M1 - Solar Car Chassis Integration

Matthew Park, Adrian Dominguez, Daniel Bellian, Manuel Garcia
Sponsor: Nate England

Project Description

➢ Design
  o Battery Box to hold 8 Deka Unigy Batteries
  o Transaxle mounts to work with existing swingarm
  o Caliper Brackets to hold brake calipers to transaxle
  o Housing for EE team’s motor control module
➢ Parts sourcing
  o Parts that are compatible with our transaxle
  o Raw material that will be used in fabrication
➢ Fabrication
  o Creating custom floorboard for the chassis
  o Structural beams to hold pedal assembly
  o Utilizing machinery and tools on campus (e.g., waterjet, mig welding, bandsaw, drill press, angle grinders)
➢ Testing
  o Solidworks stress analysis
  o 3D model parts to fit onto chassis
  o Create wooden prototypes to ensure fit on vehicle
➢ Implementation of a fully functioning braking system for the test bed for the American Solar Car Challenge
  o Design and install a braking system on current chassis
  o Design mounting units for electrical and mechanical components

Design Validation

Battery Box
  o ¼" steel protects floorboard from acid leaks
  o Designed to reduce vehicle weight
  o Mig welded at Texas State
  o Bolted to chassis

Motor Control Module Housing
  o ⅛" Aluminum Diamond Plate is used to withstand motor control module thermal properties
  o Designed to allow heat to be transferred from motor control module to aluminum plate
  o Acrylic housing protects speed control module from outside elements
  o Cut Acrylic with bandsaw and formed with heat gun around the chassis

Custom Items
  o Transaxle Mounts
    o ⅛" Aluminum, Water Jetted, milled for tolerances
  o Brake Caliper Mounts
    o ⅛" Aluminum, Water Jetted, Milled to work with transaxle
  o Cross beam for pedal assembly
  o Mig Welded, 1x1 steel tubing
  o Floorboard
  o ¼" Diamond plate aluminum
  o Bolted onto the chassis

Braking System
  o Hydraulic disc braking system to bring vehicle to a complete stop
    o Honda Del Sol Rear Caliper
    o Honda Del Sol Brake Pads
    o Honda Del Sol Brake Hoses
    o Honda Del Sol Rotors
    o Honda Del Sol Master Cylinder
    o Honda Del Sol Brake Pedal Assembly
    o Honda Del Sol Vacuum Booster
    o Steel brake line
    o 3/16" brake line fittings
    o Mechanical braking system for emergency brakes
    o Acura Integra Emergency Brake
    o Acura Integra E-Brake Lines

Motor Control Module Housing
  o ⅛" Aluminum Diamond Plate is used to withstand motor control module thermal properties
  o Designed to allow heat to be transferred from motor control module to aluminum plate
  o Acrylic housing protects speed control module from outside elements
  o Cut Acrylic with bandsaw and formed with heat gun around the chassis

Center of Gravity

Shear forces experienced by the 410 lb 1,200 lbs over 10.7 lbs and 6.3 N, and below the ultimate shear load of 14700 N.

Future Proposals

➢ Improve chassis suspension
➢ Make street legal (lights, horn, mirrors)
➢ Reduces weight
➢ Install solar panels
➢ Front brakes
➢ Assisted steering

Process

Conceptualization

Customer needs
  ➢ Create a testbed for future students to utilize in designing and creating a solar car for the American Solar Challenge
  ➢ Car to come to a complete stop at speeds greater than 50 Kmh
  ➢ A battery box to hold 8 Deka Unigy batteries securely to the chassis
  ➢ A housing to display the Electrical Team’s motor control module
  ➢ A Pedal Assembly to apply braking and an Emergency Brake in case main braking system fails

Initial Design

➢ Braking system
  o utilize car parts
  o hydraulic and mechanical braking
  ➢ Battery Box
    o metal enclosure
    o lid so batteries will not fly out
  ➢ Motor Control Module Housing
    o wood enclosure
    o metal plate board
  ➢ Transaxle mounts
    o utilize existing swingarm

Testing Concerns

➢ Front knuckle clearance is very minimal
➢ Battery box needs ventilation so it will not overheat
➢ Motor control module housing needs a heat sink to cool the module. Housing should not be wood enclosure in case of fire

Initial Rear Suspension

➢ Working concurrently with two senior electrical teams
  o D1 EE team is designing a motor controller for the solar car, integrating sensors in a accelerator pedal for regulated power to the motor, creating custom floorboard for the chassis
  o D2 EE team is creating a way to charge to the solar car, integrating sensors in a accelerator pedal for regulated power to the motor, creating custom floorboard for the chassis
  o Design mounting units for electrical and mechanical components

Final Design

➢ Honda Del Sol rear braking system
  o parts compatible to golf cart rear axle
  o affordable and sourceable parts
  ➢ Battery Box
    o metal battery tray welded at Texas State
    o open top to allow ventilation
    o tie downs similar to a car
  ➢ Motor Control Module Housing
    o acrylic enclosure formed around chassis
    o diamond plated Aluminum as heat sink and mount for module
  ➢ Transaxle mounts
    o aluminum plate milled out holes to utilize existing mount locations
    o Water Jetted ⅛ aluminum steel plate for strength

Texas State University

The rising STAR of Texas