Shell ECO-MARATHON® AMERICAS

TEAM FACT SHEET

UCLA

Country: United States
Design Class: Prototype
Fuel Type: Gasoline (Petrol)
Team Name: UCLA Supermileage
Vehicle Name: TearDrop

Team Members:

Jordan Chase - Project Manager
Philippe Gerretsen - Assistant Project Manager
Brett Rosenthal - Student Advisor
Adam Kellada - Engine Lead
Jon Ho - Fairing Lead
Jonathan Chu - Safety Lead
Josh Green - Team Member
Albert Wu - Team Member
Vito Mazzarino - Team Member
Karina Hernandez - Team Member

Award Submission(s):

Safety

In our vehicle we have sought to ensure the driver's safety in the event of a crash via several methods. The whole car has been designed around our drivers to ensure that the car will fit like a glove around the driver while providing enough area within to prevent injury from a side impact, as well as maximize the drivers comfort, thus enabling them to feel confident in and focus on their ability to maneuver the car. The chassis encloses the driver on the bottom and sides, and the roll bar prevents any injury should there be a roll, which is quite unlikely due to the low center of gravity of the vehicle. Our roll bar has a factor of safety of 2.3 for a 70 kg force applied to it. We have a 5 point harness that will keep the driver still in the event of an accident. There is a crumple zone mounted in the front of the fairing that will slow the impact of a crash by transmitting energy through several layers of foam, each being 1" in thickness.
We have a fire wall that fits exactly against the fairing to isolate the driver from the engine, gas tank, and other dangerous moving parts, as well as ensures positive drainage away from the driving compartment should a fuel spill occur. We have a fire extinguisher mounted within the driver's reach and directed at the engine to quickly extinguish any fire. We have an aluminum chain guard protecting the driver and the other vehicle components should the chain break or fall off.
Kill switches are mounted at the driver's controls and one at each side of the outside of the fairing. They are all double-throw, meaning as soon as the switch is flipped, the engine will be turned off. Everything is controlled by a master key that will need to be turned on in order for the car to start.
It is best to avoid an accident so we have placed the windows in such a way as to optimize the visibility that the driver has while in the car in an attempt to avoid collisions. Additionally we have mirrors mounted that will allow the driver to see behind the vehicle to further ensure no collisions and reduce the element of surprise should another driver fail to lay on their horn while overtaking our car on the track. There is a horn mounted at the driver's controls for her to announce his/her passing of other vehicles, making them aware of her presence. The car has hydraulic disc brakes mounted in front that are balanced in order to ensure symmetrical, simultaneous stopping power, and a V brake in the back which will provide plenty of stopping power should the driver need to avoid a crash. When the brakes are actuated they will light our brake lights to make other drivers in the rear aware of a decrease in speed.
Additionally, we have used specially designed rack and pinion steering to give the driver the control she will need to maneuver the vehicle on the track in a safe manner. We have also worked the steering through an exaggerated turning radius while under load to ensure that the system will not bind up. Our exhaust is transmitted out of the vehicle by a tail pipe that exits underneath the rear of the bottom fairing to maintain ventilation within the vehicle. Fresh air flow into the driver's compartment is also maintained through the wheel wells in front.
We have a designated team safety manager, Jonathan Chu, who is charged with ensuring safety in the workshop and in the vehicle's design. He makes sure everyone is wearing goggles and puts on face masks when necessary, as well as that team members are familiar with tools before using them. Additionally, he has been involved in the brainstorming and design of the vehicle's numerous safety systems.

Technical Innovation

We have had three themes with this year's car: minimize weight, minimize rolling resistance, and optimize aerodynamics. In our pursuit of this we designed a chassis in SolidWorks that, while still constructed out of aluminum, sought to be as minimalistic as possible while providing all the needed safety elements to protect our driver. The use of bends and small tubing allowed us to base our design from a single aluminum tube in the front half from which we would work out to form the rest of the chassis to protect the driver and support the wheels, steering, engine, and other mechanical components. Our entire chassis weighs a mere 8 lbs. Our seat is very minimalistic, being composed of a fabric hammock, supported by cam straps, in which our driver rests, with a pad placed upon the center tube of the chassis for added comfort.
We also sought to minimize weight in the fairing by building it out of carbon fiber. It was a laborious process but our bottom fairing weighs in at 15 lbs and the top at about 20 lbs. When we designed the fairing in SolidWorks we tested it with a program called FloWorks and had an estimated drag coefficient of just 0.1 at an average speed of 15 mph. The fairing was designed to fully enclose the entire vehicle, with only the wheels barely sticking out through the wheel wells, which were built to enclose the majority of the wheels.
We made use of a great number of bicycle parts which were adapted for our use. On the front wheels we employed hydraulic mountain bike disc brakes with 160 mm rotors, and a V-brake in the rear. Our steering is accomplished by implementation of 1.125" bicycle headsets that are rated for high-impact, downhill mountain biking. The wheels are also an exotic combination of bike parts; as the hubs are 20mm thru-axle style, also intended for downhill bicycles, while the rims are common to juvenile (BMX) bicycles. The steering column itself is also carried by bearings from a 1" bicycle headset that has been modified in order to allow a hex profile interface between a handle bar clamp and the steering column itself. The hex hole we manufactured with an electronic discharge machine (EDM), which is a method we have not used before this year.
Our instrumentation consists of a wireless cycling computer that allows the driver to read current speed, total distance and total elapsed time without having to remove hands from the controls.

Eco-friendly

Obviously our vehicle aims to maximize fuel efficiency, as this is the spirit of our competition and team mission. We are hoping to break the 1000 mpg mark this year for the first time since UCLA Supermileage has been around, a period of 4 years. As discussed in the technical innovation section, we have sought to maximize fuel efficiency via minimizing three main parameters: weight, rolling resistance, and aerodynamic drag.
We have constructed our very lightweight chassis out of at least 50% reused aluminum that we have salvaged from past years' cars and from scrap metal in the machine shops on campus. The total weight of the chassis is a mere 8 lbs. The wheel wells were cut right off our car from last year and after a bit of modification were attached onto our new chassis.
Our starter motor is the same one that we used two years ago, as is the clutch. We are reusing our 5 point safety harness and all of our electrical components are reused as well. Our batteries are also reused from years past.
We have reused bicycle components that we were able to take off our old cars in order to reduce excess consumption. These components include the wheels, brakes, throttle levers, and steering headsets.
Additionally, we have constructed our fairing to be as aerodynamic as possible. Our design has a theoretical coefficient of drag of just 0.1 when tested in FloWorks at 15 mph, our average speed. We were able to use leftover Bondo body filler to construct the

mold, and we had extra resin and catalyst that we could use from last year to harden the carbon fiber.
We plan to reuse our vehicle next year either by using the car to let new members get acquainted with the group, or by stripping it down and reusing the parts and materials in the next model.

Communication and Marketing

We have sought to market our vehicle to a variety of sponsors for financial and material support, and to the general public to get the word out about fuel efficiency. We attended the LA Auto Show to present our vehicle to the general public who had never heard of the Shell Eco-Marathon or the SAE Supermileage Competition. We presented our vehicle and explained methods by which we maximized fuel efficiency and developed our vehicle from an idea to a computer model to a final, drivable product. Additionally, we have spoken to a PR agent from Edelman to schedule an interview for a Los Angeles news cast. We have also had interviews with several publications at UCLA including the UCLA Institute of the Environment, UCLA Sustainability, UCLA Today, and the UCLA Mechanical Engineering Department's newsletter. We also present our project to incoming freshman at the UCLA Engineering Open House and the Welcome Week Activities Fair, to alumni at the James West Center, to university faculty and industry partners at the Industrial Advisory Board , and to the MAE Alumni Advisory Board. We also have a website to advertise ourselves to interested parties.
We have solicited sponsorships from several companies. We were able to get free metal from TW Metals for an estimated value of $200. We found a small company, DW Tubebending, that gave us a discount on pipe bending for our roll bar and the rear of the chassis. Our engine was provided free of charge from the Society of Automotive Engineers. We received several copies of SolidWorks for free from the software company. We received a sponsorship of $250 from Robert R. Chase, M.D., $1000 from General Motors, and a further $1000 from Solar Turbines. The UCLA Engineering Alumni Association provided us with $1500.
We have maintained communication with the Engineering Alumni Association through quarterly presentations detailing the progress we have made, how our group is doing with its budget, and what we need to get accomplished before our competition or the next meeting.
We have sought to maintain efficient communication within the student group by having weekly meetings that allow everyone to get up to speed on the newest progress on the vehicle in each subassembly, to discuss what will need to be accomplished before the next meeting, and to answer any questions members may have. We maintain a Google group to facilitate easy communication so everyone can be privy to when shop hours will be occurring and what needs to be accomplished.
We also have a publicity/sponsorship packet that we can submit via email if requested.