Prototype  BAJA SAE UC 2015
Design presentation

Stronger

Agility

Innovation

Faster
Frame Design Goals:

- To improve the chassis geometry and strength in different scenarios by impact analysis per action suspension system, rollover, frontal and side impacts.
- To reduce weight by varying diameter and thickness of the corresponding tubing of side members and reinforcements.

Material Selection:

- Primary Members: AISI 4130, OD 1.25” x 0.065” Wall Thickness.
- Secondary Members: AISI 4130, OD 1.00” x 0.065 and 0.049” Wall Thickness.
- Other Members: AISI 4130, OD 0.875” x 0.035” Wall Thickness and AISI 4130, OD 0.75” x 0.049” Wall Thickness.

Comparison:

Finite Element Analysis

- **Side Impact**
  - Charge Applied: 5000 N
  - Max Strength: 346.8 MPa
  - FDS: 1.3

- **Roll Over**
  - Charge Applied: 5000 N
  - Max Strength: 187.9 MPa
  - FDS: 2.3

- **Front Susp Impact**
  - Charge Applied: 5000 N
  - Max Strength: 184.0 MPa
  - FDS: 2.5

- **Rear Susp Impact**
  - Charge Applied: 5000 N
  - Max Strength: 370.0 MPa
  - FDS: 1.2

- **Firewall Impact**
  - Charge Applied: 5000 N
  - Max Strength: 237.5 MPa
  - FDS: 1.9

- **USM Impact**
  - Charge Applied: 5000 N
  - Max Strength: 206.4 MPa
  - FDS: 2.2

- **RHO Impact**
  - Charge Applied: 5000 N
  - Max Strength: 387.4 MPa
  - FDS: 1.2

- **SIM Node Impact**
  - Charge Applied: 5000 N
  - Max Strength: 372.4 MPa
  - FDS: 1.2

Comparison:

- A) Frame: BAJA SAE UC 2014
  - Weight: 40 kg
  - Total Reduction Percent (%): 15%

- B) Frame: BAJA SAE UC 2015
  - Weight: 28 kg
Suspension Design Goals:

- To design a variable suspension system, static and dynamic, that will allow an efficient vehicle configuration to improve its performance.
- To implement a rear suspension system of the unequal A-Arm type that will allow the variation of the static and dynamic toe in order to improve the maneuverability of the vehicle in close curves.

Finite Element Analysis

Components Assembly

Suspension Assembly

Rear Suspension Components

Suspension Graphs
Steering Design Goals

• Lowering turn radius based on Ackerman Criteria.
• To improve prototype’s maneuverability by reducing steering wheel’s angle, manufacturing a new steering box.

Finite Element Analysis

Steering Arm - flexion  Spindle Max Strength  Knuckle Displace  Knuckle FDS

Knuckle Design & Kingpin angle

Ackerman Criteria

Suspension & Steering Parts Assembly
Transmission and Brakes

Transmission design goals:
• To optimize the transmission system as compared to previous prototypes, a gear transmission was designed.
• To establish a transmission ratio that would allow the maximum engine torque and to increase acceleration capabilities.

Brakes design goals:
• To increase the braking pressure, still using the same pumps and calipers as the previous prototype.
• To design disks adjusted to the required measures and with a geometry according to an efficient thermal distribution.
Ergonomics, Safety & Controls

Ergonomics and safety design goals:
• To design a seat focused on improving on track driver’s comfort.
• Improving vehicle’s Aerodynamics focused on body work.

Controls
• To obtain remote information and in real time of the parameters of the prototype (RPM, speed, fuel level and acceleration) to determine the dynamic status of the prototype performance. This information can be saved for reference. An ECU, an OBD communication and an integrated ELM327 model will be used in order to visualize the program parameters already existing and commercially available.