Shell Eco-marathon Team 1

Overview
For our senior design project, we were assigned to the Shell Eco-marathon Team 1 project. At the beginning, we were given two semi-completed ultra high mileage vehicles. One was an Urban Concept Car (UC C) that was roughly 75% race ready, and the other was the Prototype Vehicle that was about 90% completed at the start of the project. We were tasked with completing these two vehicles and competing them in the 2012 Shell Eco-Marathon, held in Houston, TX.

Objectives
- The Performance of the UCC should be higher than 750 miles per gallon equivalent (mpge), and the Prototype should achieve over 4000 mpge.
- Research awards that the teams would be competing for and attempt to win as many as possible.
- Design and execute a plan to make both vehicles visually appealing

Approach
To maximize fuel efficiency, the UCC was stripped down to the frame and all major systems were redesigned to reduce to overall weight of the vehicle. The team rebuilt all of the steering components, redesigned the shifter, and reduced the weight of the motor mounting plates and driveshaft. This was accomplished by using lighter, thinner materials than were already on the vehicle, and making to components smaller. For example, the original drive shaft was a three foot long steel shaft that we changed to a two foot long titanium shaft. Any parts that had to be added to the vehicle were also extremely light. A floor needed to be on the UCC to make it race ready. The team collaborated with the Advanced Research Lab and built a carbon fiber floor to keep weight down. With weight reduction being the focus of the work, the team managed to reduce the weight of the UCC from 380 lbs. to 240 lbs.; a reduction of 140 lbs. To maximize fuel efficiency in the Prototype car, the team focused on aligning the wheels to be as straight as possible and reducing drag in the drive train by calibrating the braking system.

Besides maximizing fuel mileage the team had to fulfill the other customer needs. To win an award we looked at possible trackside awards we could win at the Shell Eco-marathon competition. The team applied for all of the awards by writing essays that demonstrated the team’s commitment to excellence. Besides the 10 trackside awards we applied to, we also strived to reach the podium with either vehicle. To decorate the UCC, the team decided to apply vinyls to the aluminum body. The design was inspired by the Penn State football team helmets.

Outcomes
Ultimately, the team met all of our customer needs. The UCC achieved about 1500 mpge, much greater than we expected, and the Prototype achieved 5200 mpge. With such high mileage, the UCC won second place, earning a $1000 prize within its division, and the Prototype came in fifth place. The UCC also received many compliments on its design scheme. We as a team are extremely happy with our project and proud of our success. It was a great learning experience all around.