The University of Tennessee at Martin
2009-2010 Baja SAE Competition

Project Outcome:
The 2009-10 UT Martin Baja SAE team designed, fabricated, tested, and raced an off-road vehicle. The team competed in the SAE Carolina competition held in Greenville, SC. The design of every sub-system in the car was improved in some manner from previous year’s designs and the new car was fabricated to be as competitive as possible. The decision to build a new car was primarily influenced by the BAJA SAE East competition not including a water event. Skyhawk Racing's major improvements consisted of a new, modular fiberglass body, lighter and more efficient transaxle assembly, redesigned suspension geometry, and a lighter tubular chassis.

Frame
The main objective of the frame design was to reduce the maximum amount of weight while maintaining the required structural integrity and bending strength properties. Therefore, the frame incorporates a lighter 1.0” x 0.065” alloy tube that composes the majority of the frame. Also, the rear portion of the frame was redesigned to remove unnecessary members and accommodate suspension design modifications. The new fabricated frame has a weight of 85 pounds which is a reduction of 25 pounds from the previous frame.

Drive Train
In order to reduce weight, the gearbox geometry was modified. By simply shifting the gear center points, the weight of the transaxle case was reduced by three pounds.

Casting
A 3D Rapid Prototype Printer was used to build the models of the transmission housing that was created in SolidWorks. The printed parts served as templates for sand casting. The use of the 3D Printer allowed the sharp detail designed in SolidWorks to be incorporated into the fabrication of the parts.

Suspension
The intention of this year’s rear suspension redesign was to increase the track width, resulting in a more stable vehicle platform. The width is being extended closer to the competition limit of 64 inches. Along with the rear being extended, the new design reduces the CV angle from the transaxle and allows for 14 inches of suspension travel. The design objective of the front suspension was to reduce the camber angle as the tire moved from full bump to full droop, as well as reduce the bending stress in the bottom A-arm. This was accomplished by rotating the top a-arm attachment inward on the frame and relocating the top shock mount to a lower position on the frame.

Cockpit & Body
The primary objectives in designing the cockpit and body included creating the best looking and most ergonomic seat and body that has ever been used in any of the previous UTM competitions. The cockpit and body have also been designed to be as lightweight as possible. Fiberglass was used in the fabrication of the body.

Fuel & Brake Systems
Several improvements were made to the Fuel & Brake systems this year. Due to rules of the competition the fuel tank and connector hose are preset but the tank must be fully separated from any spill reaching the hot motor. With such a high emphasis on aesthetics we decided to make the splash guard out of thermoformed plastic. In addition, a proper throttle connector was designed to accommodate the full ranges of throttle response. The team decided to keep the existing calipers but the rotors were made from non heat treated 4130 steel. Our objective for this is to confirm that the non heat treated rotors will, in fact, last the length of the race.

The 2010 BAJA SAE competition consisted of 100 universities from 3 different countries competing against one another.

UT Martin placed 8th in design, but due to mechanical failures encountered the team placed 78th overall.

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