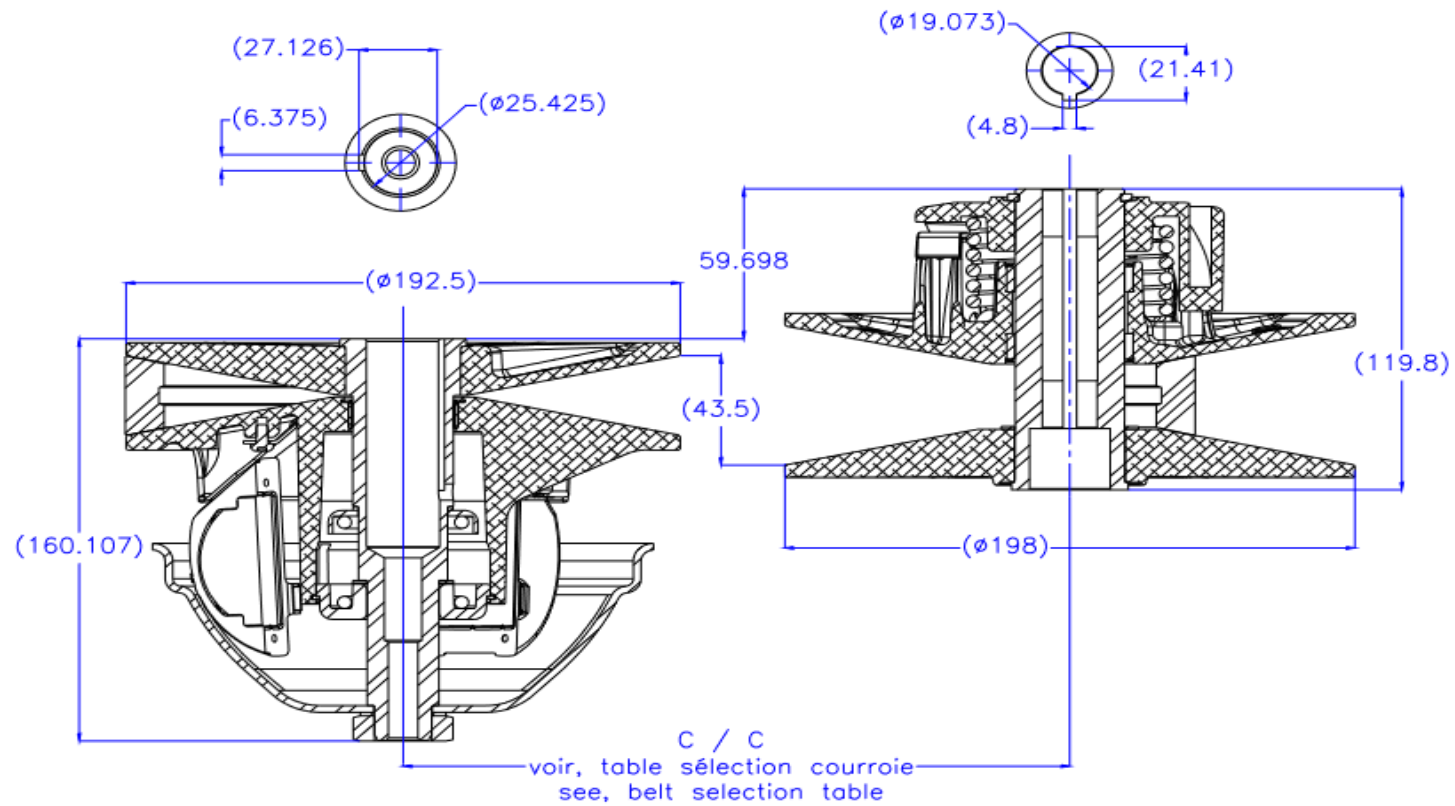
High speed ratio ( $r_{cvt-h}$ ) : 0.43 Low speed ratio ( $r_{cvt-l}$ ) : 3

- Differential: Dana Spicer, H-12 FNR

Forward ratio ( $r_{gb-F}$ ): 13.25 Reverse ratio ( $r_{gb-R}$ ): 14.36

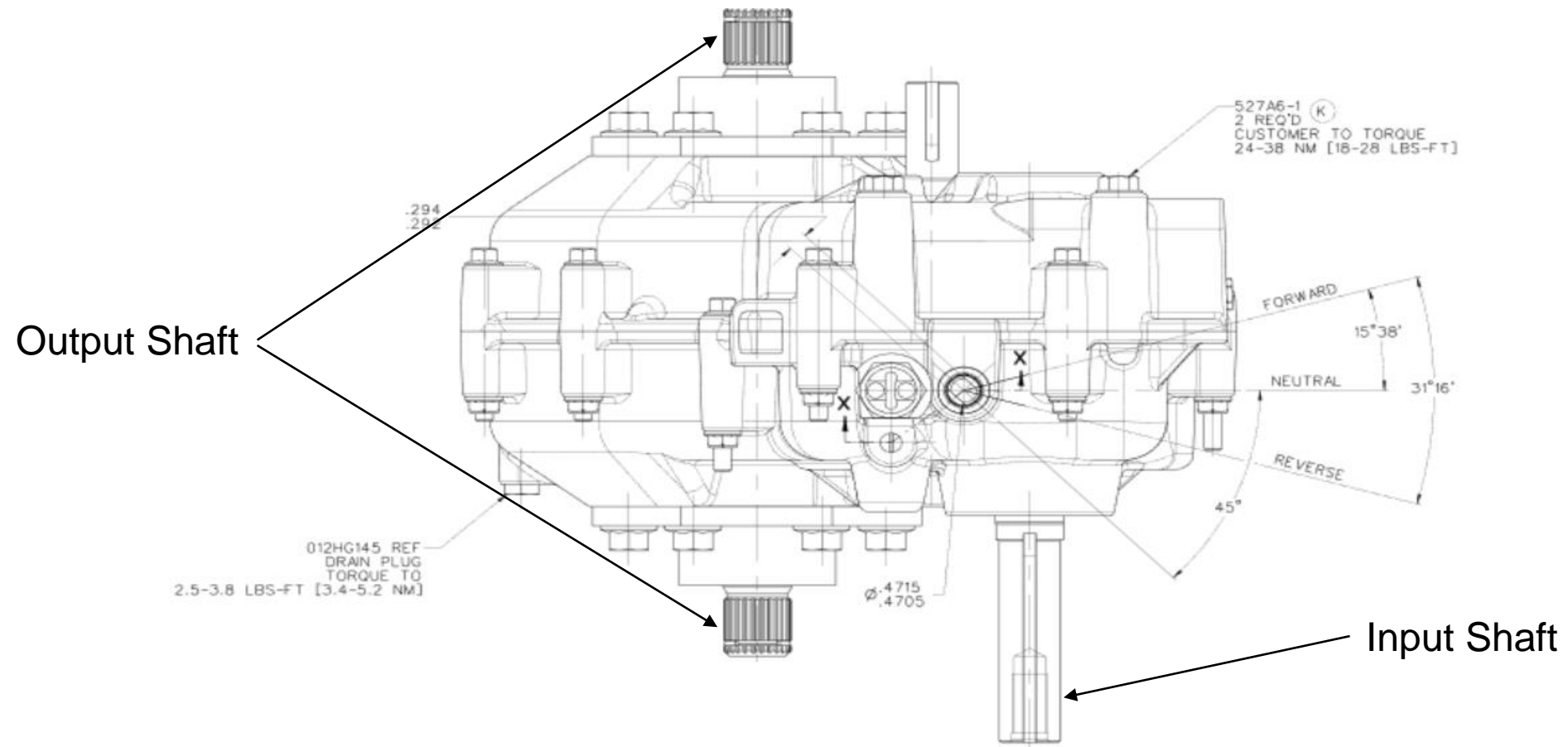
# New CVT

## Mini Baja geometry



Note: All dimensions are in millimetres (mm)

# Differential

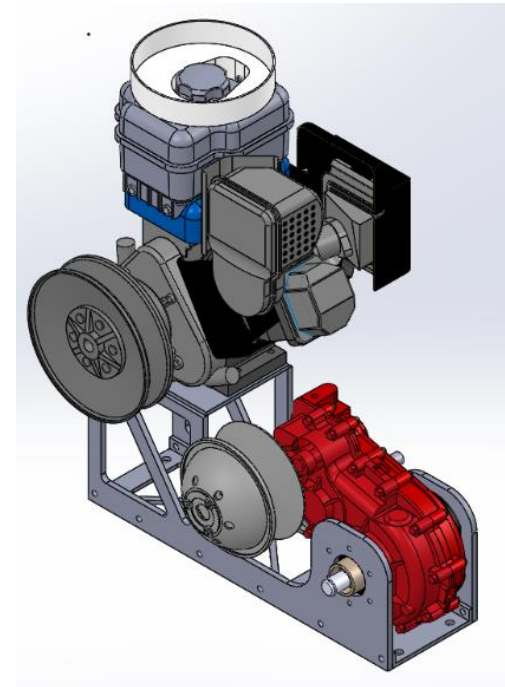
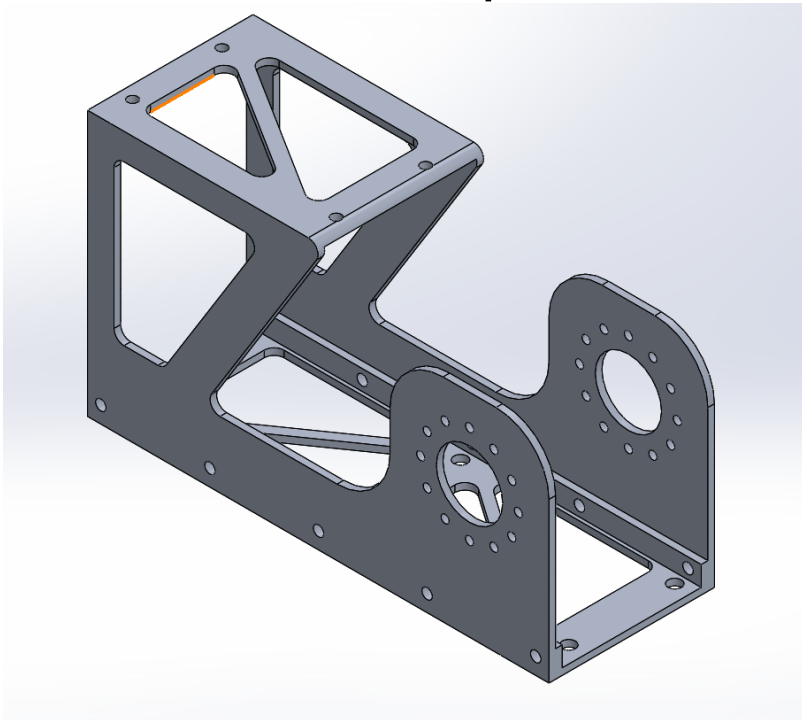


# New Speed and Torque Calculation

Engine rpm	Torque output (lb-ft)	CVT ratio	Total ratio	Torque on wheel (lb-ft)	Speed (mph)
1800	13.20	2.082	24.278	320.467	5.06
2000	13.70	1.899	22.137	303.282	6.17
2200	14.10	1.715	19.997	281.956	7.51
2400	14.30	1.531	17.856	255.347	9.17
2600	14.45	1.348	15.716	227.096	11.29
2800	14.52	1.164	13.576	197.117	14.08
3000	14.50	0.981	11.435	165.809	17.90
3200	14.40	0.797	9.295	133.843	23.49
3400	14.20	0.614	7.154	101.590	32.43
3600	13.80	0.430	5.014	69.190	49.00

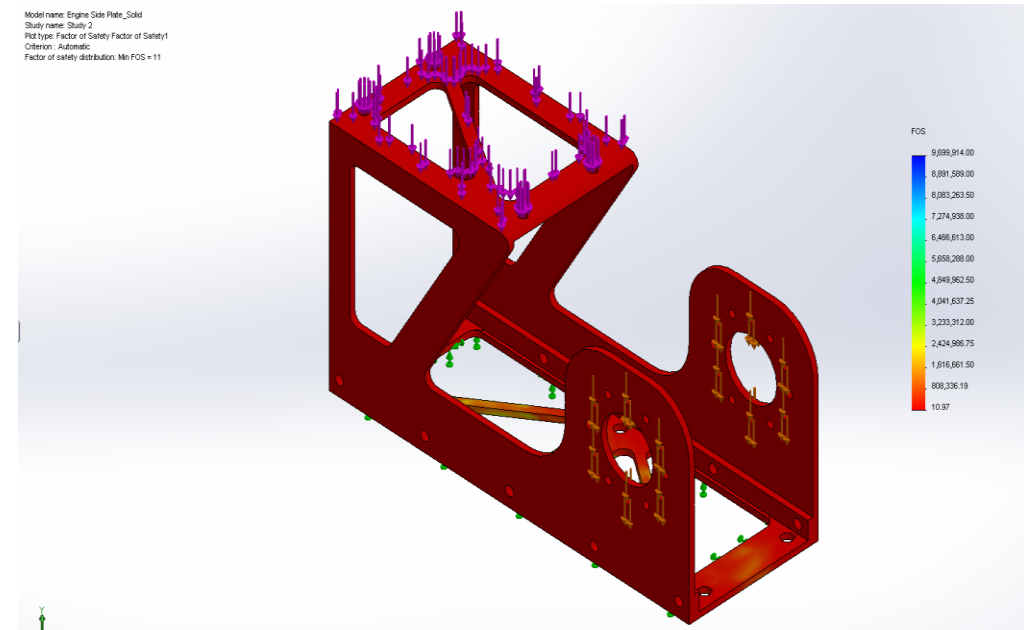
# Engine and Transmission Mount

- The team designed a mount for engine and transmission.
- The mount is made by aluminum.
- The team came up with the FEA analysis for this mount.



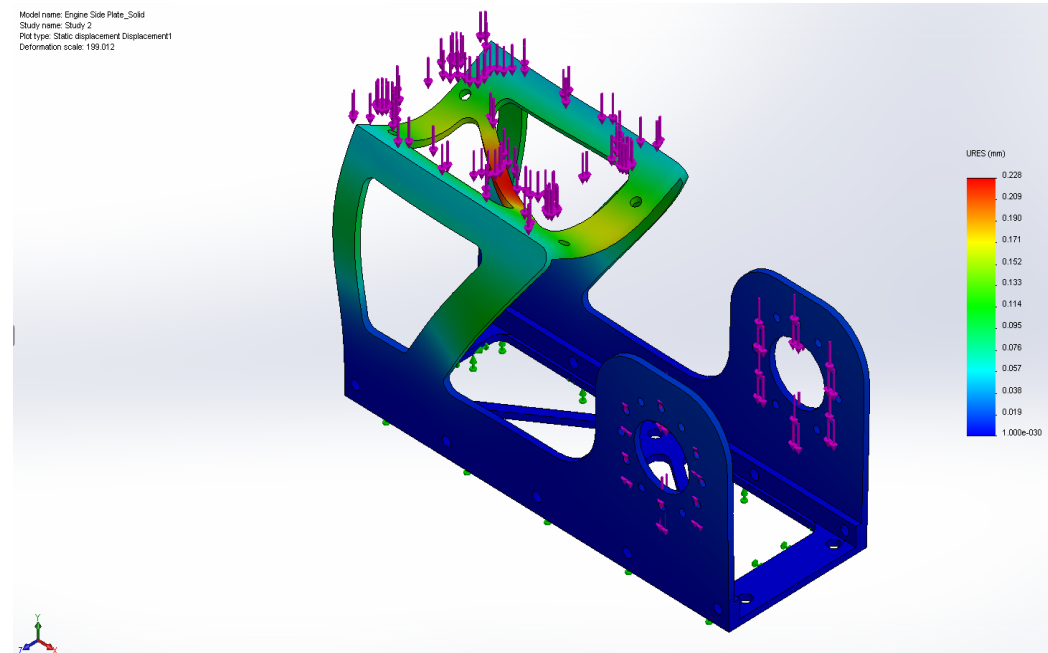
# Finite Element Analysis

- In order to make sure the mount can support the load, the team provided the FEA for the mount.
  - Assumptions: the load applied on the engine support is 200lb.  
the load on the differential support is 80 lb.
  - Safety factor: The minimum safety factor is 10.97.



# Finite Element Analysis

- Displacement: the maximum displacement on the mount is 0.228mm.



# Cost Analysis

- Old Budget
- New Budget
- Bill of materials Comparison
- Parts Order Status



# Old Budget

	Price(\$)	Quantity	Comments	Total
Engine	200	1	Ship fee	200
Gearbox	400	1	GaoKin	400
CVT	580	1	CV-Tech	580
Shaft	28.5	2	Metals Depot	57
Bearing	15	4	Polaris	60
Key	5	4		20
Sprocket	16	4	G & G	64
Chain	15	2	G & G	30
Half-shaft	260	4	Polaris	1040
Shipping	200			200
<b>Total Price (include tax)</b>				<b>2451</b>

# New Budget

	Price(\$)	Quantity	Comments	Total
Engine	200	1	Ship fee	200
Differential	1000	1	Dana	1000
CVT	250	1	CV-Tech	100
Key	5	4		20
Half-shaft	260	2	Polaris	520
Shipping	200		Fed Ex	200
<b>Total Price (include tax)</b>				2040

# Bill of Materials Comparison

- These prices are based upon whole sale costs or approximately 50% of listed price

Half shafts	Engine	CVT	Differential	Key Material	Total
1,040,000	979,980	500,000	2,000,000	5836	4,525,816

12 tooth sprockets	36 tooth sprockets	Half shafts	2 feet 1040 Steel Shaft	Engine	CVT	Gearbox	Chain	Total
10,120	30,360	526,000	5,700	979,980	1,160,000	800,000	5836	3,511,996

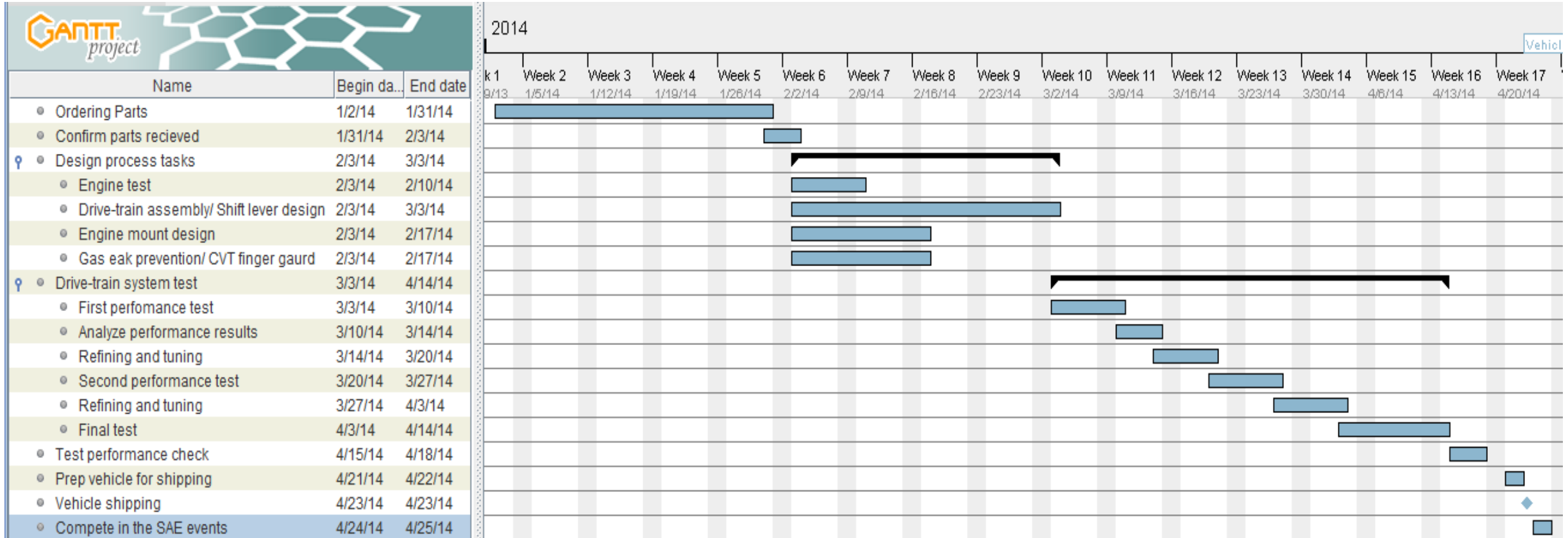
# Parts Order Status

Ordered Parts	Quantity	Status
Engine	1	Arrived
Differential	1	Arrived
CVT	1	In transit
Shaft	2	Not ordered
Key	4	Not ordered

# Drive-Train Tasks List

Task	Leader
Gas Leak Prevention/ CVT Finger Guard	Ruoheng Pan
Engine Test	Abdulrahman Almuflih
Drive-train Assembly/ Shift Lever Design	Andrew Perryman
Drive-train System Test	Caizhi Ming
Engine Mount Design	Zan Zhu

# Project Plan- Spring 2014



# Conclusion

- Parts of the final design were changed from last semester.
- All the parts have been ordered.
- Some parts arrived and others are still in transit.
- Testing of the parts will be performed when possible before assembly.
- The team will start building as soon as all the parts are received and tested.

# References

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# References

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<http://www.carparts.com/transmission.htm>

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- The Big Bearing Store

<http://www.thebigbearingstore.com>

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<http://www.rollerchain4less.com>