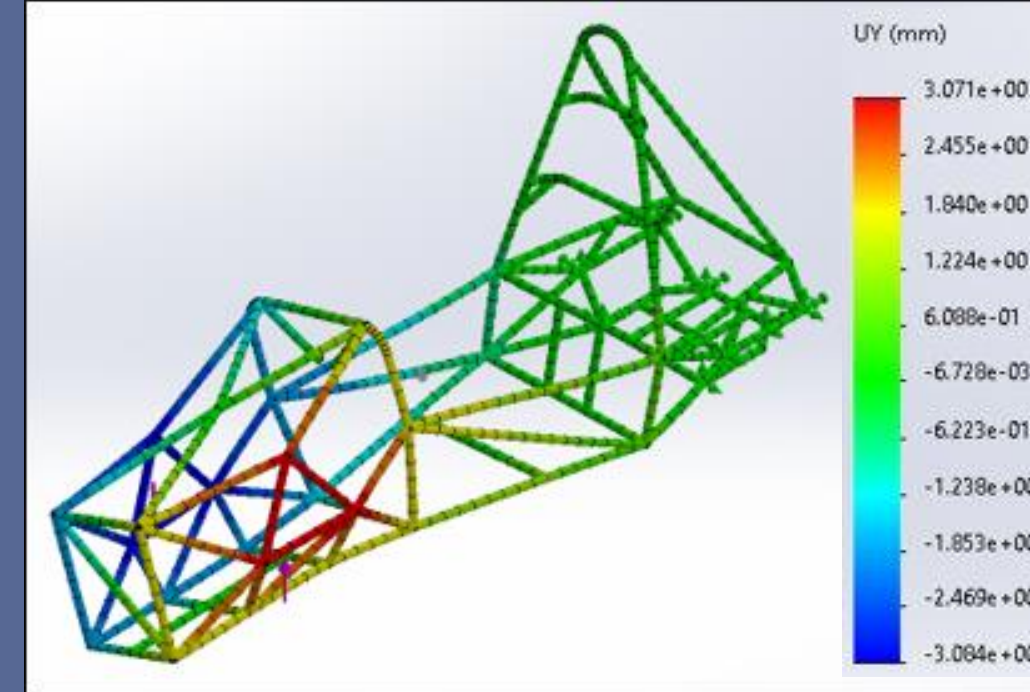
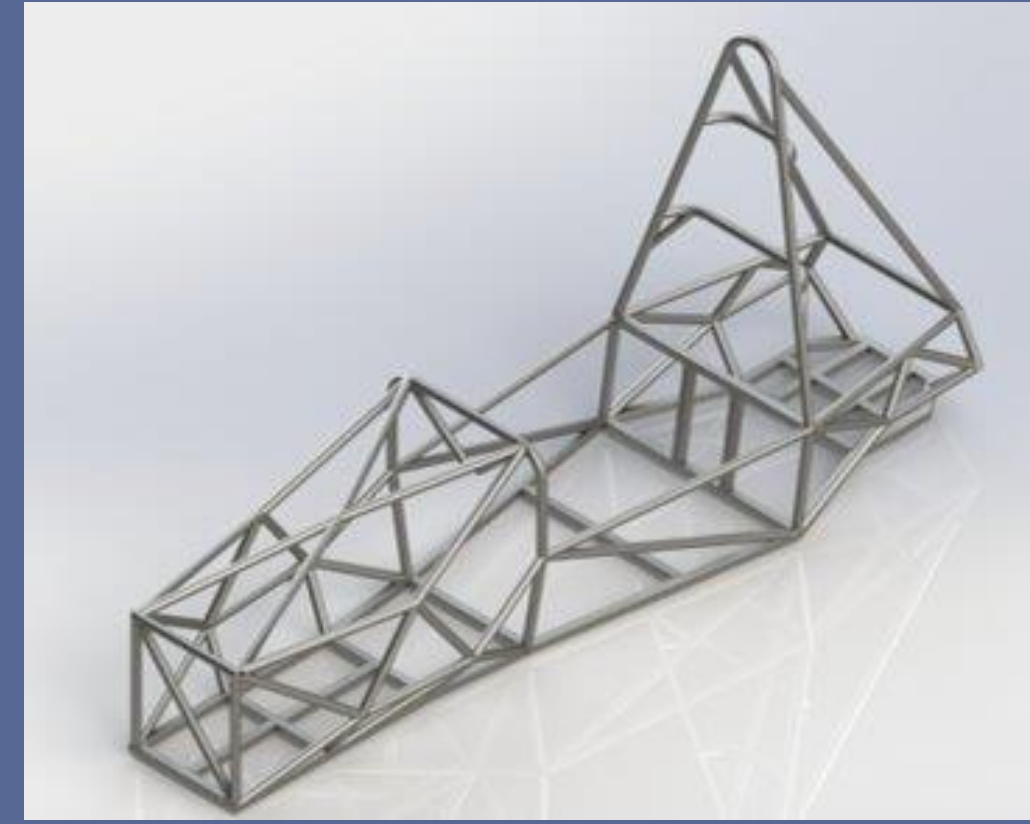




College of Engineering and Physical Sciences Mechanical Engineering Department

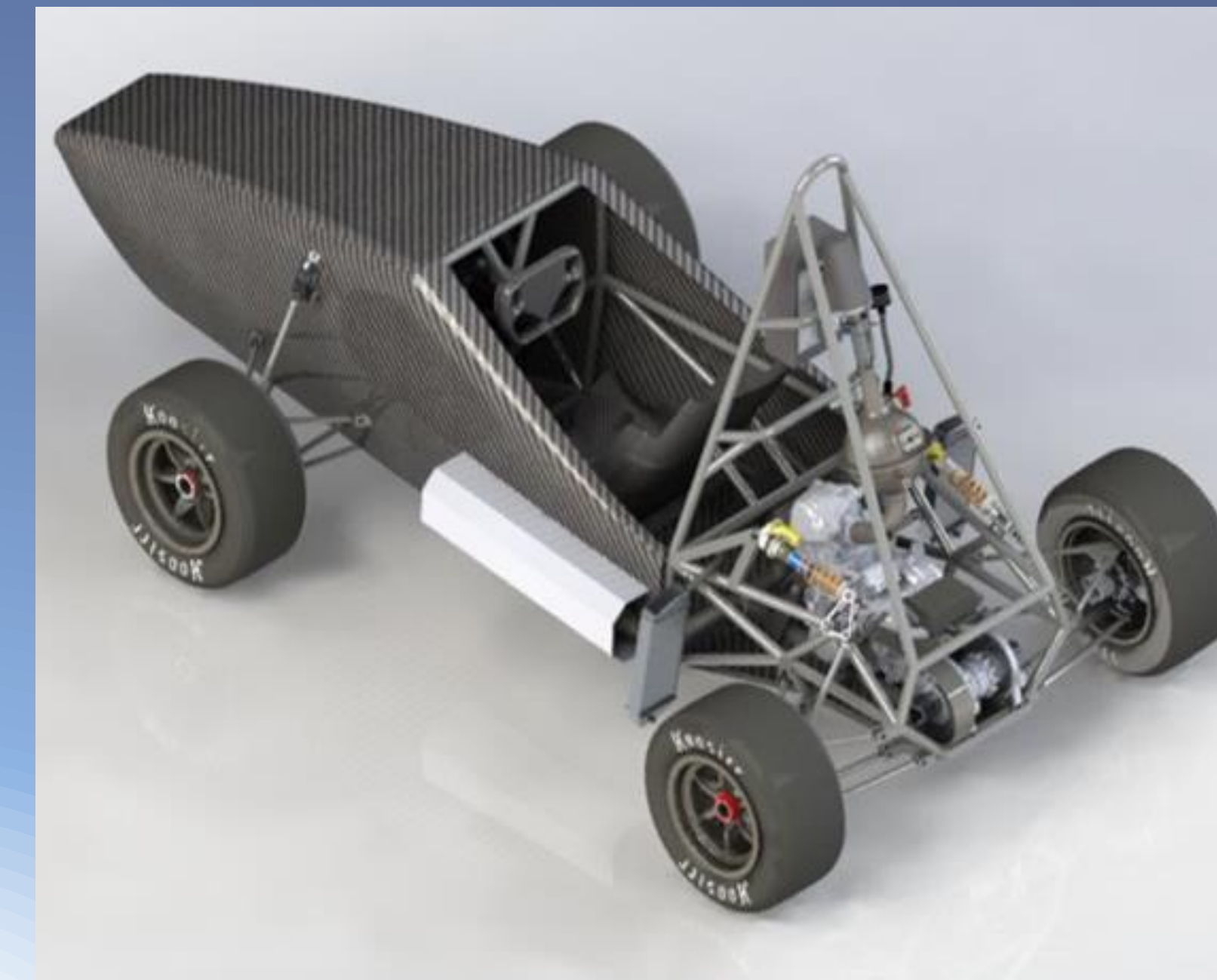
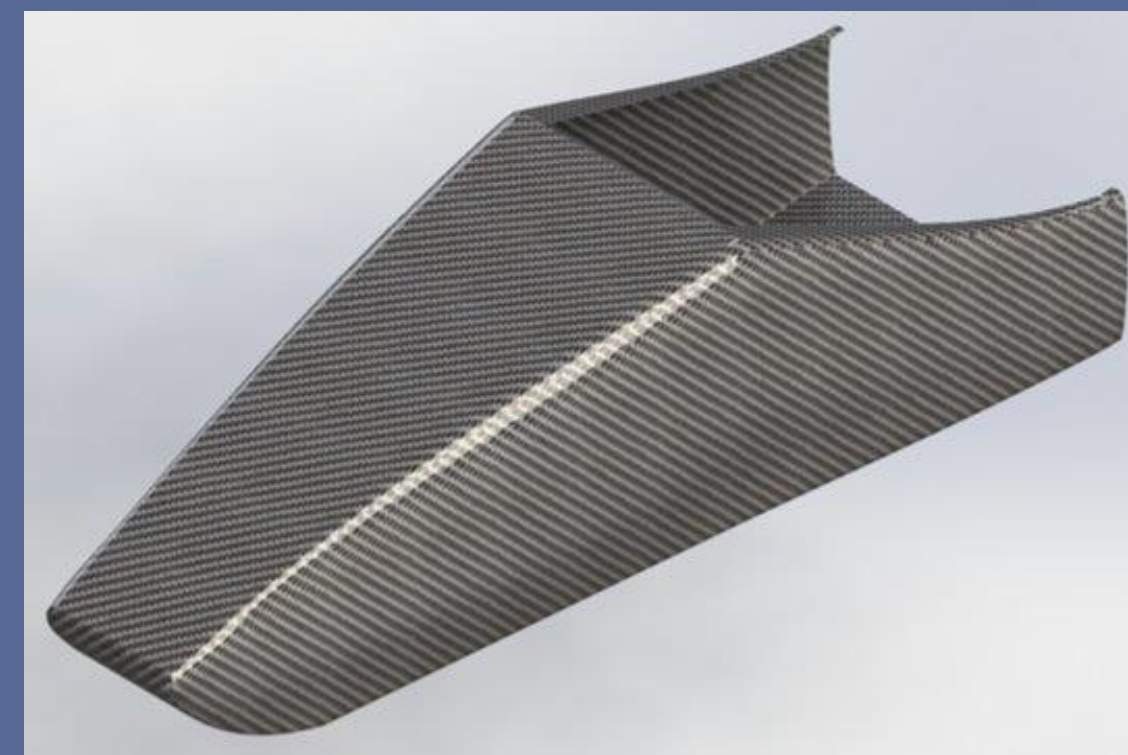
Frame

- Design Goals
 - Torsional stiffness greater than 1500 [Nm/deg]
 - Maintain weight less than 100 lbs
 - Effectively maximize space for the driver, powertrain, suspension, and controls
 - Meet all structural qualifications outlined by the SAE structural equivalency survey
- Manufactured design
 - TIG welded AISI 1020 steel tube members
 - Torsional stiffness equal to 1,831 [Nm/deg]
 - Weight of manufactured frame equal to 89lbs
 - Allows for optimal suspension attachment
 - Fits a driver of the 95th percentile
 - Adheres to SAE rules to ensure driver safety



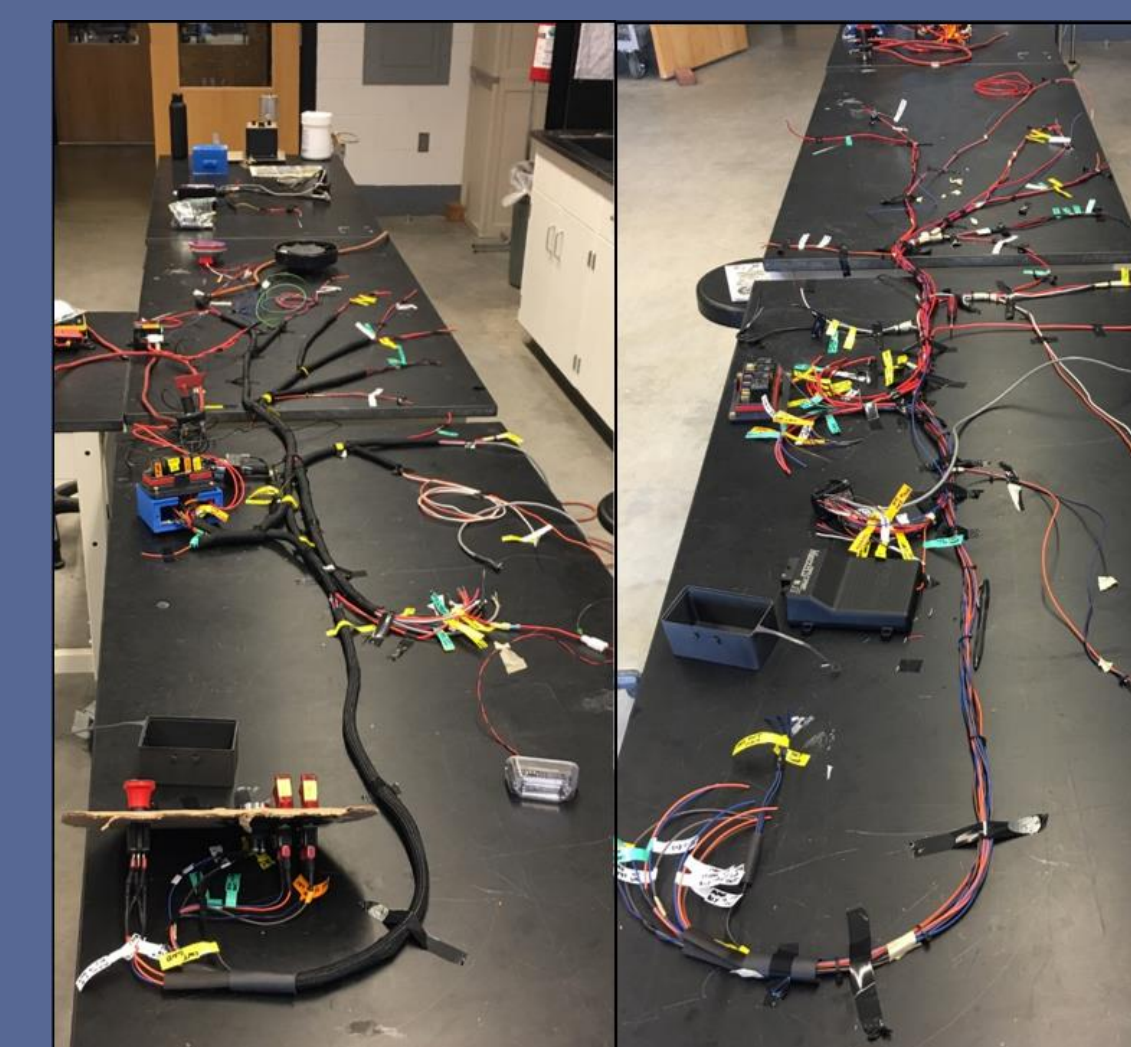
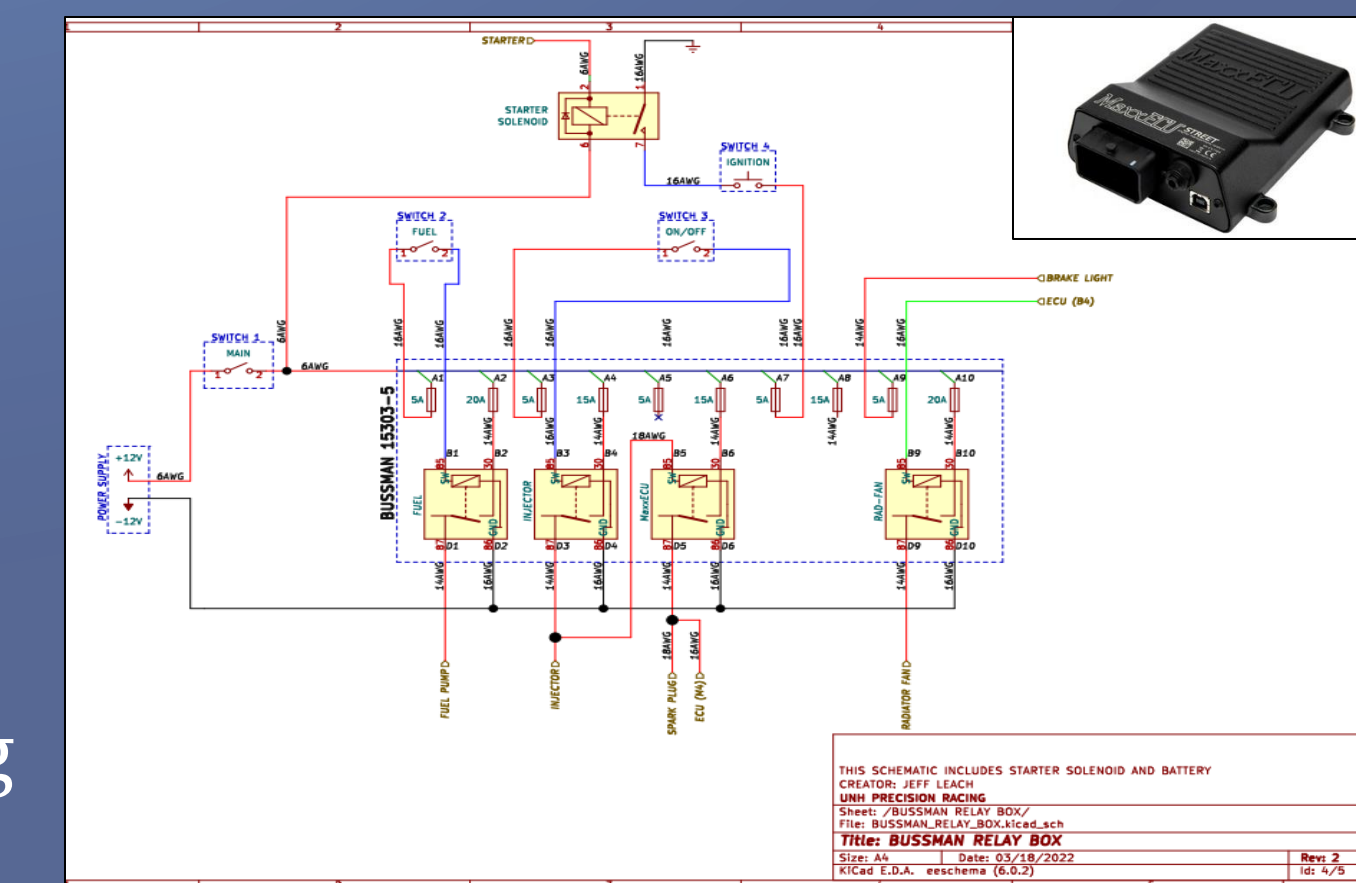
Bodywork

- Process breakdown
 - Design bodywork/nosecone in SOLIDWORKS around chassis & suspension
 - Create mold for bodywork panels and nose cone out of foam
 - Carbon fiber wet layup with vacuum bagging
 - Attach bodywork to chassis using quick release quarter-turn fasteners
- Mold construction and materials
 - XPS Insulation Foam
 - Bondo Body Filler
 - Hexcel Fiberglass Plain Weave 2.1oz/71gsm
- Carbon fiber layup with vacuum bagging:
 - Carbon Fiber Fabric - 4x4 twill 3k
 - 8.3oz/281gsm Toray T300
 - Thin- 2:1 two-part thin epoxy resin system



Electronics

- Engine Management
 - MaxxECU STREET standalone Engine control unit
 - Single injection for better trigger sensing and atomization
 - Variable Reluctance crankshaft position sensor
 - Ignition cut for launch control and shifting
- Wiring Harness
 - Schematics created in KiCad
 - Breaker protected circuits for easy reset and short protection
 - Bussman relay/fuse box for improved organization and trouble shooting
 - Deutsch connectors for IP67 protection and high cycle life
 - Crimped wire connections for greater strength than solder



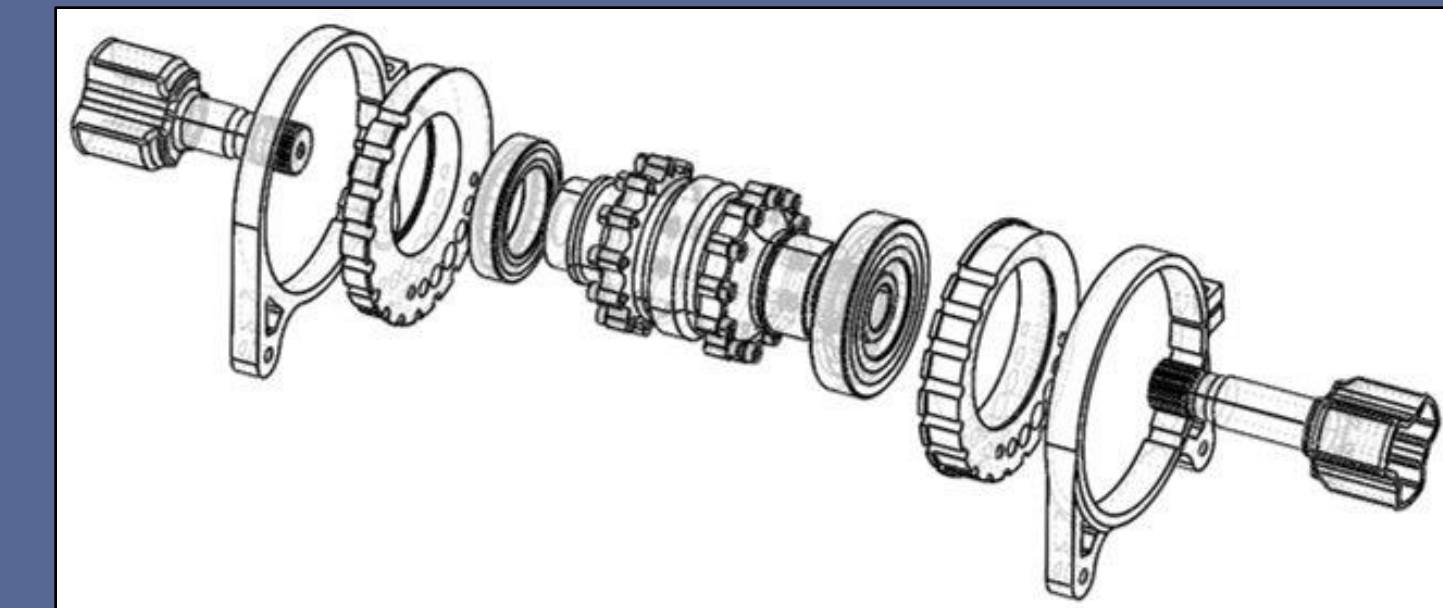
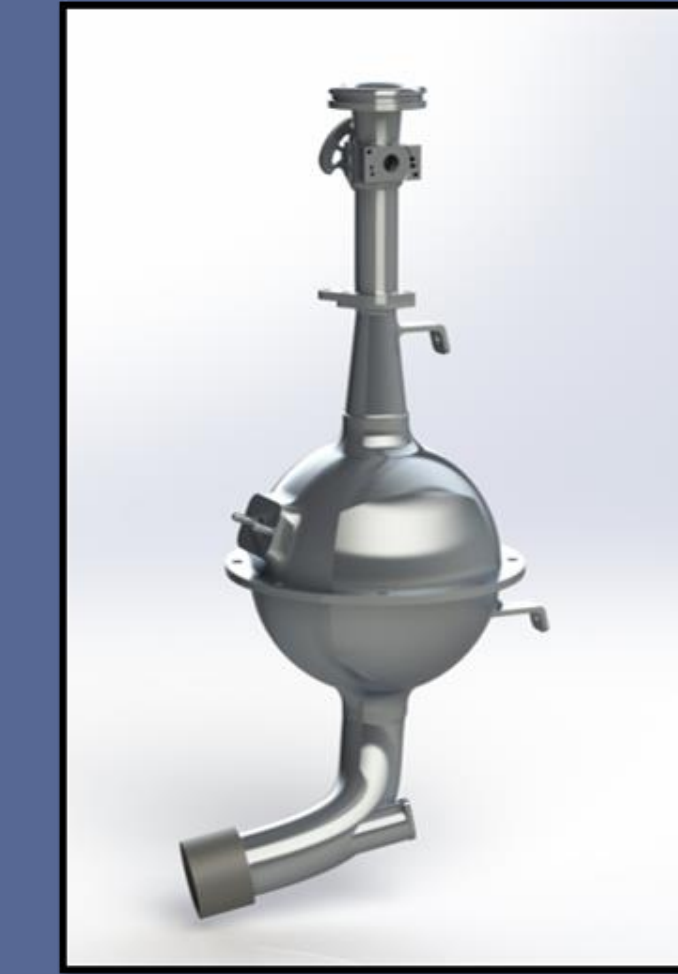
Controls

- Pedal Assembly
 - 6061-T6 Aluminum components withstand 2000N (450 lb-f) force from the driver.
 - Vertically mounted master cylinders optimize packaging, braking force, and pedal travel.
- Safety Considerations
 - 6-point harness holds driver securely in place.
 - No part of the driver can contact the ground.
 - Impact attenuator on the front of the car absorbs impact forces.
- Steering Column
 - Utilizes double universal joint designed for automotive steering shafts
 - Rack mounted behind the front axle to improve Ackermann Steering.
- Cooling
 - Dual radiators on sides of car increase cooling.
- Brakes
 - Racing quality rotors, calipers, lines, and pads increase braking capabilities.



Powertrain

- Engine
 - 2016 KTM 450 SX-F
 - Max Torque : 34lb-ft @ 7000 RPM
 - Max Power: 53 HP @ 9500 RPM
 - Naturally aspirated, 100 Octane
 - High torque at low RPM's and linear power curve makes driving easier for inexperienced drivers
- Drivetrain
 - Chain Drive
 - Drexler Limited Slip Differential
 - RCV Half-Shafts
 - Aluminum differential designed to allow tightening of the chain using an eccentric disk concept, various locking points.
- Intake Manifold
 - 3000 cc plenum
 - Utilize AT Power's FSAE throttle body with built in restriction diameter
 - Made from printed titanium, experimenting with ABS plastic printing.
 - Runner length of 264 mm with a single 42 lb./hr. injector firing directly at the intake valves.



Suspension

- Purpose
 - Resist chassis roll – maximize tire contact patch with road
 - Roll center placement prioritizing responsiveness
 - Minimize roll center migration, increase stability/predictability
 - Select coilover to achieve desired ride frequency and roll rate
 - Adjustability: static camber, ride height, toe angle
- Geometry Selection
 - Double wishbone, Short-Long Arm (SLA), pushrod actuated
 - Rear bell-crank repositioned out-of-plane to improve packaging
- Component Modeling & FEA
 - SolidWorks 3D modeling - FEA and kinematics in MSC Marc Mentat, MATLAB, & LOTUS Shark
 - Calspan tire data used to predict dynamic forces
- Manufacturing
 - Waterjet in Olson Center, finish machining in CEPS machine shop, TIG welding

