

Abstract

The project consisted of the design, analysis, and manufacture of a prototype battery-electric car to compete in the Shell Eco-Marathon Americas 2019. The five member team was instructed to improve the car from the previous year while following a set of standards and rules as well as staying under a \$1500 budget. Improvements were made by reducing the overall weight and increasing the aerodynamics of the car to increase efficiency. This was done by numerous CAD Drawings and ANSYS simulations to produce the best results with the minimum weight while still staying within the rules of the competition. These models were then manufactured and implemented into the car. On April 3-6, the team traveled to Sonoma Raceway in Sonoma, California. Teams from across the United States, South America, and Canada 'raced' against each other to produce the most energy efficient car. The four-day event consisted of passing technical and safety inspection and attempting to complete runs to place at the event. Our car completed one successful run for an efficiency of 68 mi/kWh, placing 6th out of 22 teams in the Battery-Electric Prototype category and received a cash prize of \$500.

Customer Needs and Requirements

- Shell Eco-marathon challenges student teams around the world to design, build, test and drive ultra-energy-efficient vehicles.



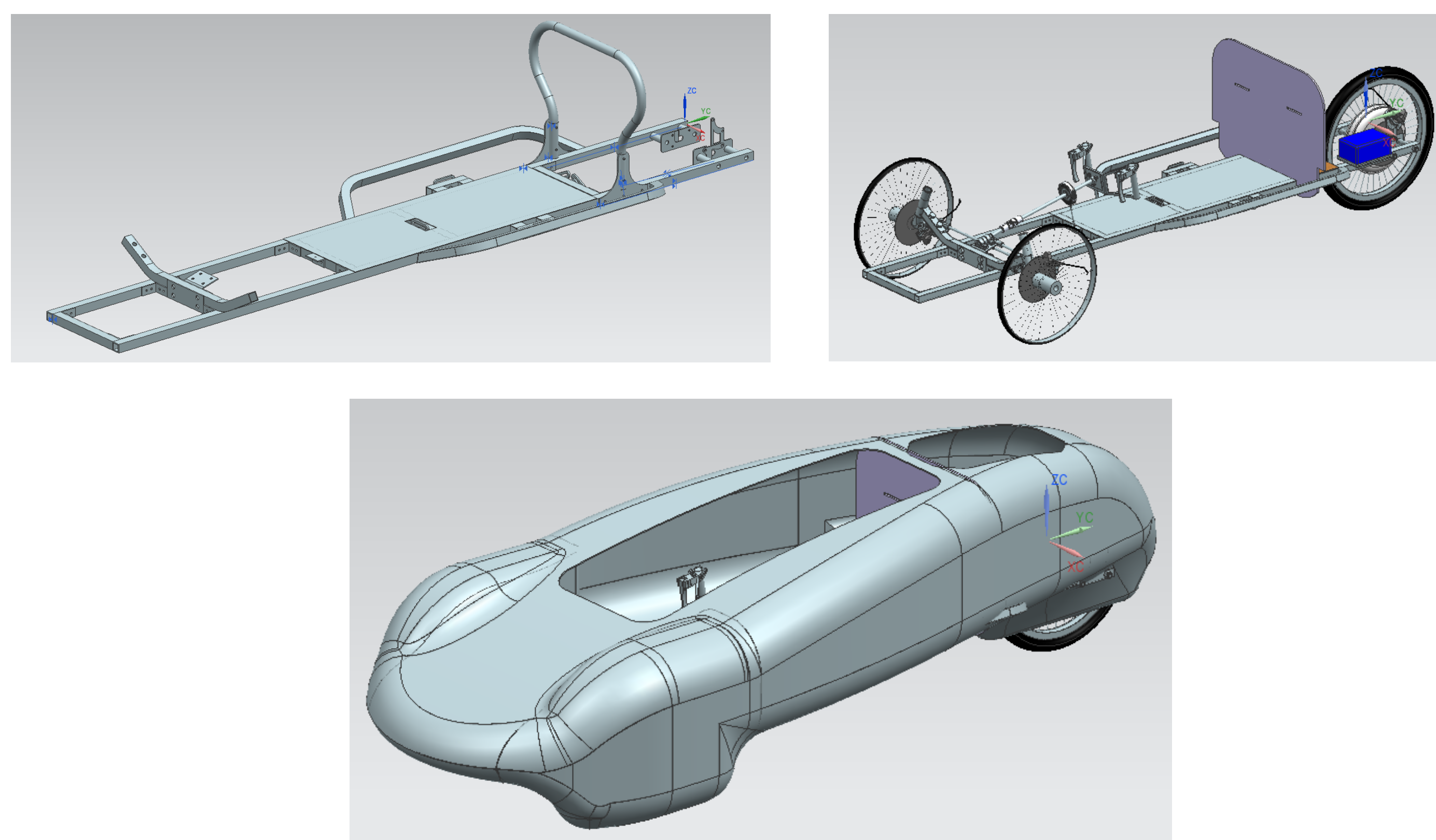
- Pass safety and technical inspection
- Deploy a safe, energy-efficient vehicle

Concept Selection



- Polycarbonate shell
- Aluminum frame with aluminum rivets
- Fixed steering rod
- Brushed DC motor with chain drivetrain
- Hydraulic disc brakes

Design Solution



Manufacturing

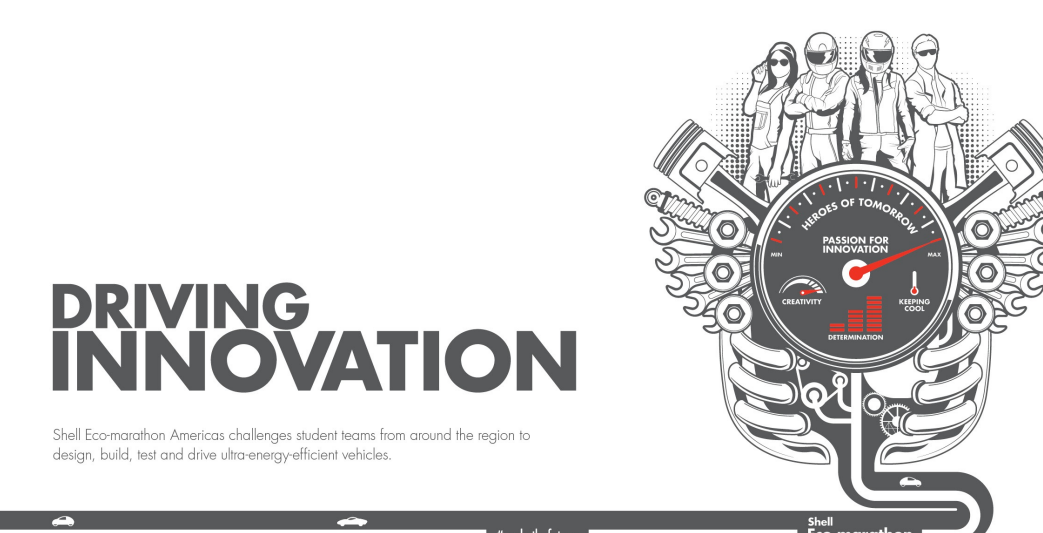
Safety	Bubble	Steering	Motor	Electrical	Frame	Brakes

Improvements from previous vehicle:

- Overall weight reduction
- Increased driver's safety
- Instilled a fixed steering system
- Improved aerodynamics by lowering the driver's head

Testing and Validation

- Test 1:**
- Checking frame strength
 - Checking turn radius
 - Checking for break rub
 - Checking for breaking distance
- Test 2:**
- Incline brake test
 - Exit test
 - Vision test
- Test 3:**
- Full chain-driven motor
 - Testing Joulemeter
 - Overall efficiency rating
- Competition Results**
- Passed Technical Inspection
 - 68 mi/kWh
 - Placed 6th (of 22)
 - Earned Prize - \$500



Acknowledgments



The Shell Electric team would like to thank: our advisor Dr. Pavan Karra, Dr. Jon Koch, the Mechanical and Electrical Engineering Departments, along with Lab Technician Joseph Thompson and Jason Blume for making this project possible. Special thanks to all of our sponsors for supplying us with additional funding and allowing us to participate in this incredible opportunity.