

# NDSU Formula SAE



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# What is FSAE?



- Hosted by Society of Automotive Engineers (SAE)
- 13 International Competitions
  - 2 USA (Michigan & Nebraska)
- Static Events
  - Cost, Design, Presentation
- Dynamic Events
  - Skid Pad, Acceleration, Autocross, Endurance, Efficiency



# Team Background

- Student Run Organization
  - 9 current members, all majors welcome
  - Mostly Engineering, eligible for Senior Design credit
- Last Competed in 2017
  - Team has usually operated on 2-year competition cycle
  - Covid-19 caused the project to sit dormant since 2020
  - Currently trying to rebuild the club



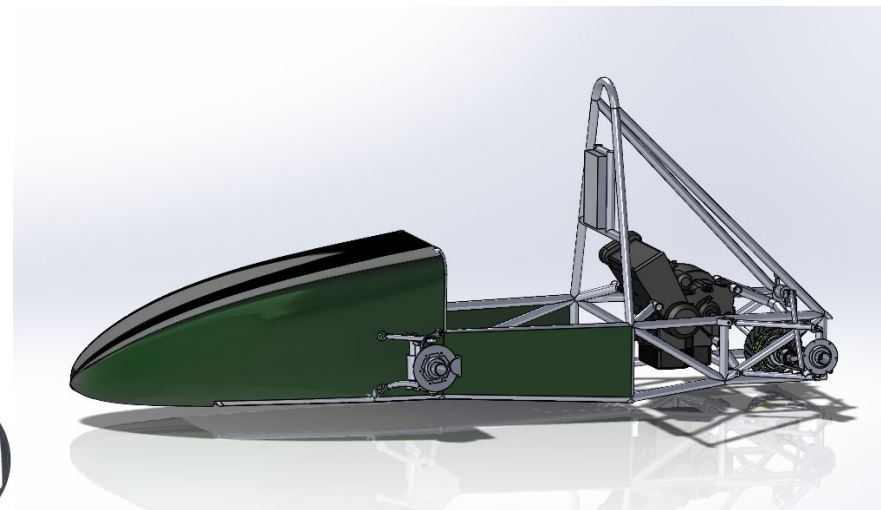
# Project Background

- 4 Previous Senior Design Groups
- Our Team Focus
  - Bodywork
  - Cockpit
  - Frame & Suspension
  - Testing
- Goal: To build a simple and robust car that future teams can build off



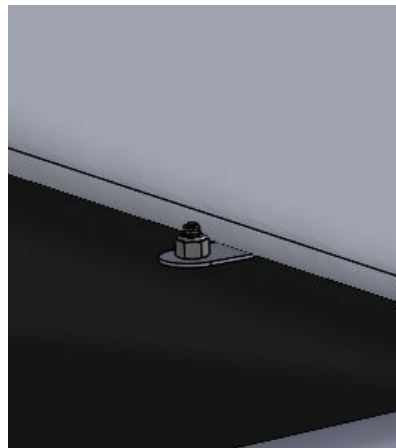
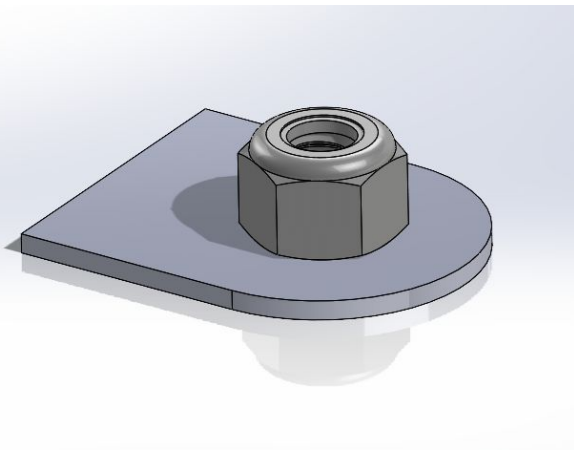
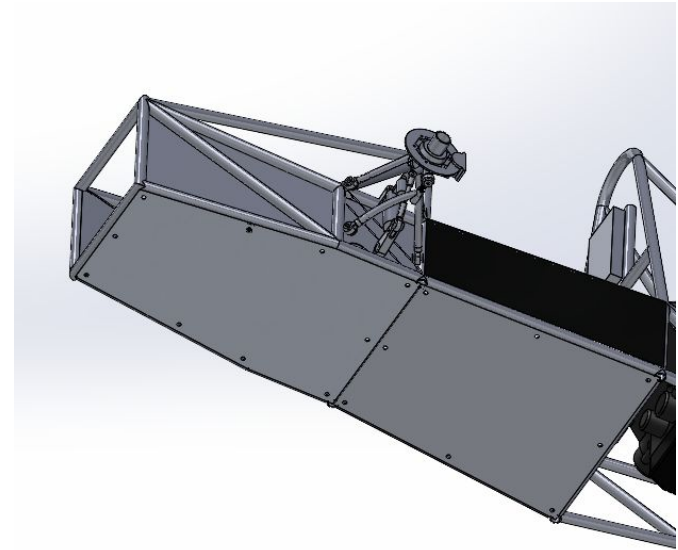
## Nose Cone & Side Panels

- Nose cone designed and fabricated by previous team.
  - Adding body filler to get a smooth finished surface
- Fiber Glass vs. Carbon Fiber
  - Already have fiber glass material
  - Cheaper (\$500 savings)
  - Will be painted
- Mounting
  - Adjustable
  - Easy to remove and install (no tools required)



## Skid Plates

- 6061 Aluminum vs. Composite
  - Simple to fabricate
- Mounting
  - Removable
  - Simple to install
  - Minimize loss of ground clearance



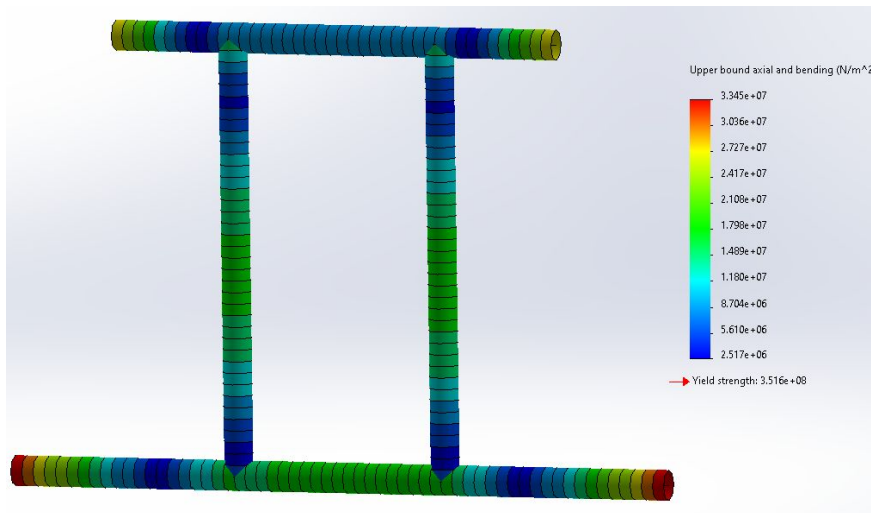
# Cockpit

## Driver Head Restraint

- Protect driver's head from violent motion
- SAE loading requirements

## Driver Seat

- Carbon fiber composite
- Lightweight and strong

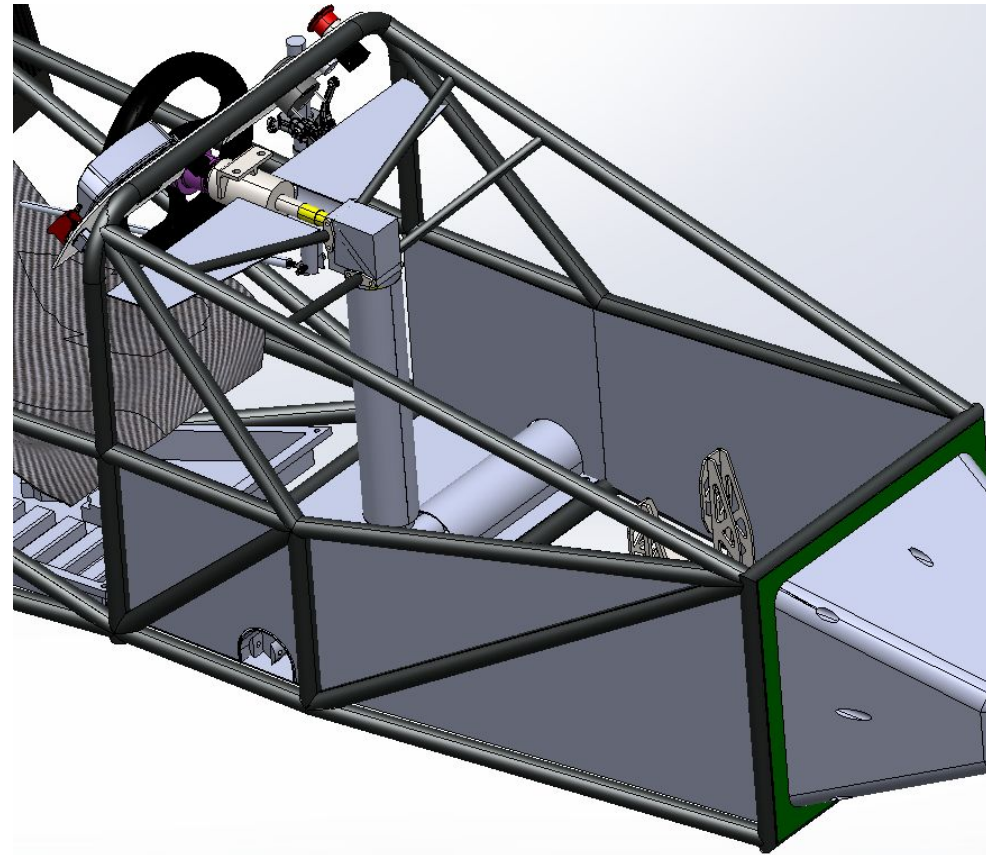
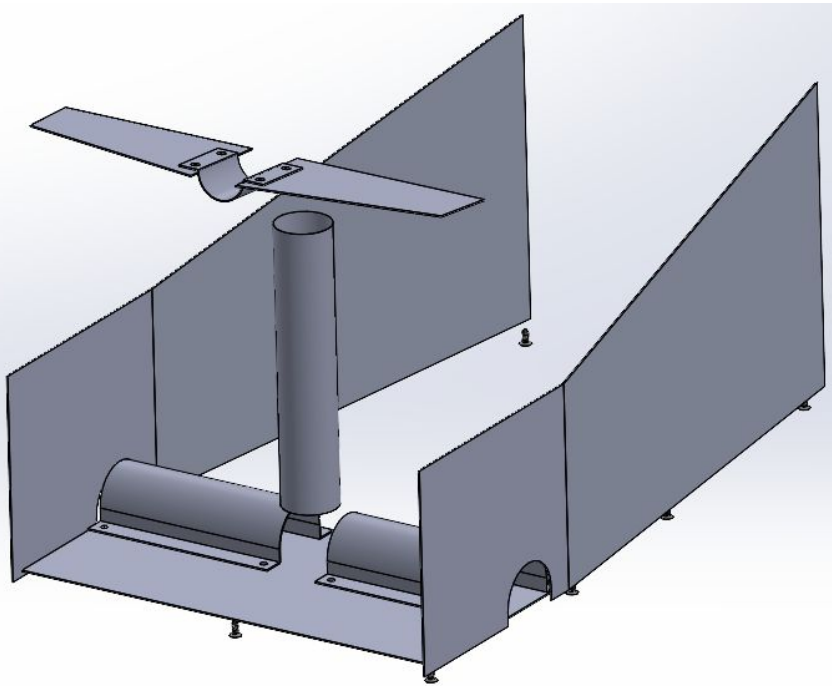


Head Restraint FEA



## Driver Leg Protection

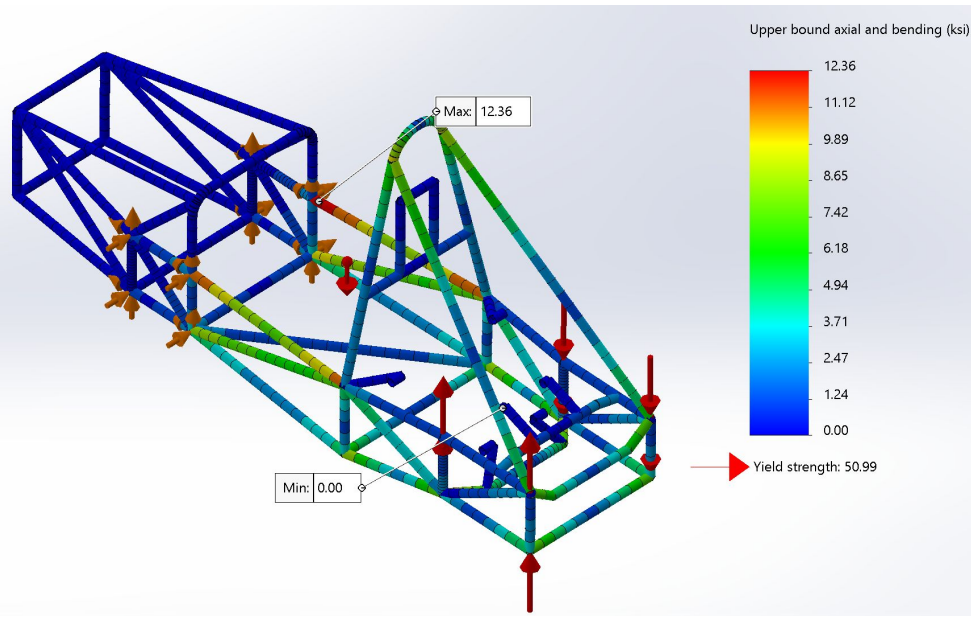
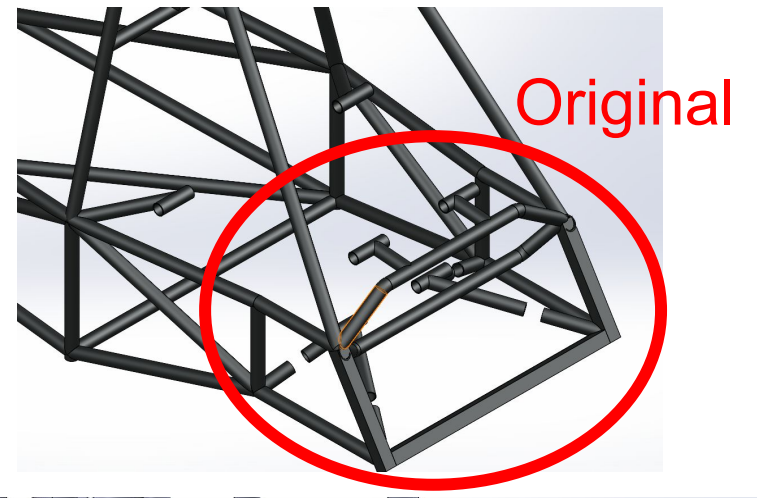
- Protect Driver's Legs
- Solid Material
- Easily Removable





## Rear Frame

- Optimized for new suspension
- Revised engine and suspension mounts
- Simplify design from previous car



# Suspension

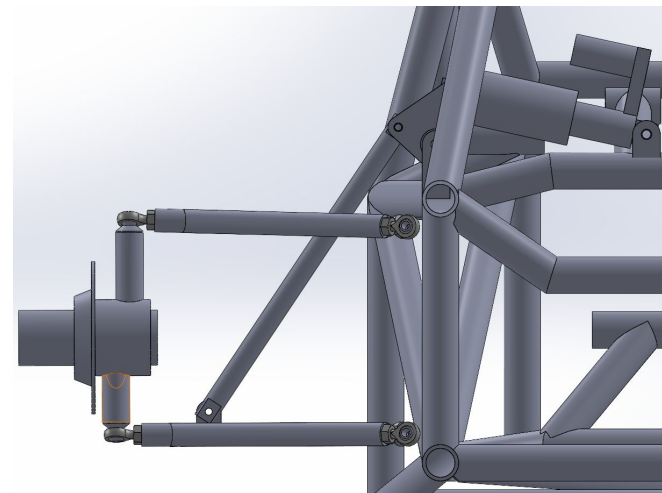
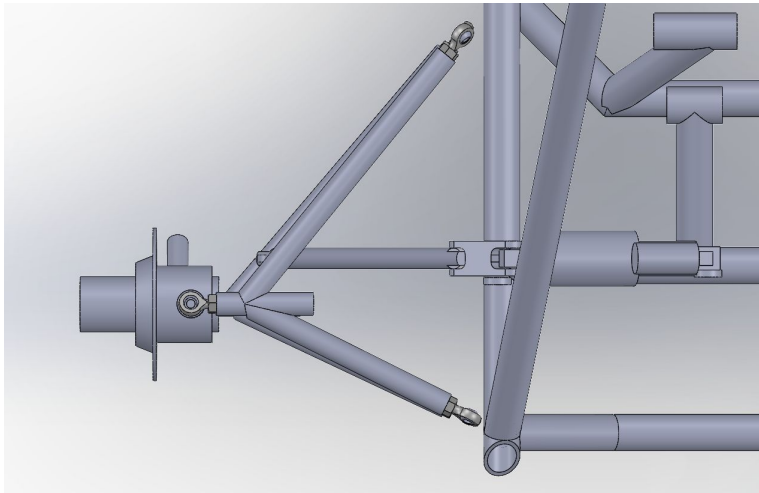
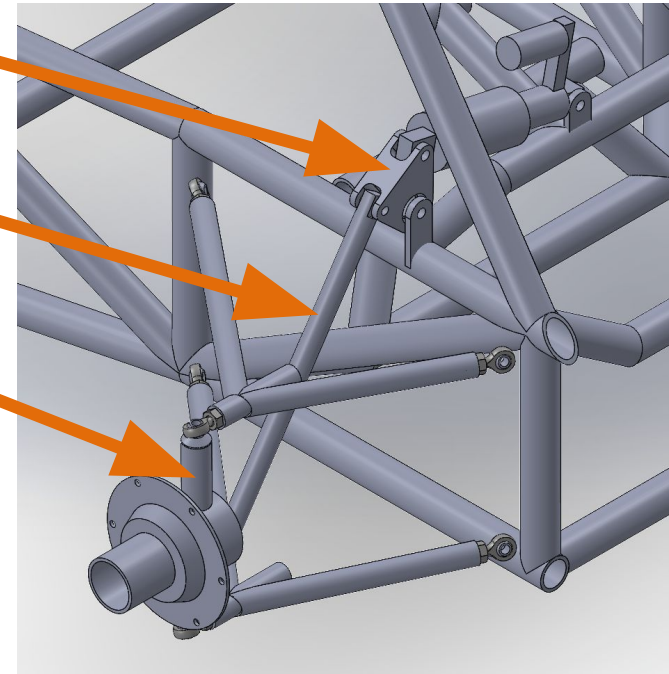
## Final Design

- Cantilever design
- Reuses bell cranks, spindles, Heim joints, and pushrods

Bell Crank

Pushrod

Spindle



## Optimization

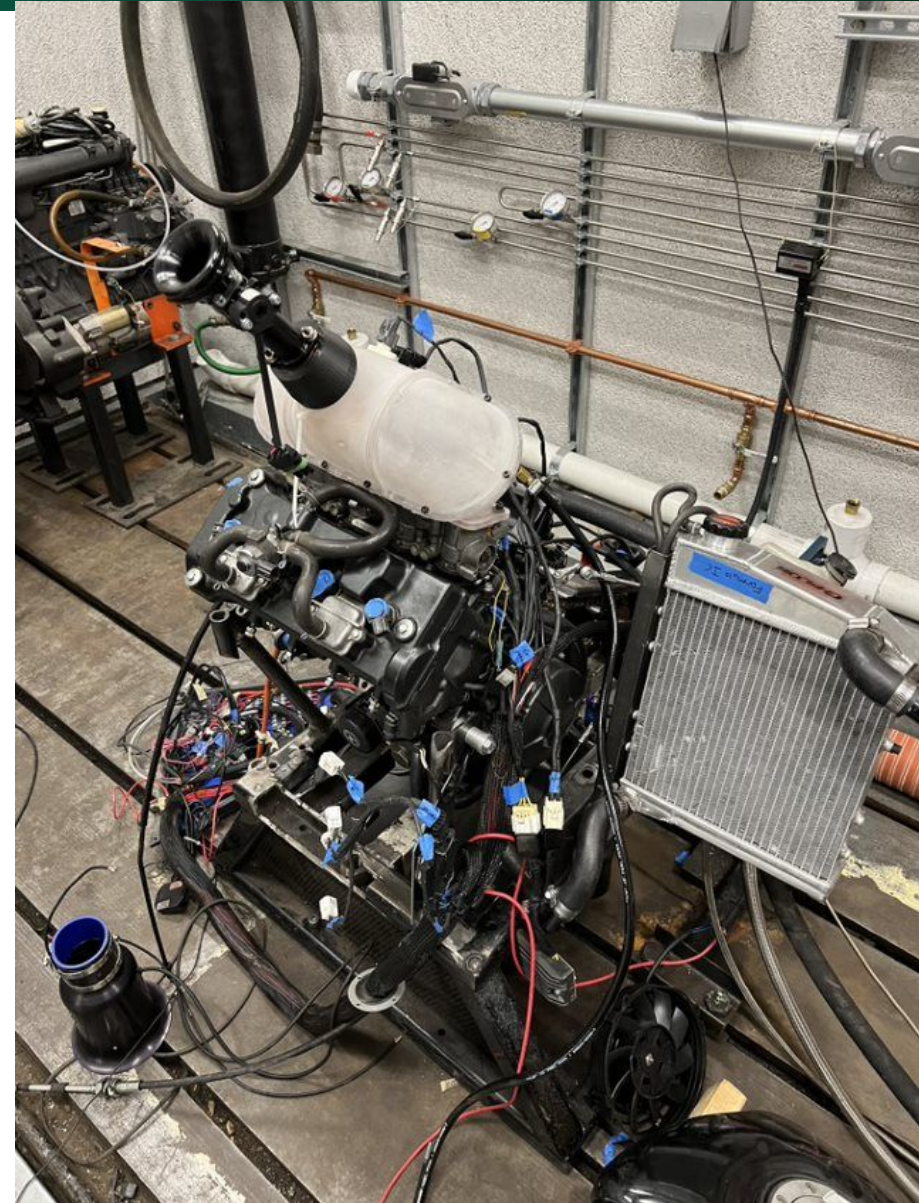
- Fuel to Air Ratio
- Power to Fuel Efficiency

## Tuning ECU

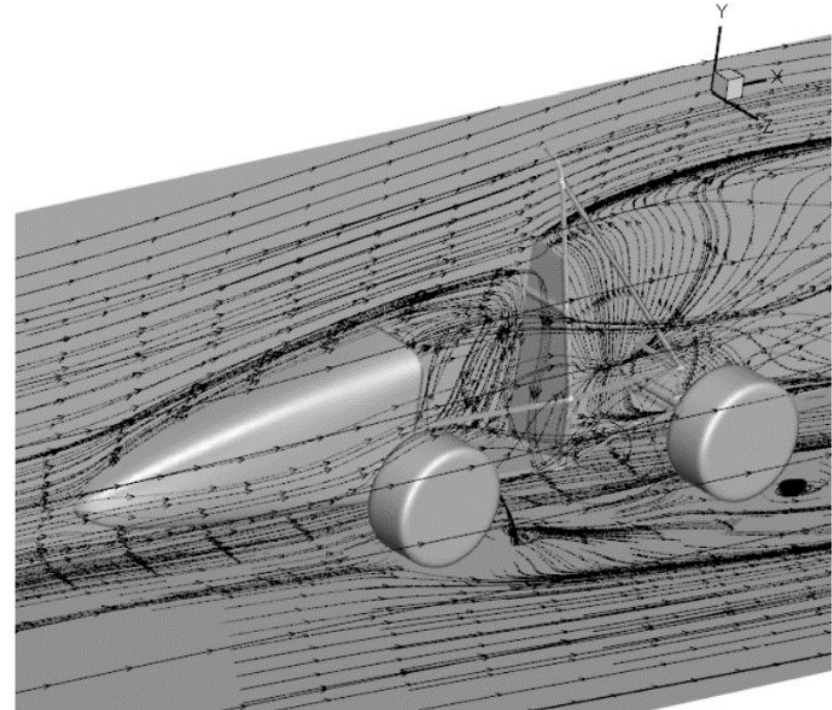
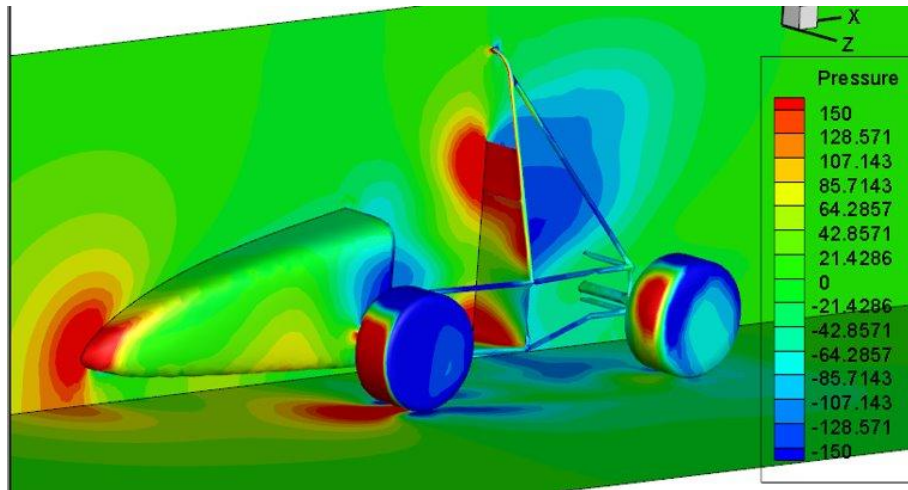
- AEM EMS-4
- Smoother Running

## Dynamometer

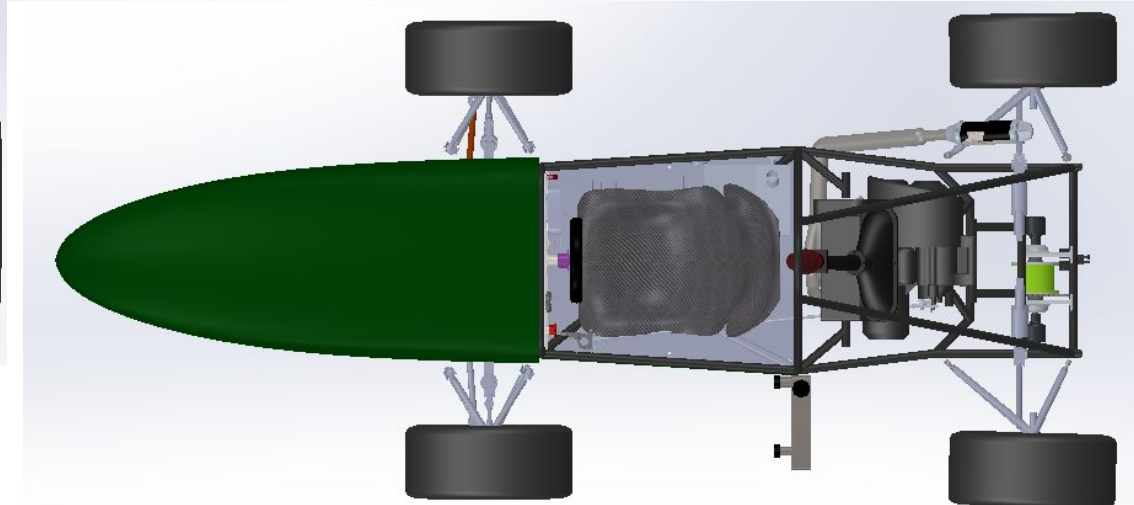
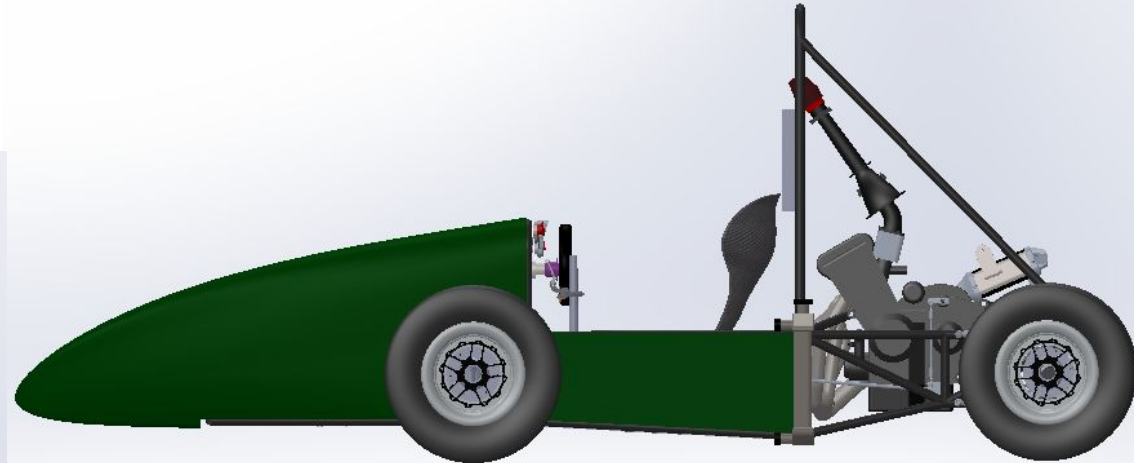
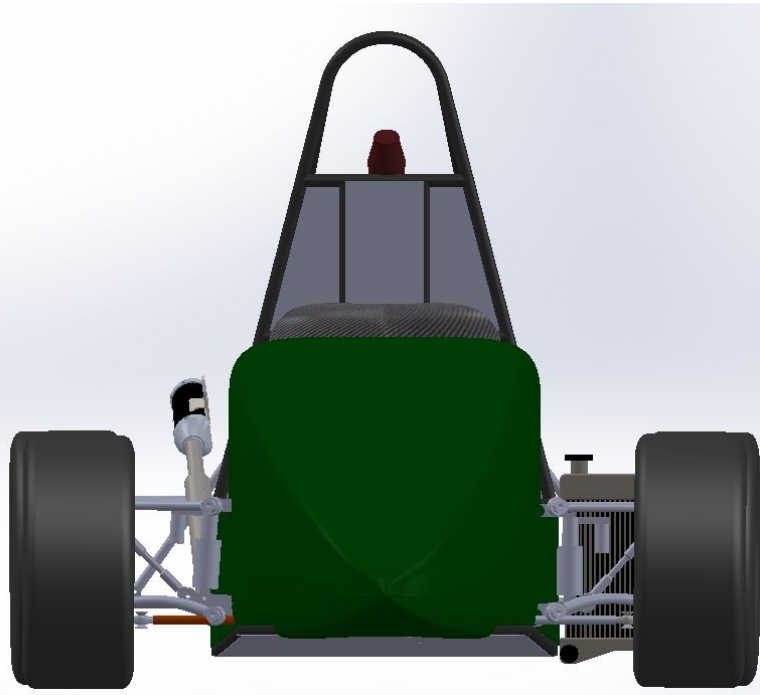
- DYNOMite
  - Water Brake Dyno.
  - Uses RPM and Torque for HP



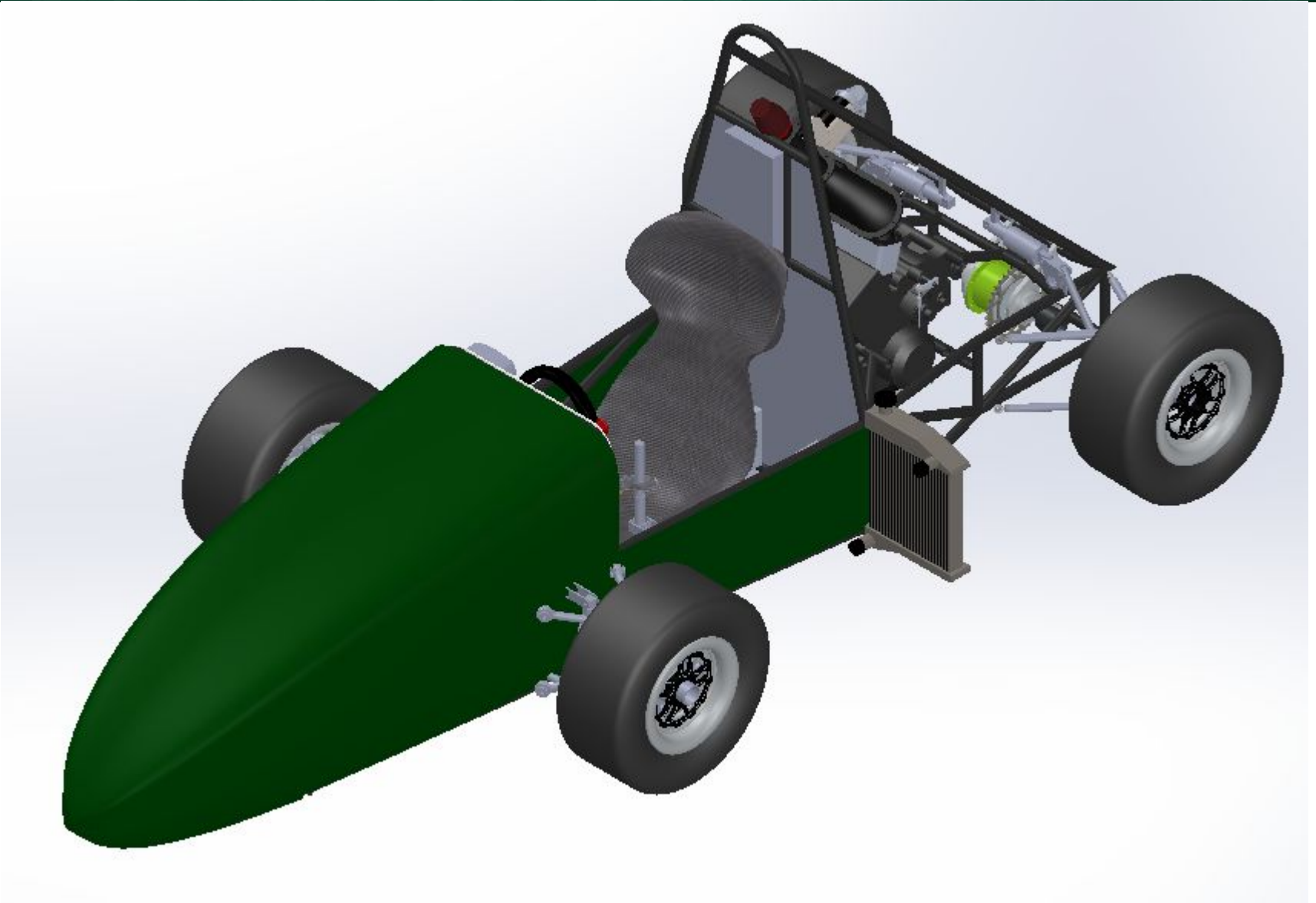
- Strict SAE Guidelines and Constraints
- Modern Engineering Methods and Standards
- Project and Budget Management
- Complex Engineering Problems



# Full Car



# ISO View



# Acknowledgements

# Thank you!

