

USU Mini Baja SAE

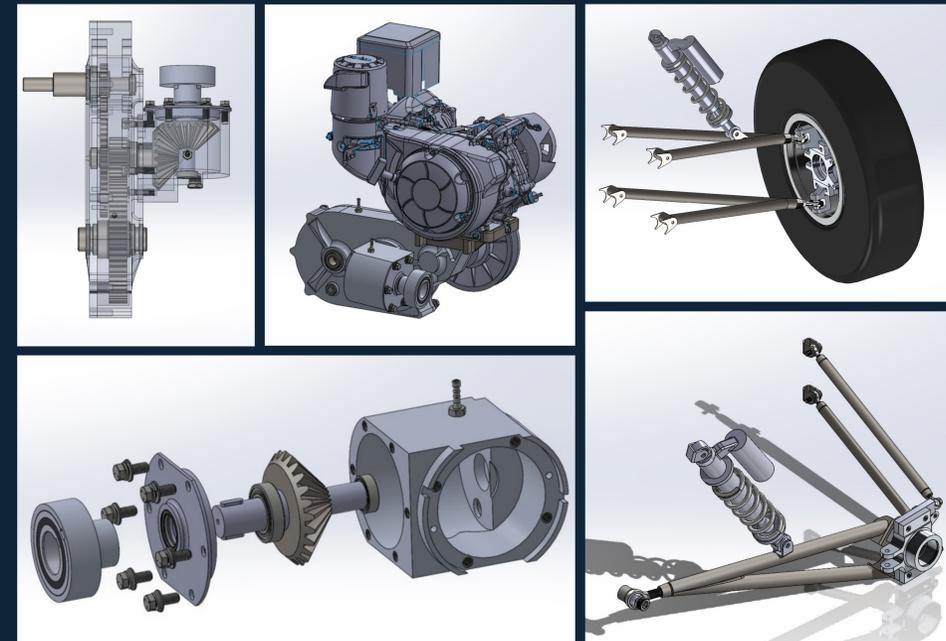
Project Description



The goal for this project is to design and build a Baja buggy to compete in the 2023 SAE Oregon Baja Competition. Our goal is to improve on last year's design and perform better at the competition. The following are areas where we focused our efforts.

- Pass the SAE Tech inspection
- Increase time to first failure
- Improve accessibility of key components
- Decrease acceleration time over 150 m distance
- Improve the turning radius
- Increase suspension travel and vehicle ground clearance
- Decrease the time required for a driver to exit the vehicle
- Decrease vehicle weight

Design Description

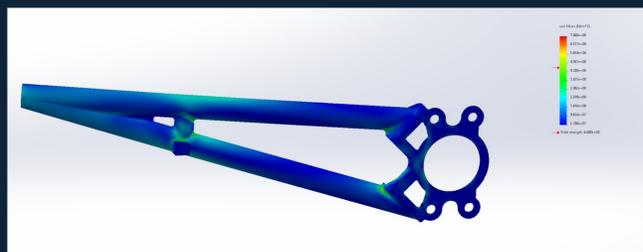


Modeled Components:

Top: Gear Box, Engine and Gear Box, and Front Suspension Assembly

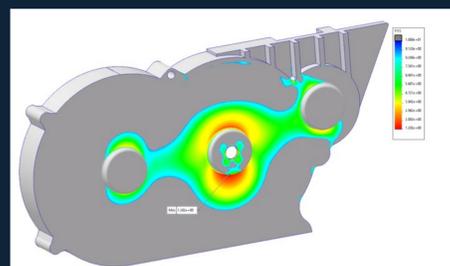
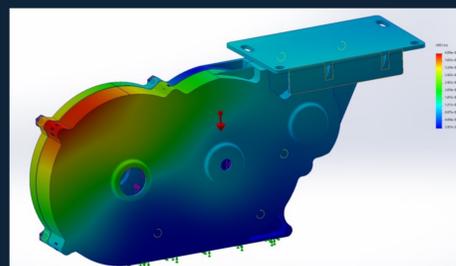
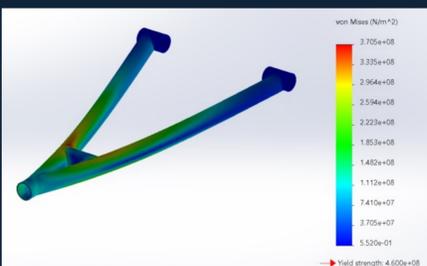
Bottom: Bevel Gear Case and Rear Suspension Assembly

Performance Review



Our analysis is broken into three steps: calculations, finite element analysis (FEA), and physical testing

- Calculations: the drivetrain team wrote a 4226-line Matlab program to calculate the optimal dimensions of the gears, shafts, and bearings.
- FEA: Once the components were modeled, they were analyzed using FEA to ensure everything fell within our desired factor of safety.
- Physical Testing: This step is still ongoing. As pieces are manufactured and assembled, the vehicle is tested against our performance metrics.



Conclusion

Requirement/Constraint	Target	Threshold	Predicted Performance
Vehicle Weight	415 lbs	465 lbs	475 lbs
Time to First Failure	3.5 hours	2 hours	4 hours
Time to Accelerate from 0 to 150ft	4.47 seconds	5.27 seconds	5.05 seconds
Turning Radius	105 in.	111 in.	106.8 in.
Suspension Clearance	Ground Clearance	13 in.	12 in.
	Suspension Travel	10 in.	9 in.
Time for Driver to Egress Vehicle	3 seconds	5 seconds	5 seconds
Time to Replace Major Components	5 min	8 minutes	1.5 minutes

Results:

- Although we did not meet every goal set, the vehicle has improved in many meaningful ways. In particular, our focus on reliability should allow the vehicle to complete the 4-hour endurance challenge and be competitive in all dynamic events.

Lessons Learned and Recommendations for Next Year's Team:

- In a successful design, all components must work together. By not siloing our sub-teams we were able to avoid compatibility errors.
- Lock in the general design of subsystems early. This gives the team time for iteration and improvement.
- Keeping organized is essential to success.
- Good communication between the team and the club speeds up progress and helps avoid errors.



College of Engineering
UtahStateUniversity

Lance Bullock, Austin Gardiner, Thomas Heaps, Benson Hegemann, Levi Johnson, Landon Morrison, Case Todd, Kurtis Walker, Jack Woolfenden
Contact: Lance Bullock - a00931982@usu.edu

Special Thanks to: Jackson Graham, Tristan Spencer, Sam Adams, Terry Zollinger, The USU SAE Baja Club, and our sponsors