SAE Baja

Problem Definition and Project Plan

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

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Overview

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Introduction

- **Client**: SAE club and Dr. John Tester
- **Background**: NAU's SAE club, advised by Dr. Tester, has a Baja vehicle but it is not working.

Current Baja in Fabrication shop

Problem Definition

Need Statement

-NAU’s SAE club, advised by Dr. Tester, does not have an operational Baja vehicle for the SAE competition.

Goal Statement

- To win
- Build an operational Baja vehicle
- As a learning opportunity
- Inspire teamwork related to engineering design and practices

Objectives

Objectives	Measurement
Light Weight	lb.
High Traction	lb.
Quick Acceleration	ft./s^2
Safe	ksi/ksi
Endurance	Testing hours
Ergonomic Cockpit	ft

Constraints

- Fully operational by March 1st, 2016
- Verify the frame is less than 2 years old
- Must have at minimum 2 forward gears and 1 reverse gear
- Cannot exceed 108” in length or 64” in width
- Weigh between 400 and 800 lb.
- Must use a 10 hp Briggs and Stratton engine

Quality Function Deployment

Engineering Requirements / Customer Requirements	Young's Modulus	Body Weight	Transmission	Dimensions	Frame Thickness	Factor of Safety	Total Cost	Exhaust Pipe Length	Engine Power	Spring Stiffness	Velocity	Maximum Steer Angle
Follow the 2016 SAE Baja Rules		9	9	9				9	9			
Safety	9				9	9						9
Inexpensive	9	9		9	9		9			9		
Aesthetic				3	3			1				
Maneuverability	9	9	9	1	1				9	9	9	9
Ergonomic Cockpit				3								
Traction		9	9	9					9			9
Robust	9			3	9		3			9	9	9
Endurance	9	9			9	9	1			3		9

Legend	
Strong Relationship	9
Moderate Relationship	3
Weak Relationship	1

House of Quality

Young's Modulus												
Body Weight												
Transmission		-										
Dimensions		+										
Frame Thickness	-	+		+								
Factor of Safety	+	+			+							
Total Cost	+	+		+								
Exhaust Pipe Length				+								
Engine Power							+					
Spring Stiffness						+	+					
Velocity												
Maximum Steer Angle		-	+						+			
Engineering Requirements	Young's Modulus	Body Weight	Transmission	Dimensions	Frame Thickness	Factor of Safety	Total Cost	Exhaust Pipe Length	Engine Power	Spring Stiffness	Velocity	Maximum Steer Angle
Column#	1	2	3	4	5	6	7	8	9	10	11	12
Direction of improvements	↑	◊	↑	◊	◊	↑	↓	◊	◊	↑	↑	↑

Positive Correlation	+
Negative Correlation	-

Maximize	↑
Target	◊
Minimize	↓

Project Plan

Gantt Chart

Task	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Communicate With Client															
Defining Project ,Need, Goal, Objective, and Constraints															
Preparing Quality Function Deployment:															
State Of the Art Research															
Verify The Date of Frame															
Creating Function Diagram															
Conceptualizing Alternative Approach:															
Register with SAE															
Engineering Analysis for Current Baja															
Decision Matrices															
Brainstorming for the transmission															
Concept Selection:															
Budget Analysis															
Engineering Analysis for Improved Baja															
Fabrcating Concept Protopyte:															
Order The Engine and Other Necessary Materials															
Testing Concept Prototype:															
Finalizing The Project:															
Problem Definition and Project Planning															
Concept Generation and Selection															
Concept Prototype															
Project Proposal															

State of the Arts: Transmission

- Centrifugal Clutch: Single gear ratio
- Continuously Variable Transmission (CVT): Multiple gear ratios, controlled by pulley system
- Sequential Transmissions: Used in motorcycle designs, multiple gear ratios

Conclusion

- Problem definition: NAU's SAE club, advised by Dr. Tester, does not have an operational Baja vehicle for the SAE competition to win.
- Objectives: Light weight, has high traction, quick acceleration, safe, able to endure the race, and ergonomic cockpit
- Constraints: Operational March 1st 2016, frame is less than 2 years old, 2 forward gears and reverse, below 108'' in length and below 64'' in width, use 10 hp Briggs and Stratton engine
- Quality Function Deployment: Customer and engineering requirements
- Project Plan: Fall 2015 SAE Baja schedule
- State of the Arts: Sequential gear box

Reference

- 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.

- Panchal, D. *Two and three wheeler technology*. New Delhi: Asoke K. Ghosh, 2015.