Rogue: UCI's First All-Wheel-Drive Off-Road Vehicle

Advisors: John Michael McCarthy, Quoc "QV" Viet Dang, Robert "Smitty" Smith, Phil Chipman, Ron Kessler
Project Leads: Alan Diaz, Yavin Evenich, Natalie Luu, Wil Deomampo, Kamal Elamri, Bevan Chiu, Nathan Martinez, Cindy Tan, Blaise Baker

UCI Samueli School of Engineering | Department of Mechanical and Aerospace Engineering

Overview

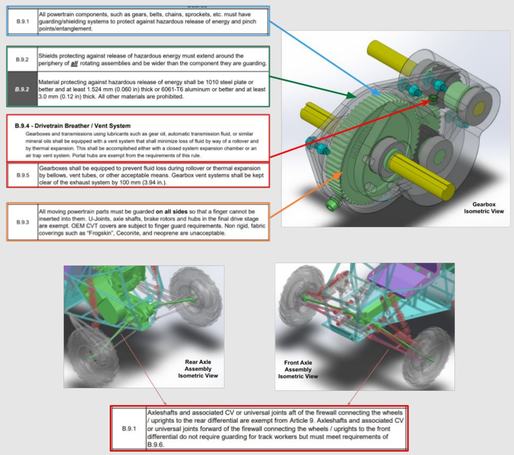
Rogue is Anteater Baja Racing's first All Wheel Drive (AWD) All-Terrain Vehicle (ATV). Our objective is to design, manufacture, and race a reliable vehicle to complete every event at the 2023 Baja SAE Oregon competition scheduled for May 31 - June 3rd, 2023.

The Baja SAE competition features student teams from over 100 universities directly competing in several performance event categories: Acceleration, Maneuverability, Hill Climb, Suspension, and Endurance.

BAJA SAE Rules Verification

Every year Baja SAE provides a set of rules and technical requirements teams must follow to standardize the pool of competitors and ensure the safety of all competing vehicles. A rigorous technical inspection is done during the first day of competition.

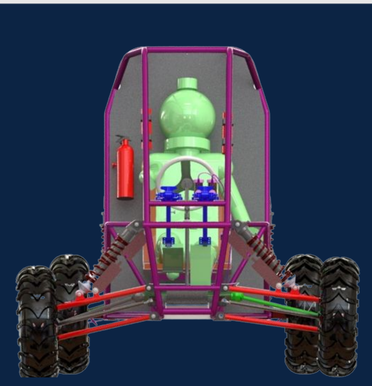
Anteater Baja Racing is continuously verifying all rules for each subsystem to meet SAE requirements through CAD models and physical prototypes.



System Requirements

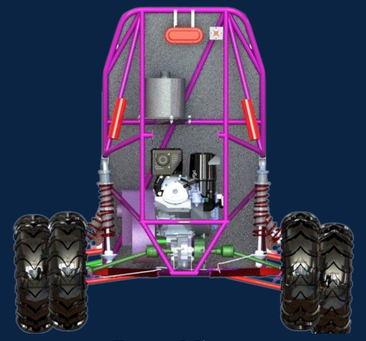
Requirements	Design Target	Performance Estimates
Weight (w/ 155 lb driver)	412-721 lbs	640 lbs
Weight % Bias Front/Rear	40-50 / 60-50	45-55
Wheelbase	Max: 60 in	57 in
Overall Width (Outside Edge of Wheels)	Max: 60 in	59 in
Overall Height (Ground to Top of Roll Cage)	50-65 in	64 in
Ground Clearance	Min: 12 in	12 in
Tire Size	Min: 20in	22 in
Front Suspension Travel	9-10 in	10 in
Rear Suspension Travel	9-10 in	10 in
Steering Wheel Rotations Lock-to-Lock	216-290 deg	270 deg
Turning Radius	Max: 12 ft	7.9 ft
Steering Effort	8 - 10 ft*lbs	8.8 ft*lbs
Top Speed	25-35 mph	35 mph
Torque Output ea. Wheel	100 - 120 ft*lbs	107.9 ft*lbs
Acceleration Time (100ft, 150ft)	150ft: 5 to 6.6s	6.1 s (accel: 7.7 m/s^2)

Rogue Winter 2023 CAD Model

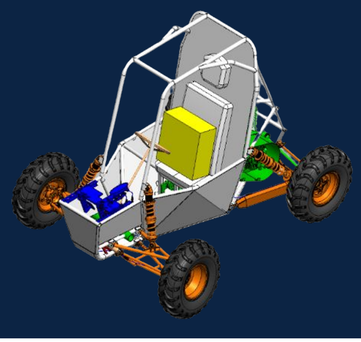

Front View


Isometric View

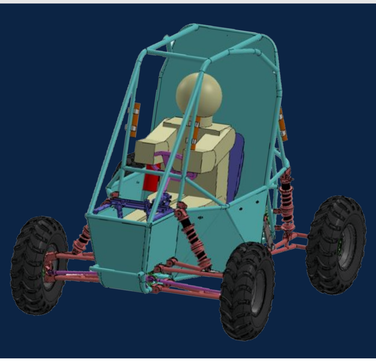

Side View


Rear View

Rev. A, Spring 2022



Rev. B, Summer 2022



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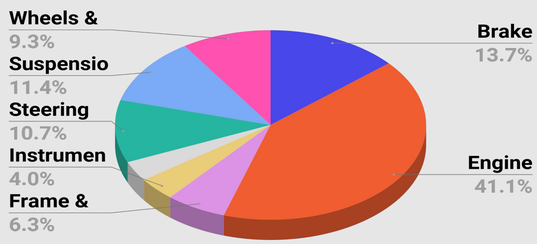
Cost Analysis

Cost Breakdown by Subsystem



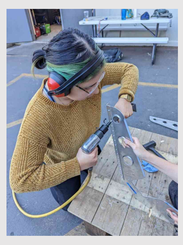
Manufacturing Methods

Angle Grinding

Tube Bending

Machine Turning

Welding



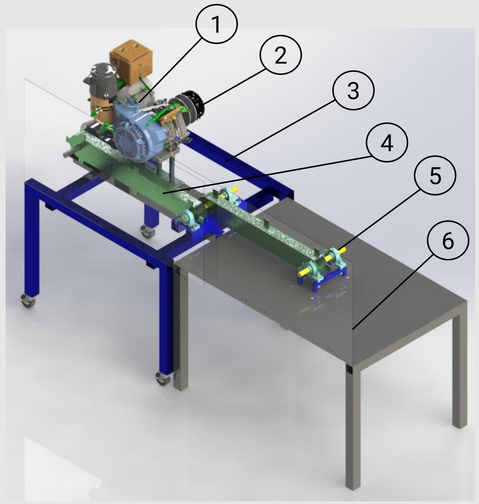
Riveting

Website

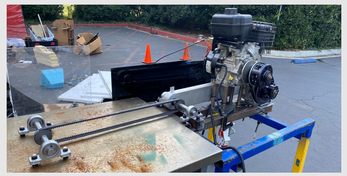
Zotfunder

Instagram

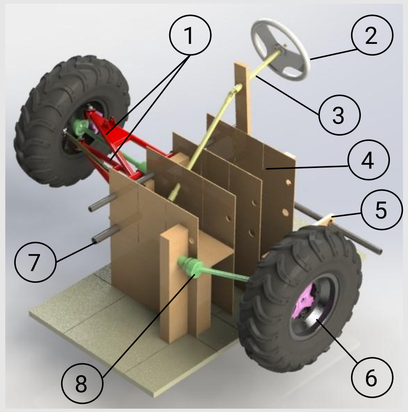
Powertrain Subsystem Prototype



Component Breakdown	
1	Kohler CH440 Engine
2	GX9 CVT Transmission
3	Test Bench
4	6061 Powertrain Driveline Guards
5	Front Axle and Pillow Block Bearings
6	Safety Panel Guards



Suspension & Steering Subsystem Prototype



Component Breakdown	
1	4130 Upper/Lower Control Arm
2	13" Al Steering Wheel
3	Steering Shaft
4	Wooden Supporting Panels
5	Wooden Trailing Arm
6	Wheel Assembly
7	Relative Chassis Geometry
8	Front CV Axles

Prototype Goals

1. Verify no interference between any cross-subsystem components exists in the Powertrain and Suspension/ Steering Prototype.
2. Visually verify successful torque transfer from Kohler Ch440 to front axle
3. Measure torque input/output at each Powertrain interface.
4. Visually verify suspension and steering travel throughout entire travel.
5. Measure suspension and steering travel at extremes.

Prototype Results

Powertrain Prototype

- ➢ Successful visual torque transfer test with live engine
  - ○ Utilized previously SAE mandated Briggs and Stratton Engine. Pending modifications to run with CH440

Suspension Prototype

- ➢ Binding & interference while steering near max levels of droop and compression
- ➢ Pending rear suspension travel with trailing arm and rear CV axles.