-Intro:Max -Design:All Shifter:Max\$ Transmission:Sean\$ Fuel Catchment:Fahad\$ Suspension:Auston\$ Muffler:Peng -Frame Design:Peng and Jing *Precheck:Peng *F.E.A., Cost, Website: Jing -Goals For March 31st -Overall Conclusion:

\$=Goals at beginning, progress report, Goals for rest of semester

SAE Baja Pre-Proposal

Fahad Alajmi, Sean Collins, Peng Li, Auston Solway, Maximillian Whipple, Jingyuan Zhang

> Srinivas Kosaraju Mar. 10, 2016





Introduction

The expectations for individual design components at start of semester

Progress report of individual components to date

- Goals for individual components: completion, testing, and assessment
- Analysis of frame, results of the pre-check reports, and the possibility for competition
- Overall goal: have a driveable Baja by April 1, leaving time to test and reevaluate

Design: Shifter



- End of last semester 3D print of the shifting mechanism was complete
- Major components of the shifter have been machined and fit to the shifting shaft
- Goal is to have shifter and mechanism installed and assembled by April 1st

Design: Shifter





- Expectation: Fully operational by Hardware Review 3 (March 2)
- Progress of transmission:







• Progress of Transmission (cont.):





- Goal for completion: •
 - Modify shift fork for reverse gear
 - Break in gears
 Order a clutch





Design: Fuel Catchment

- Expectation: Revise fuel catchment design, and make it agreed with the project requirement.
- Progression: Making side shield of sheet metal, to protect the catchment of the heat from the muffler.
- Final step(fabrication): Fabricate the fuel catchment to be as the new design.

Design: Fuel Catchment



Suspension: Initial Goals

Old Single Trailing Arm Design

<image>

This design acts as a cantilever when coming into a turn which causes a large moment at bushing. Additional linkages allow for support during horizontal loading.

Desired Three Link Design (Representation)

Suspension: First Iteration Of Design



The original design change included two additional links but due to an issue with the upper link mounting location the design was simplified to a single link.

Suspension: Second and Current Design & Analysis



The decision was made to only as one additional link onto the baja and access the situation as the build became drivable.

Suspension: Second and Current Design & Analysis



- The next step is to analyze the rear suspension travel under load.
- How will the bushing hold up with an arc due to the additional member?
- Will the cv shafts still attempt to pull from the transmission?

Old Muffler







Muffler: Design Requirements (SAE)

- Muffler Relocation: ID of 32mm (1.25 in)
- Must use the original muffler
- Muffler Supports
- Exhaust Pipe Length
- Exhaust Pipe Holes & Tubes
- Exhaust System Durability Required
- The exhaust exit must not exit towards the driver.

New Muffler



Frame Pre-check (Approved by SAE)

- Roll Cage Specification Sheet & frame material documentation (invoices, certifications, calculations, etc.)
- Engineering Drawings of the frame from several specific views

Updated FEA



Updated FEA

	Maximum Stress *10^8 Pa	Yield Stress *10^8 Pa	Factor of Safety	Factor of Safety Requirement
Front impact	1.551	4.6	2.96	1
Side impact	3.972	4.6	1.158	1
Rear impact	4.092	4.6	1.124	1
Roll over	1.859	4.6	2.470	1

Gantt Chart: Milestones

Task																															
	1	1	2 3	3 4	15	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29 3	30 3	31 3
Problem Definition and Project Planing							\square	\square	\square	\square	\square		\square	\square	\square	\triangleleft	\square	\square	\square			\square								\top	\top
Concept Generation and Selection							\square	۲	\square	\square	\square	\square	\square	Ζ	\triangleleft	Χ	\triangleleft	\square	\square	\square		\square		1							
Concept Protopyte							\square	\square	\square	\square	\square	۲	\square	\square	\triangleleft	Λ	\triangleleft	\square	\square	\square		\square		1							
Project Proposal							\square	\square	\square	\square	\square	\square	\square	Ζ	\bigstar	Λ	\triangleleft	\square	\square	\square		\square	\square	1							
Hardware Review 1		1					\square	\square	\square	\square	\square	\square	\square	\square	Ζ	\land	\triangleleft	\square	\bigstar	\square		\square		1							
Hardware Review 2							\square	\square	\square	\square	\square	\square	\square	Ζ	\triangleleft	Χ	\triangleleft	\square	Ζ	\square	♦	\square		1							
Hardware Review 3		∇	$\overline{\mathcal{V}}$	$\overline{\nabla}$	∇	\square	\square	\square	\square	\square	\square	\nearrow	\square	\square	Ζ	Λ	\triangleleft	\land	\square	\square		\square	/								
Midpoint Review						\square	\square	\square	\triangleleft	\land	\triangleleft	\square	\square	\square		\square		•													
Hardware Review 4		1					\square	\square	\square	\square	\square	\square	\square	Ζ	\triangleleft	Λ	\triangleleft	\square	\square	\square		\square	\square	1		٠					
Hardware Review 5							\square	\square	\square	\square	\square	\square	\square	\square	\triangleleft	\land	\triangleleft	\square	\square	\square		\square		1				٠			
Make Sure the Baja is driverable							\square	\square	\square	\square	\square	\square	\square	Ζ	\triangleleft	Χ	\triangleleft	\square	\square	\square	7	\square	\square	1					•		\top
Walkthrough Prensentation					$\overline{\nabla}$		\square	\square	\square	\square	\square	\square	\square	\triangleleft	Z	X	Z	\square	\square			\square		1					•	•	
UGRADS Presentation and Final Reports							\square	\square	\square	\square	\square		\square	\square	Z	Χ	\triangleleft	\square	\square			\square	\square	1						4	
Operations Manual		$\overline{\mathcal{V}}$	$\overline{\mathcal{V}}$	$\mathbf{\nabla}$	$\overline{\nabla}$		\square	\square	\square	\square	\square	\square	\square	\square		\land	Ζ		\square			\square		1							4

Gantt Chart: Progress Plan

Task																															
	1	L	2	3 4	4 !	5	6 7	7 8	8 9	9 1	0 11	l 12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29 3	0 3	1 32
Communicate With Client		V	V	\mathbf{V}	V	V	V	V	V	V	V	V	\mathcal{V}	\mathcal{V}	\vee	И	/	\vee	/	Л		Λ	Λ								
Defining Project ,Need, Goal, Objective and Constraints		V	$\overline{\mathcal{V}}$		\overline{V}	$\overline{\mathcal{V}}$	$\overline{\mathcal{V}}$	\overline{V}	\overline{V}	$\overline{\mathcal{V}}$	∇	∇	∇	∇	\square	И	7	\square	/	Л		Ζ	Λ								
Preparing Quality Function Deployment:		\mathcal{V}	\mathcal{N}	\mathbf{V}	\overline{V}	$\overline{\mathcal{V}}$	\mathcal{V}	V	\overline{V}	$\overline{\mathcal{V}}$	\mathcal{V}	\mathcal{V}	\overline{V}	∇	\bigvee	И	/	\bigvee		Л		\square	Λ								
State Of the Art Research		\mathcal{V}	Λ	\mathbf{V}	\overline{V}	\overline{V}	\overline{V}	V	\overline{V}	$\overline{\mathcal{V}}$	\mathcal{V}	∇	\overline{V}	∇	\square	И	7	\bigvee		Л		\square	Λ								
Verify The Date of Frame		V		\mathcal{V}	\overline{V}		V	\mathcal{V}	\mathcal{V}	$\overline{\mathcal{V}}$	V	∇	\overline{V}	∇	\square	И	/	\square	/	Ζ	/	\square	Ζ								
Creating Function Diagrame:		V	Λ	V	V	1	V	V	V	V	V	V	\mathcal{V}	\mathcal{V}	\vee	И	/	\vee	/	Л	/	Λ	Λ								
Conceptualizing Alternative Approach:		T	$\overline{\mathcal{N}}$		\overline{V}		$\overline{\mathcal{V}}$	\overline{V}	\overline{V}	\overline{V}	∇	∇	∇	∇	\square	И	7	\square	7	Л		Ζ	Λ							Т	Т
Register with SAE		$\overline{\mathcal{V}}$	Λ	\mathcal{V}		Λ		\overline{V}	$\overline{\mathcal{V}}$	$\overline{\mathcal{V}}$	\overline{V}	∇	\overline{V}	∇	\square	И	/	\square	/	Л	/	\square	\land								
Decision Matrices		T	$\overline{\mathcal{N}}$	\overline{V}		Λ	\overline{V}	\overline{V}		$\overline{\mathcal{V}}$	∇	∇	∇	∇	\square	И	7	\square	/	Л		\square	Λ								
Brainstorming for the transmission		T	$\overline{\mathcal{V}}$	\overline{V}	\overline{V}		\overline{V}	\overline{V}		$\overline{\mathcal{V}}$	∇	∇	\overline{V}	∇	\square	И	7	\square	7	Л		Ζ	Ζ							Τ	Τ
Concept Selection:				1	1/	1		$\overline{\mathcal{V}}$			$\overline{\mathcal{V}}$	∇	$\overline{/}$	∇	\square	И	7	\square	7	Л		Ζ	Ζ							Τ	Τ
Budget Analysis		1	$\overline{\mathcal{N}}$	1	1	1		\overline{V}			$\overline{\mathcal{V}}$	∇	\overline{V}	∇	\square	И	7	\square	7	И		Ζ	Ζ								
Engineering Analysis for Improved Baja		V	$\overline{\mathcal{N}}$	\mathcal{V}	\overline{V}	$\overline{\mathcal{V}}$	\mathcal{V}	\mathcal{V}	\mathcal{V}	\mathcal{V}	$\mathbf{\nabla}$	\mathcal{V}	\overline{V}	∇	\square	И	/	\bigvee		Л		\square	Λ								
Fabrcating Concept Protopyte:		T	$\overline{\mathcal{V}}$	∇	∇	て	∇	∇	∇	∇	∇	∇	∇	∇	\square	И	7	\square		Л		\square	\square							Т	Т
Testing Concept Protopyte:			1/	1/	1/	1	1/	1	1/		1/	1/		$\overline{\mathbf{Z}}$		\square	7	\square		\square										T	T
Order The Engine and Other Necessary Materials		t	イ	1	ヤ	イ	1/	レ	1		1	17		$\overline{\mathbf{Z}}$	\square		7	\square			7	\square	7							+	+
Finalizing The Project:		1	1	1	1/	1	1/	1	1/							\square	7	\square		\square	7									T	T
Preparing for Hardware Review 1		t	1	1	1	t	1/	1	1	t		1/		\mathbb{Z}	\square	\square	/		/	\square		\square	\square						+	+	+
Preparing for Hardware Review 2		1	1/	1/	1/	1	1/	$\overline{\mathbf{V}}$	1	1		17		\overline{D}		И	7	\square	7	Ζ	/	\square	Ζ							\top	\top
Preparing for Hardware Review 3		1	1	1/	1/	1	17	17	1/	1	17	17		$\overline{\mathbf{Z}}$	\square	\square	7	\square		\square										T	T
Preparing for Midpoint Review		t	1	1	1	Ť,	1/	t	1/	1	1/	17	ľZ	17			7		7	\square	/								+	+	+
Preparing for Hardware Review 4		t	1	1	1/	t	1/	t	1	t	1/	17	17	17	\square		7	\square	7	\square									+	+	+
Preparing for Hardware Review 5		t	イ	1/	1/	1	1/	Ĺ	1	Ĺ	1/	17	17	17			7	\square	7	\square		\square							+	+	+
Preparing for Walkthrough Prensentation		t	イ	t	1/	Ĺ	1/	t	1	Ĺ	1/	17	17	ľZ			7	\square	7			\square	7								+
Preparing for UGRADS Prensentation and Final report		t	1	t	t	t	1/	t	t	t	1	1/	1/	ť7	\square	\square	7	\square				\square	\exists								
Preparing for Operations Manual	1/	t	1	1	1	Ť	17	1	1	1	17	17	17	17			7		7	\square	7										

Conclusion

The expectations for individual design components at start of semester

Progress report of individual components to date

- Goals for individual components: completion, testing, and assessment
- Analysis of frame, results of the pre-check reports, and the possibility for competition
- Overall goal: have a driveable Baja by April 1, leaving time to test and reevaluate

References:

• Erickson, Wallace D. Belt Selection and Application for Engineers. New York: M. Dekker, 1987.

• Naunheimer, Harald. Automotive Transmissions Fundamentals, Selection, Design and Application. 2nd ed. Berlin: Springer, 2011.

👷 MyNAU Portal: MyNAU H 🗙	Google Docs - crea	ate and $ imes ig $ \Box G	oogle Slides	×	📒 McMas	ster-Carr	×	+											-	8
(>) (www.mcmaster.com/	≠standard-rod-ends/=11gzl	b7e											C Search] ☆	ė V	, +	î	9)- ·
McMASTER-CARR			help? Call (562) 65 I, or text 75930. TACT US	2-5911,			BOOKM	ARKS				ORDE	DER HISTORY	03/09/16 - 0 I BUILD ORDE	ER					Log in 4
Narrow By Clear All Type Ball Joint Shank Type Male Female Inch/Metric Inch	More	phi-hand threaded sha turned clockwise. I st common thread. It drawings and 3-D m all Joint Rod E	odels, click on a nds With at least 5	part number.	en turned co	ided shank tig unterclockwis I ends accomm	e.	ater misalignme	nt than any ot	her rod en	nd we offer. All	have a	-	How ca	n we impri	ove? Pr	int For	ward 🛛	View catal	og page
Shank Thread Size are"-24 see"-18 1/2"-20 are"-16 Shank Thread Direction Right Hand (most common) Left Hand ID (Inner Diameter)	Male Threaded		Shank Thread Size Male-Threade Size Male-Threade	Ball Max. Ball I otati Ball Max. Ball D (A) Swivel d Shank Bas 55 1/2* 65*	ion and reduc and 3-D mode all O'all Wd. (B)	O'all Thick. (C) (D)	Thread Thread Lg. (E) 15/8°	Static Radial Load Cap., Ib 10,174 15,038		land ds Each 59.92 20.36		nd s Each <u>\$9.92</u> 20.36								
3.6" 5.6" 1/2" 3.4" Overall Thickness "[]"	• -iAI-	Te	5/8"-18 3/4"-16 3/4"-16 Female-Threa 3/8"-24 1/2"-20 5/8"-18	1/2" 65" 64" 64" 518" 64" 324" 61" ded Shank 318" 55" 1/2" 65" 518" 64" 314" 61"	1 3/4" 2" 1 1/8" 1 1/2" 1 3/4"	1 3/8" 27 1 3/8" 3 3 1 1/2" 3 3 7/8" 2 1 1 1/4" 2 5 1 3/8" 2 7	/8" 2" /8" 2" /8" 1 1/16" /8" 1 3/8"	15,038 19,394	6960T21 6960T31 6960T51 6960T51 6960T71 6960T81 6960T91 6960T131		6960T32 6960T42 6960T52 6960T72									
7/8" 1 3/8" 1 1/4" 1 1/2" Housing Material Steel																				

Home | Help | Returns | Careers | Settings