Shell Eco-Marathon – Team 1 (New Design)

Overview
The Shell Eco-Marathon is an annual competition where educational institutions compete to design, create, and drive the most fuel-efficient vehicle. For years, Penn State has been a part of this competition. This year, the New Design Team was formed to help the pre-existing teams create and improve the current and future designs of both the Penn State prototype and urban concept vehicles.

Objectives
This Spring 2017 New Design Team was given three major objectives:
- Fabricate a new body and canopy for the 2017 prototype car
- Design a new frame for the future urban concept car
- Reduce parasitic losses in the 2017 urban concept car

Approach
- A list of customer needs was generated from the 2017 Shell Eco-Marathon rulebook
- The team researched existing products as well as creating new concepts to solve the objectives and selected the most promising concepts to pursue for each objective
- CAD models and drawings for each of the designs were created
- Computational Fluid Dynamics, Finite Element Analysis (FEA), and stress calculations were applied to the new body, new frame, and parasitic loss designs, respectively
- A final design was created for the new frame while the new body and parasitic loss designs were fabricated and implemented on the 2017 competition cars
- The fabricated body was measured to ensure the body satisfied rule requirements and the body was tested to see if the driver could escape quickly and have the required sight forward and 90 degrees to either side
- The new frame underwent several iterations to find the lightest weight frame that satisfied FEA loading simulations
- Parasitic losses were tested using visual inspection, current draw, roll down tests, and vehicle weight to verify that losses were reduced

Outcomes
The team accomplished each to the project’s goals:
- The designs were created for a budget of $1014.61
- The new prototype body was manufactured and installed for competition, satisfying necessary rules
- A new 39 lb urban concept frame was designed from 6061-T6 aluminum
- New aerodynamic lights with current draw of 0.75A were installed, drive axle bearing roll down was increased from 3.48s to 32.60s, and 7 lbs were removed from the urban concept car