Suspension Rockers **Redesign** and Implementation Using 3D-Printed Material

Team: Nakoma Austin, Sean Bryant, Raio Lively, Jonas Nouchet, and Charles Wilson

Department of Mechanical and Aerospace Engineering, Old Dominion University, Norfolk VA

11/08/2023

Advisor: Dr. Ashish Tamhane Graduate Student Advisor: Bryce Thacker

Project History and Background

- Background: the ODU FSAE Team produces a racing vehicle every two years and competes nationally.
- Project was undertaken because the previous aluminum rockers were:
 - Expensive to produce
 - Heavy
 - Inconvenient (untimely) to obtain through outside vendors
- Objective: to determine if the FSAE Race Car can operate using PA-6CF 3D-Printed Rockers, which can be made on-campus with the AM Lab, are cheaper to produce, and made of a lighter material than aluminum.

Front Rocker



Rear Rocker



Project Items

Completed	Upcoming/In-Progress
Static Simulations (SolidWorks)	 Manufacture of the Rockers
Dynamic Calculations	Completion of Test Rig Bracket
Re-run of the Topology	Designs (ASME Y14.35 & 14.5)
Simulations (SolidWorks)Basis/Template of the Test Plan	Creation of the Test Rig Brackets
	(AWS D1.3 & ANSI Z49.1)
(ASTM-E606)	Design Annealing Process
	 Ordering of the Bushings and Shocks

Bracket Design



Test Rig – MTS

• Picture 1: Full MTS

- Picture 2: Bottom Attachment of MTS
- Picture 3: Top Attachment of MTS



Bracket Motion



Gantt Chart

ID	%	Task Name	Duration	Start	Finish	September 2022 December 2022 November 2022 December 2022
	Complet	b				22 22 52 83 13 3 6 9 12 15 18 21 24 27 30 3 6 9 12 15 18 21 24 27 30 2 5 8 11 14 17 20 23 26 291 2 5 8 11 14 17
1	50%	ROCKER REDESIGN PROJECT	75 days	Mon 8/28/23	Fri 12/8/23	
2	96%	1. DOCUMENTATION	25 days	Mon 8/28/23	Fri 9/29/23	1
3	100%	1.1. Project Proposal	8 days	Mon 8/28/23	Wed 9/6/23	Nakoma, Raio
4	100%	1.2. Responsibility Assignments	1 day	Mon 8/28/23	Mon 8/28/23	Team
5	95%	1.3. Load Testing Plan	25 days	Mon 8/28/23	Fri 9/29/23	Sean, Jonas
6	98%	2. SIMULATION	5 days	Mon 10/2/23	Fri 10/6/23	
7	100%	2.1. Complete Static Analysis	5 days	Mon 10/2/23	Fri 10/6/23	Raio
8	95%	2.2. Complete Dynamic Analysis	5 days	Mon 10/2/23	Fri 10/6/23	Raio
9	25%	3. MANUFACTURE PARTS	14 days	Tue 11/7/23	Fri 11/24/23	• • • • • • • • • • • • • • • • • • •
10	25%	3.1. Secure Material (PA6-CF)	14 days	Tue 11/7/23	Fri 11/24/23	Charles
11	25%	3.2. Manufacture Front and Rear Rockers	14 days	Tue 11/7/23	Fri 11/24/23	Charles,AM Lab
12	9%	4. TEST AND ANALYZE ROCKERS	29 days	Mon 10/30/23	Thu 12/7/23	
13	100%	4.1. Obtain Load Testing Plan Approval	1 day	Mon 10/30/23	Mon 10/30/23	📕 Team
14	20%	4.2. Secure Test Rig	10 days	Tue 11/7/23	Mon 11/20/23	Sean, Jonas
15	0%	4.3. Perform Cyclic Testing and Record Data	20 days	Tue 11/7/23	Mon 12/4/23	Team
16	0%	4.4. Revise Initial Data and Testing Methods	2 days	Tue 12/5/23	Wed 12/6/23	Team
17	0%	4.5. Analyze New Data	1 day	Thu 12/7/23	Thu 12/7/23	👔 Nakoma, I
18	50%	5. REPORT AND PRESENTATION	4 days	Tue 12/5/23	Fri 12/8/23	r
19	50%	5.1. Create Project Report	4 days	Tue 12/5/23	Fri 12/8/23	Nakoma
20	50%	5.2. Create Project Presentation	2 days	Tue 12/5/23	Wed 12/6/23	📩 Team,Nak

Complete List of Engineering Standards

- ANSI Z49.1: covers all aspects of safety and health in the welding environment, with an emphasis on oxyfuel gas and arc welding.
- ASME Y14.35: establishes the practice for revising drawings and associated documentation and demonstrates methods for identification and revisions.
- ASME Y14.5: establishes the rules, symbols, definitions, requirements, defaults, and recommended practices for stating and interpreting Geometric Dimensions and Tolerances on engineering drawings, models defined in digital data files, and related documents.
- ASTM-E606: fatigue testing by cyclic load simulated by typically used by servo-hydraulic testing until failure.
- ASTM-B438: specifies requirements of bronze-based bearings produced from mixed metal powders using powder metallurgy technology and then impregnated with oil to supply lubrication.
- AWS D1.3: structural welding of steel sheet metal to other structural sheet steels or to supporting structural steel members, including Tungsten Inert Gas (TID) welding.
- ISO 9001: international standard that specifies requirements for a quality management system.

Questions?