



Shell Eco-Marathon FAMU-FSU 2014 Solar Car Milestone #4 Presentation Team #2



Presentation Overview

- Introduction
- Requirements
- Scheduling
- Concept Generation
- Mechanical Overview
- Electrical Overview
- Safety and Req. Tests
- Budget

Introduction

Requirements

Scheduling

Concept
Generation

ME
Overview

EE
Overview

Safety
& Req Tests

Budget

Introduction

- General Problem Statement
- General Solution Approach
- Operating Environment
- Intended Use(s)/User(s)



Race Track (Operating Environment)



Competition Requirements



- 3 Phase Registration
- Driver Safety
- Vehicle Safety
- Energy Requirements
- Chassis/Body Requirements
- Electrical Requirements
- Mechanical Requirements
- Placement Criteria

Introduction

Requirements

Scheduling

Concept
Generation

ME
Overview

EE
Overview

Safety
& Req Tests

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Scheduling & Progress

Completed:

- Shell Registration
- Shell Design Level Review
- Millstones 1-3
 - Reports
 - Presentations
- Design Phase

In Progress

- Manufacturing (Delays)
 - Stock Parts
 - Custom Parts
- Installation

Next:

- Testing
- Competition (April 25-27)



ME Manufacturing & Installation

Day 1

Seat

Roll Bar & Rear
Wheel Mount

Day 2

Motor & Wheel → Rear Brake Mount & Brake

Day 3

Front Wheel → Truss → Roll Hoop
Mount

Day 4

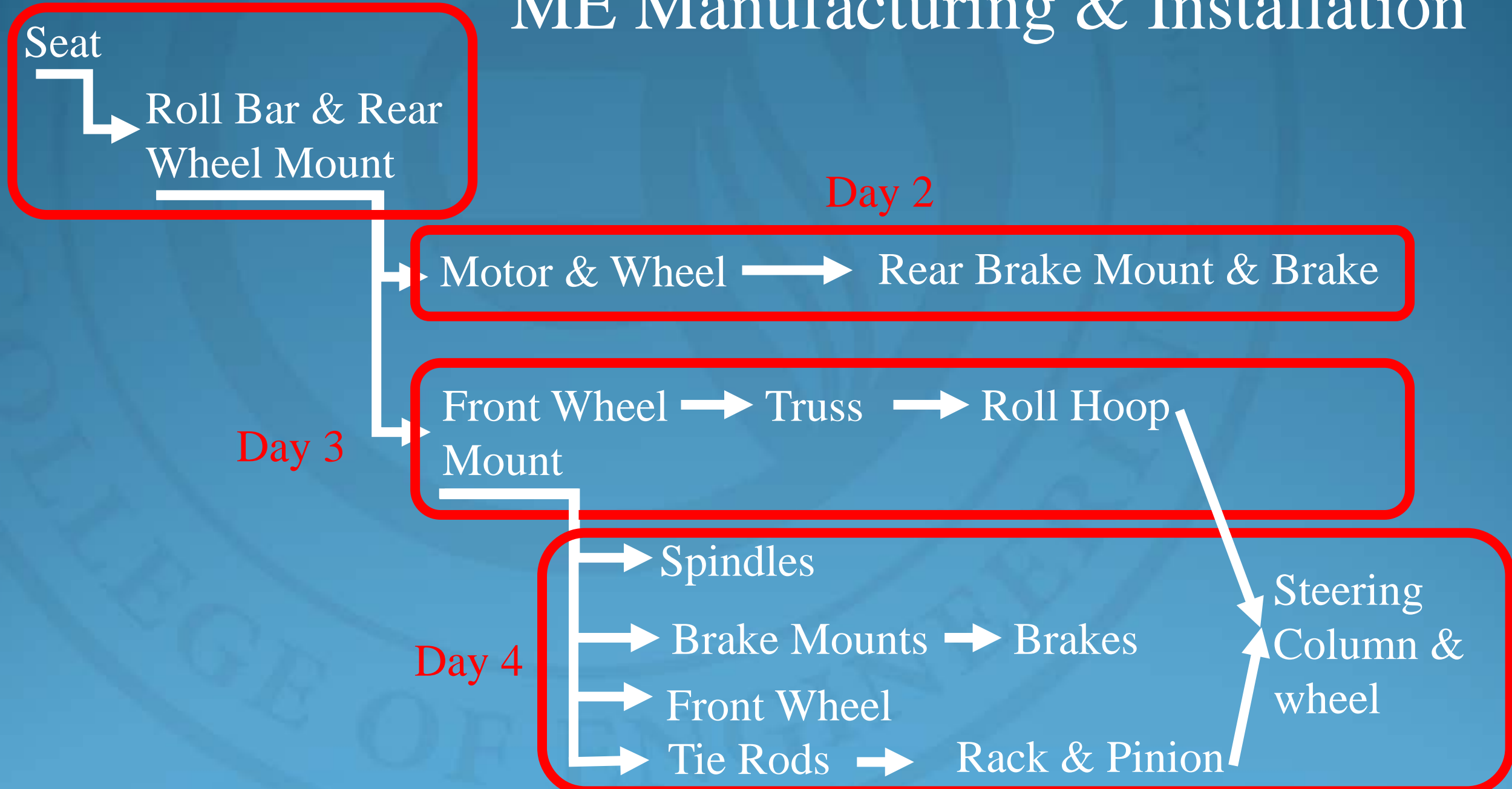
Spindles

Brake Mounts → Brakes

Front Wheel

Tie Rods → Rack & Pinion

Steering
Column &
wheel



Concept Generation

Step 1: House of Quality

Step 2: Comparison Matrix

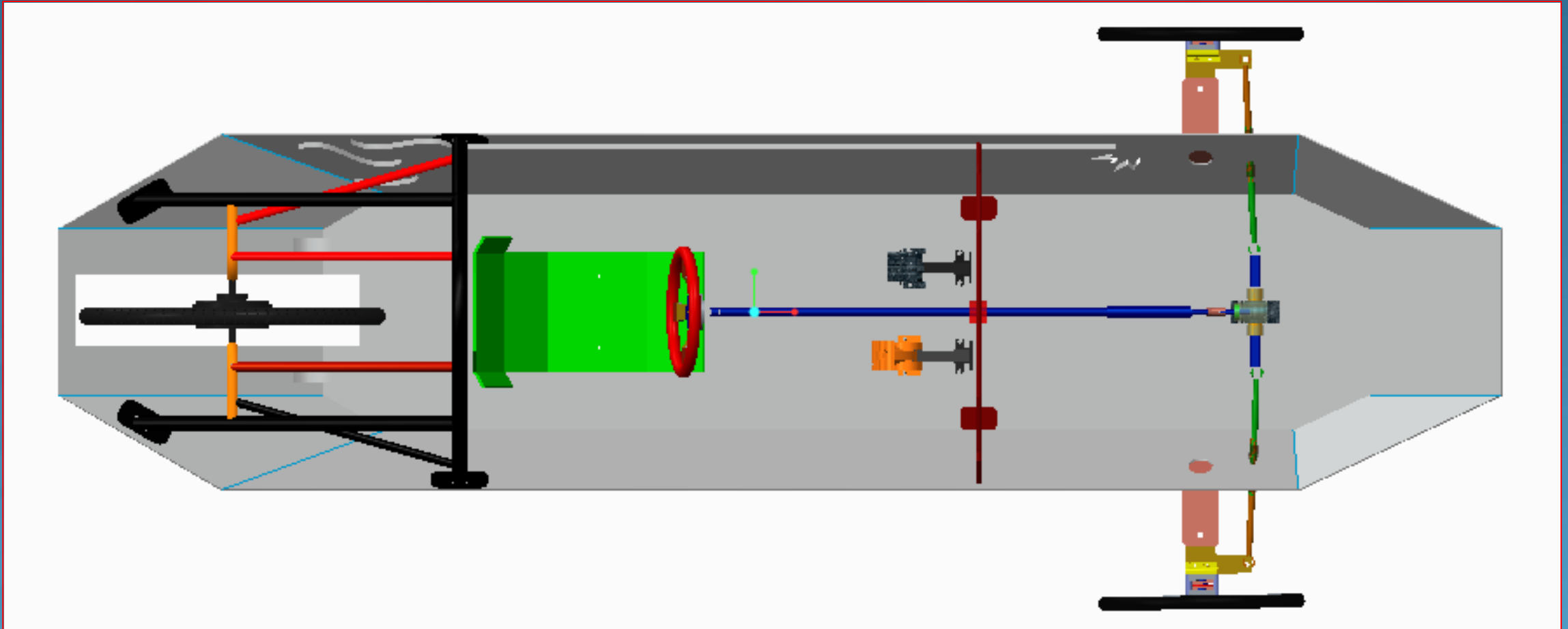
Design Options	Safety (0.432)	Cost (0.208)	Component Weight (0.187)	Implementation (0.173)	Total
Design 1	2	1	1	2	1.605
Design 2	1	2	2	1	1.395

Step 3: Professional Opinion

Step 4: Final Selection



Mechanical Overview



Introduction

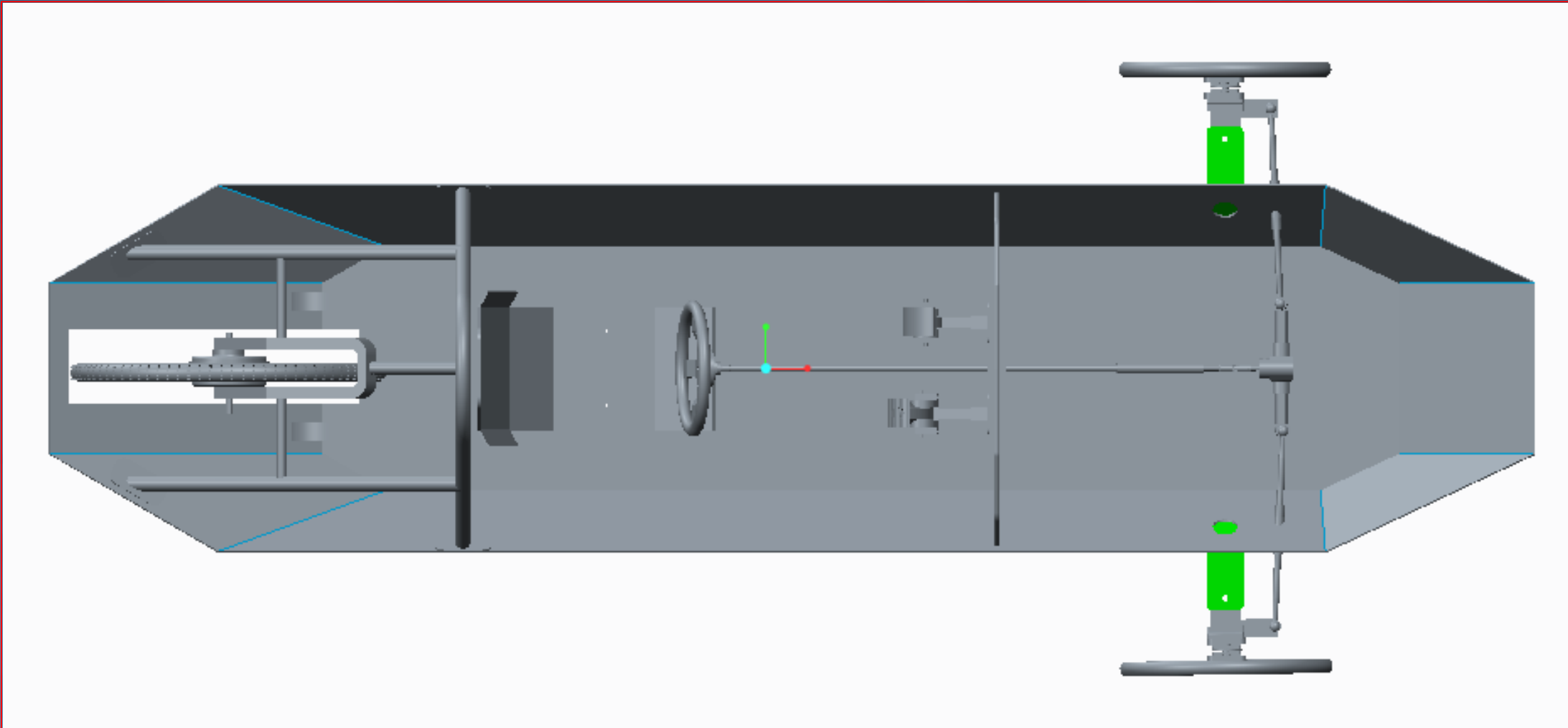
Requirements

Scheduling

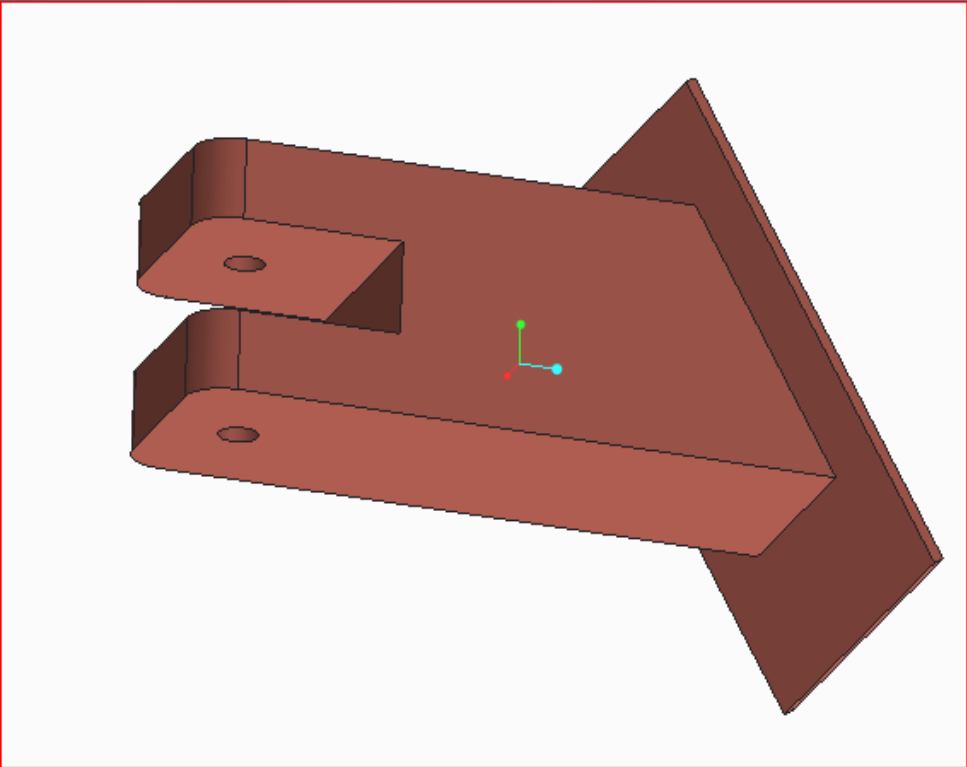
Concept
GenerationME
OverviewEE
OverviewSafety
& Req Tests

Budget

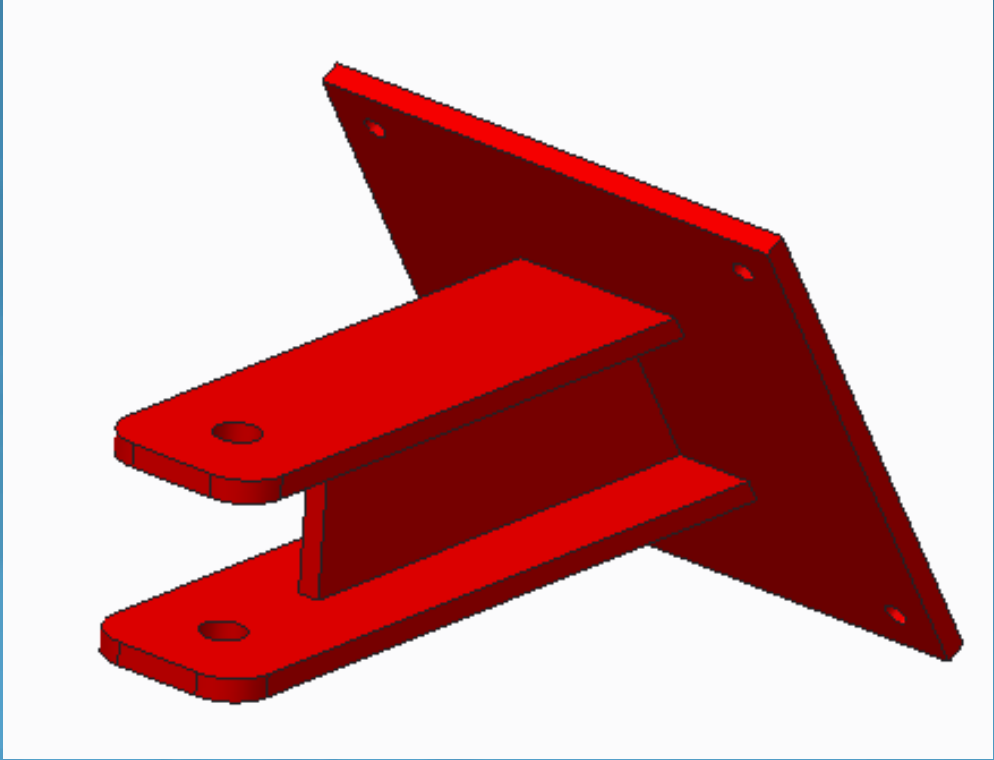
Front Wheel Mounts



Front Wheel Mounts

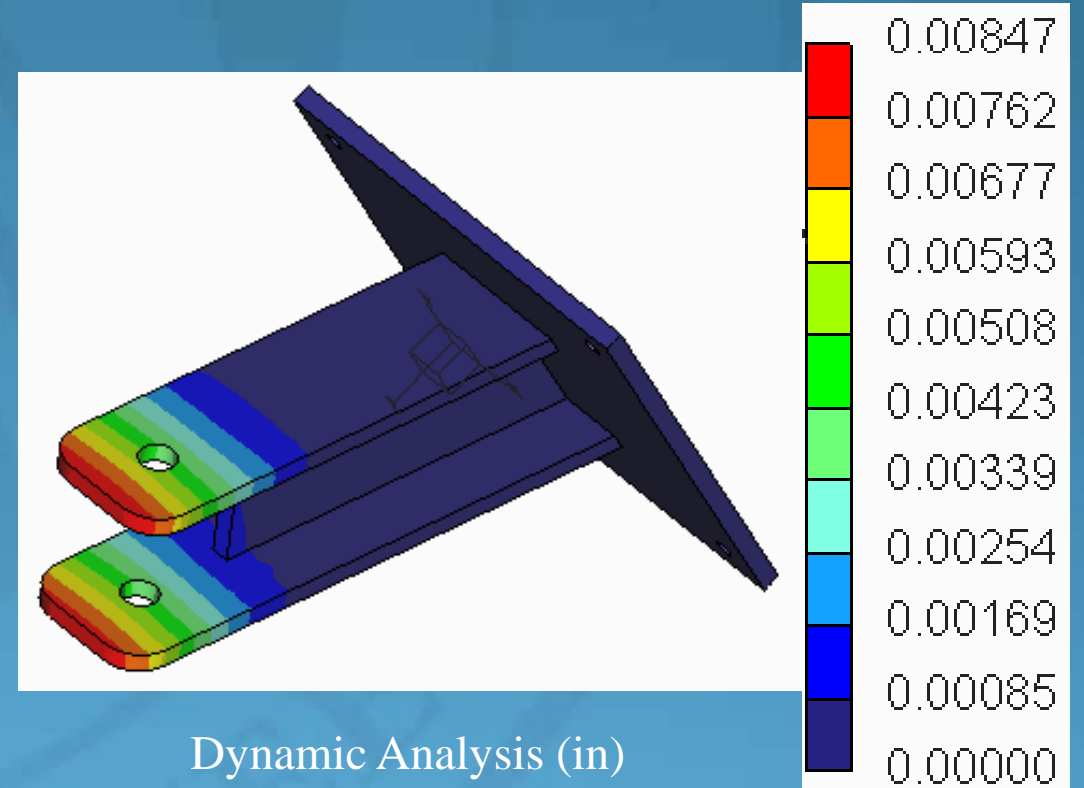
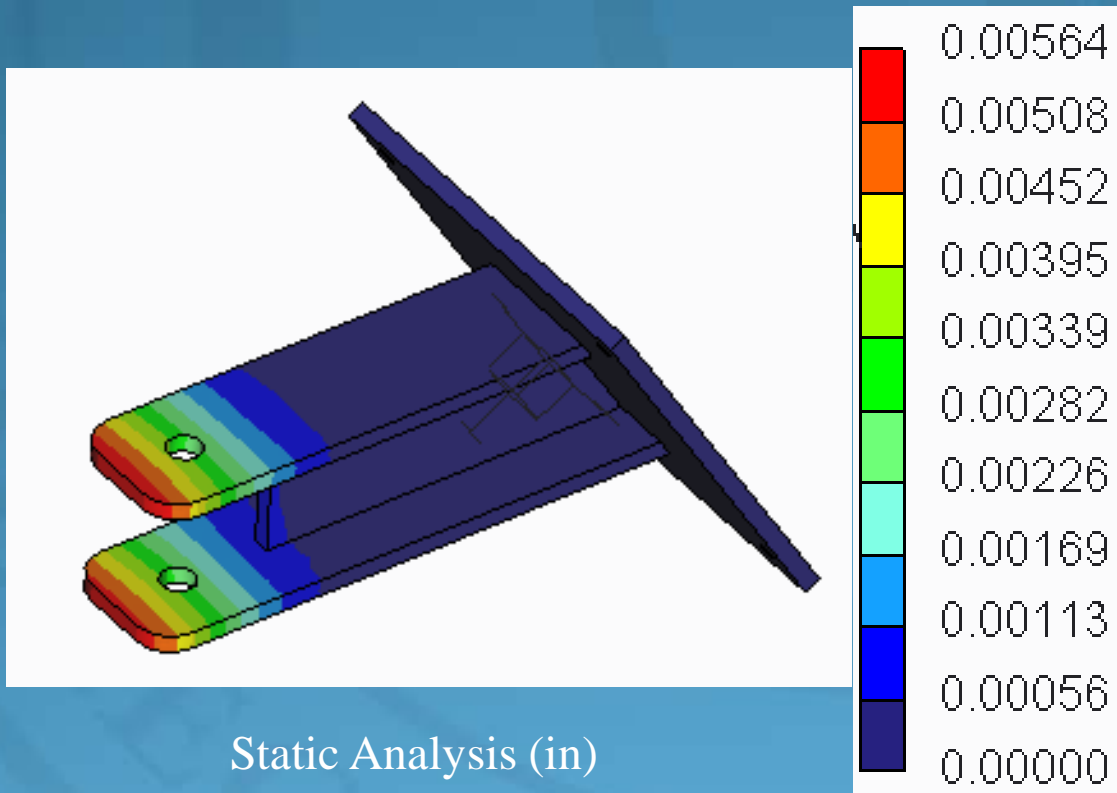


Volume: 33.84 in^3

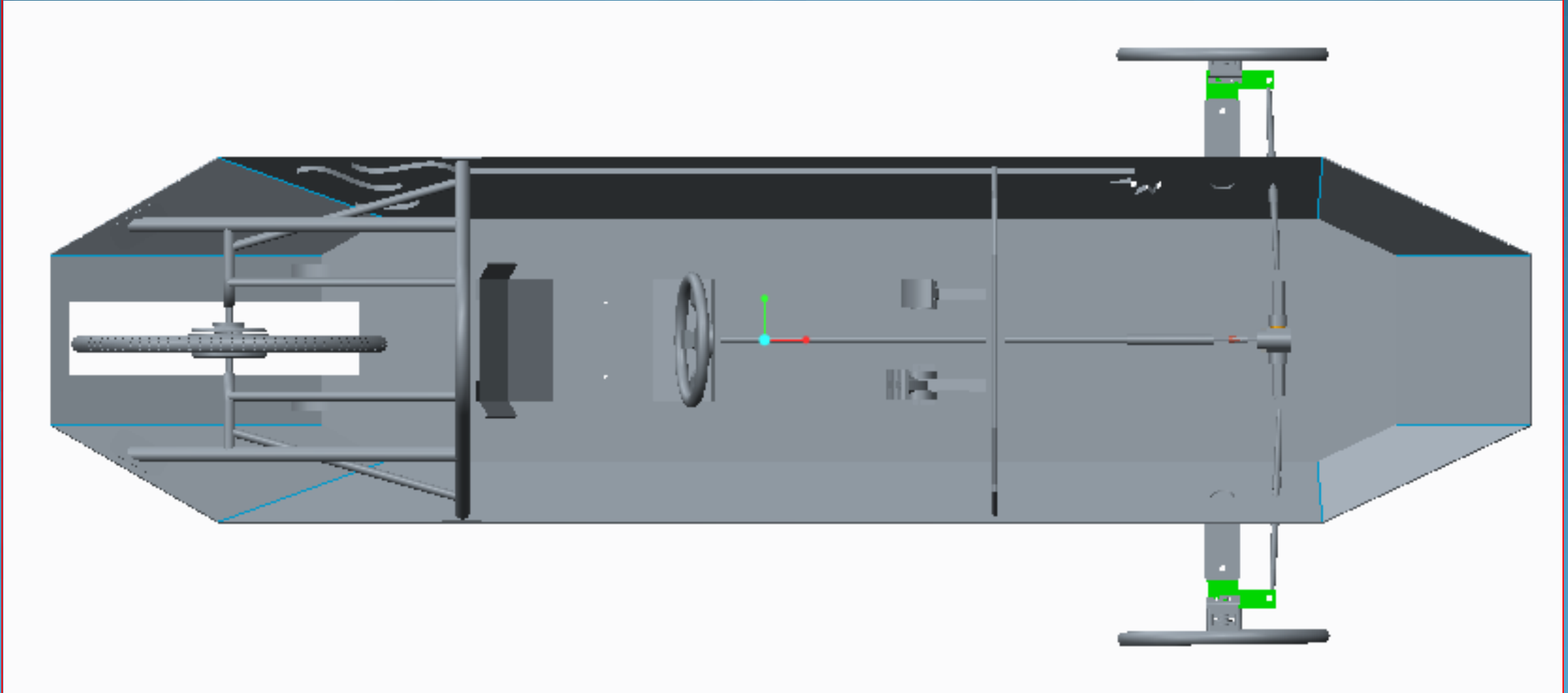


Volume: 18.37 in^3

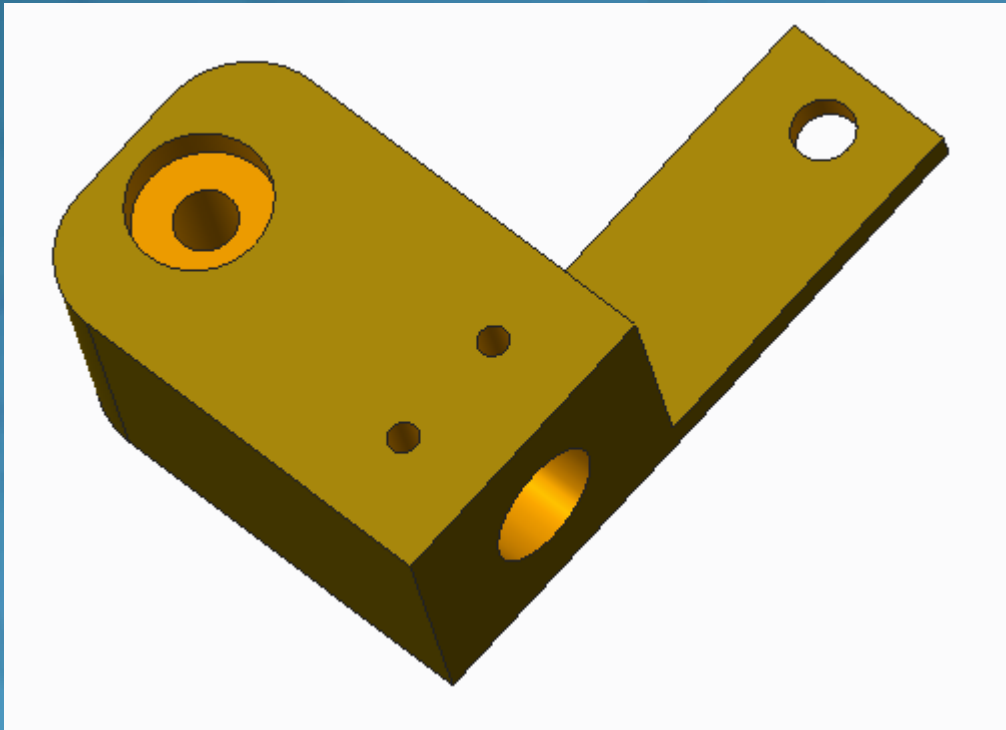
Front Wheel Mount Test and Result



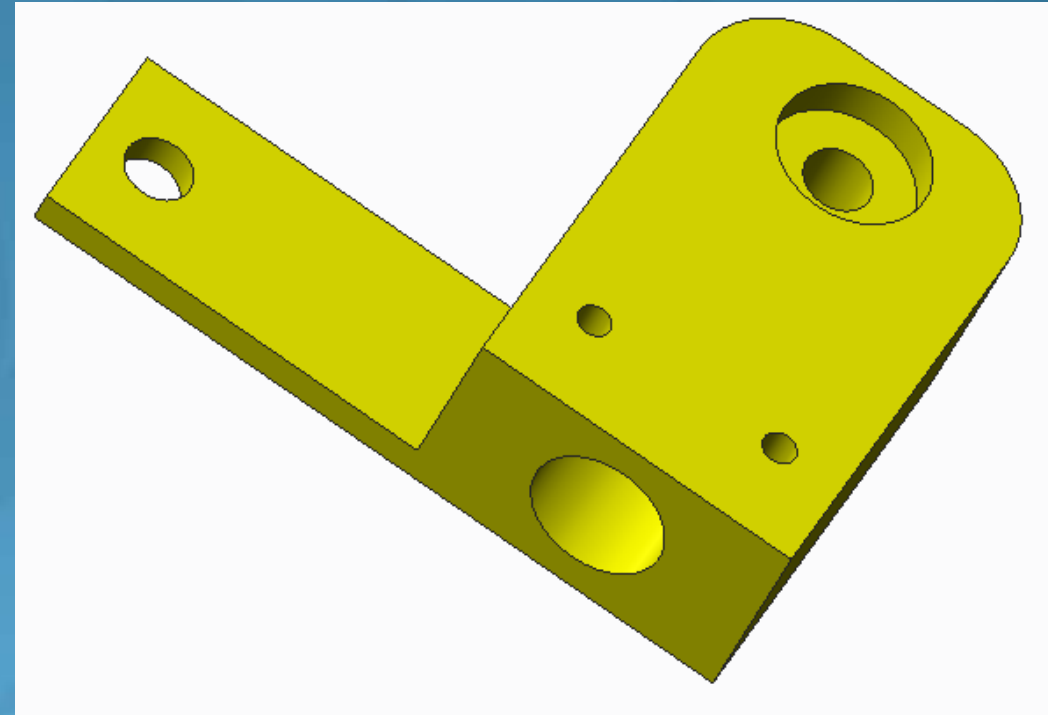
Front Wheel Arms



Front Wheel Arms

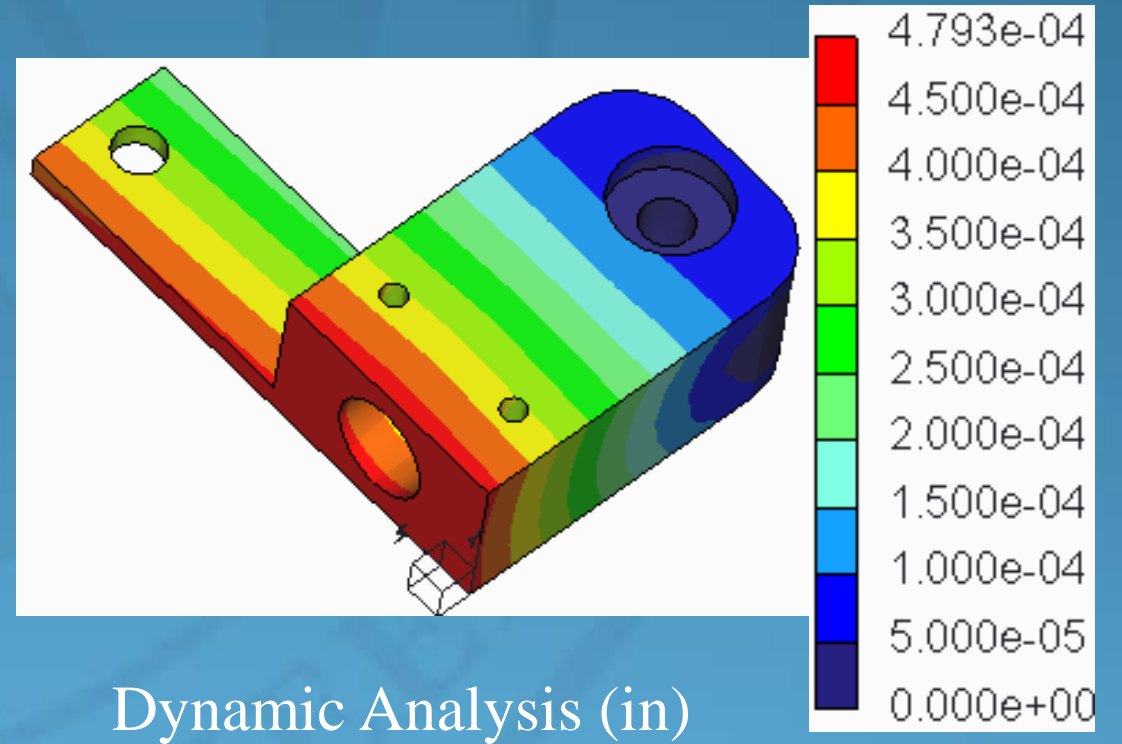
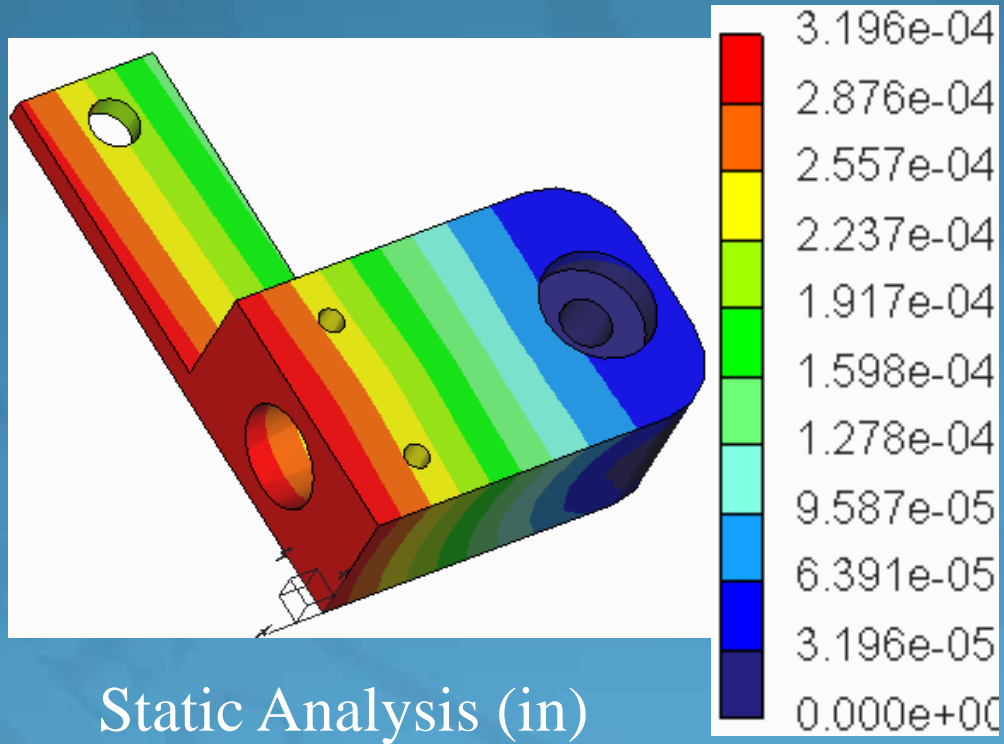


Volume: 17.88 in^3

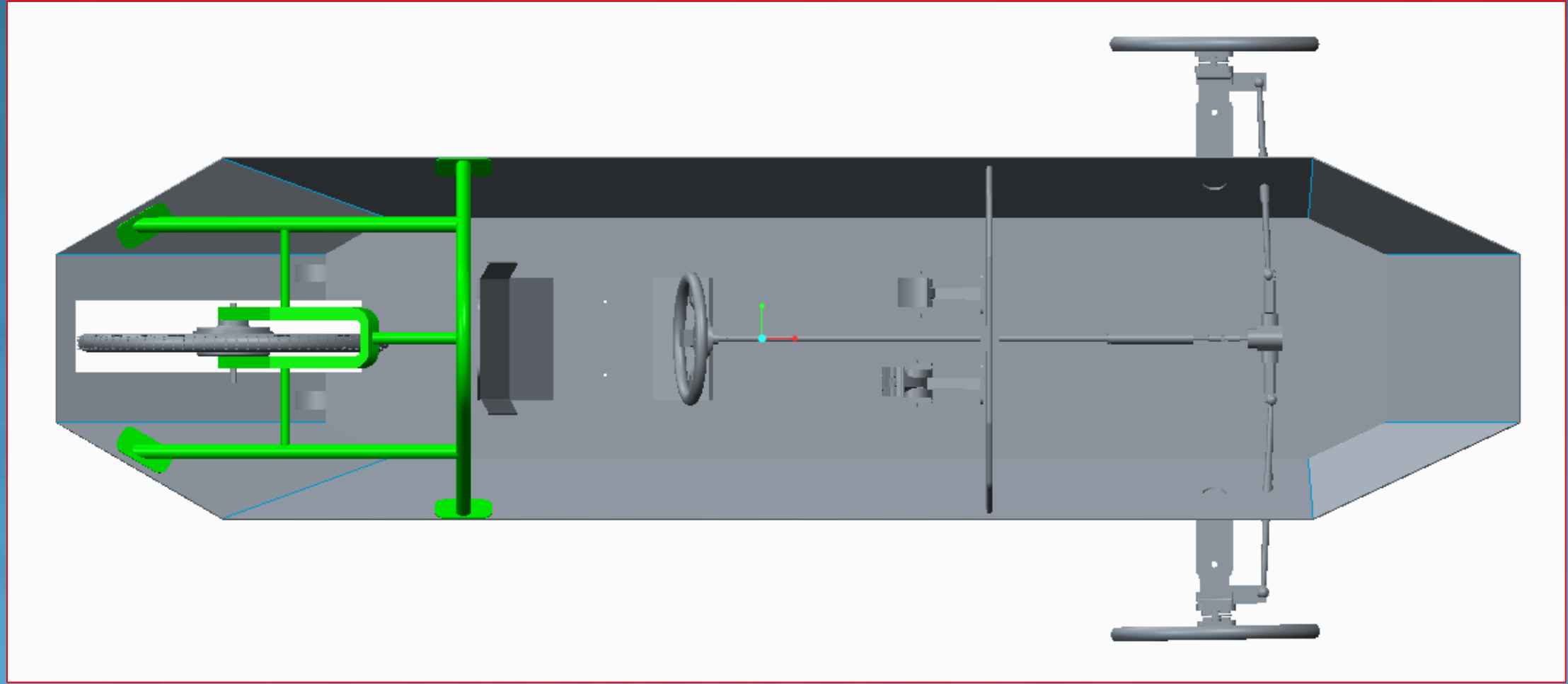


Volume: 13.10 in^3

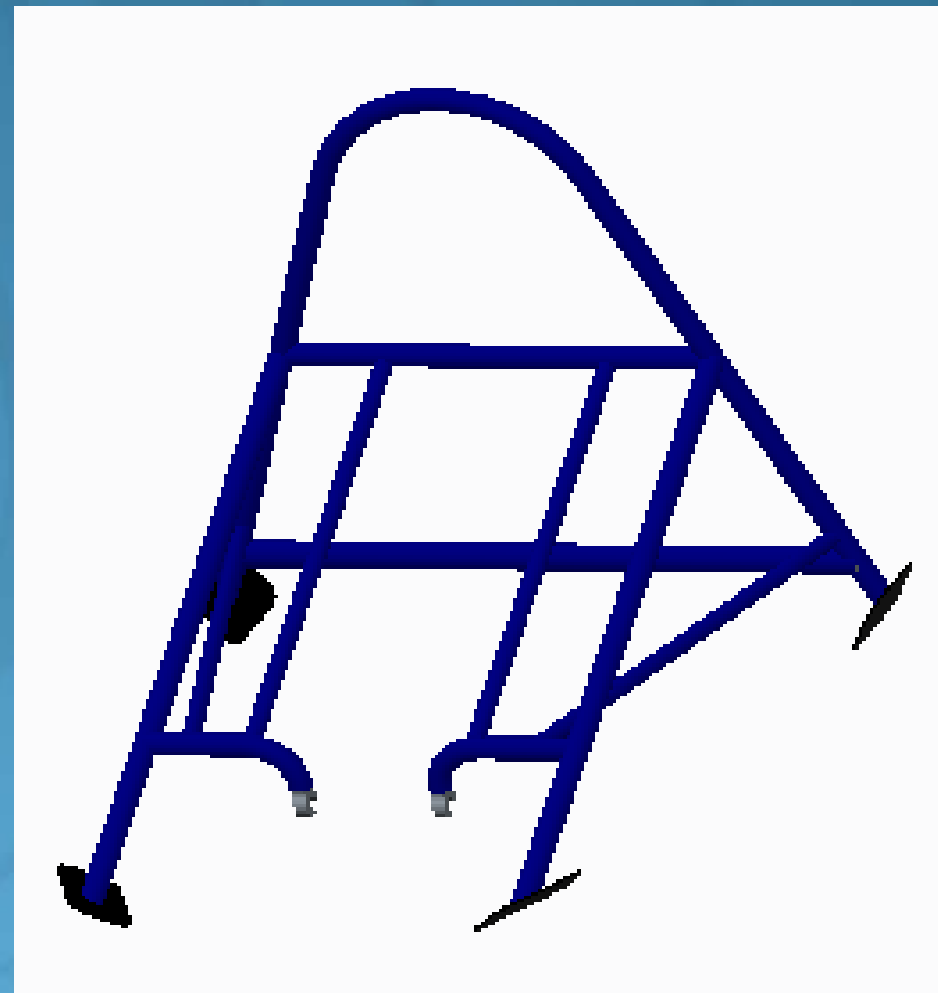
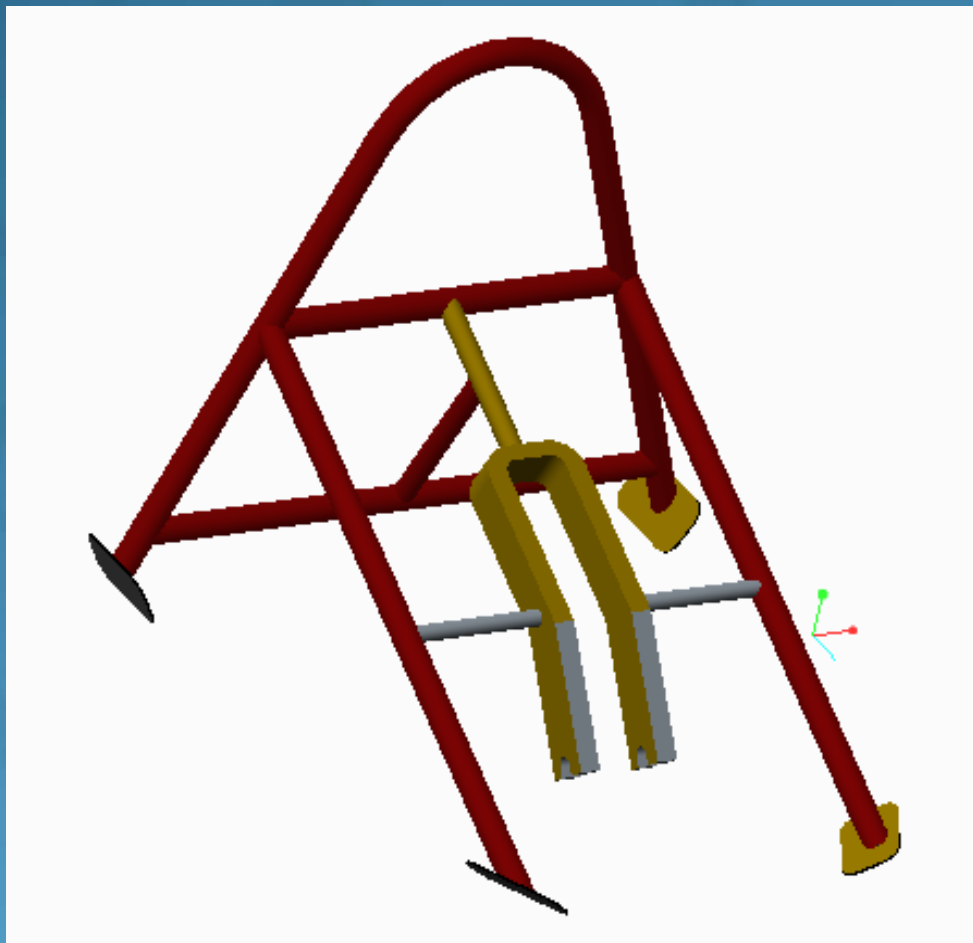
Front Wheel Arms Test and Result



Roll Bar & Motor Mount

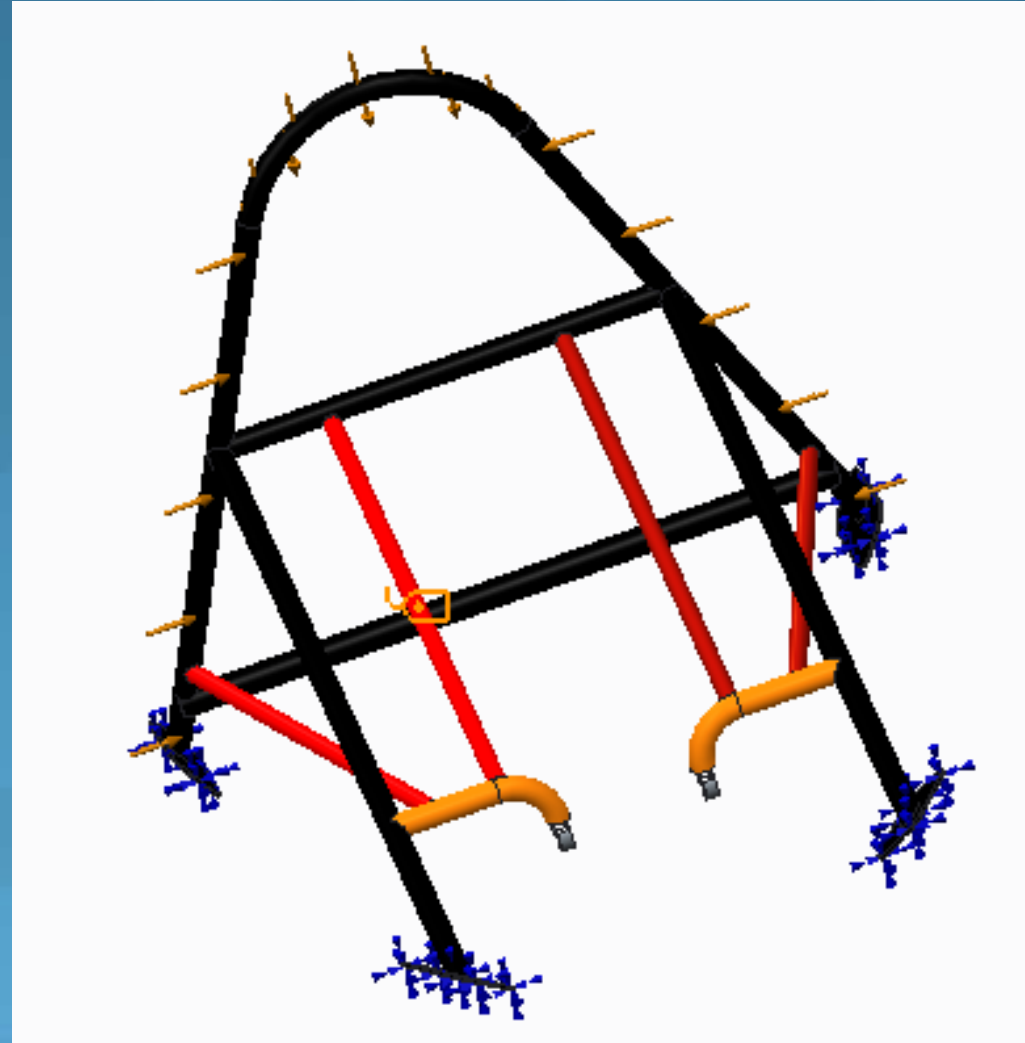


Roll Bar

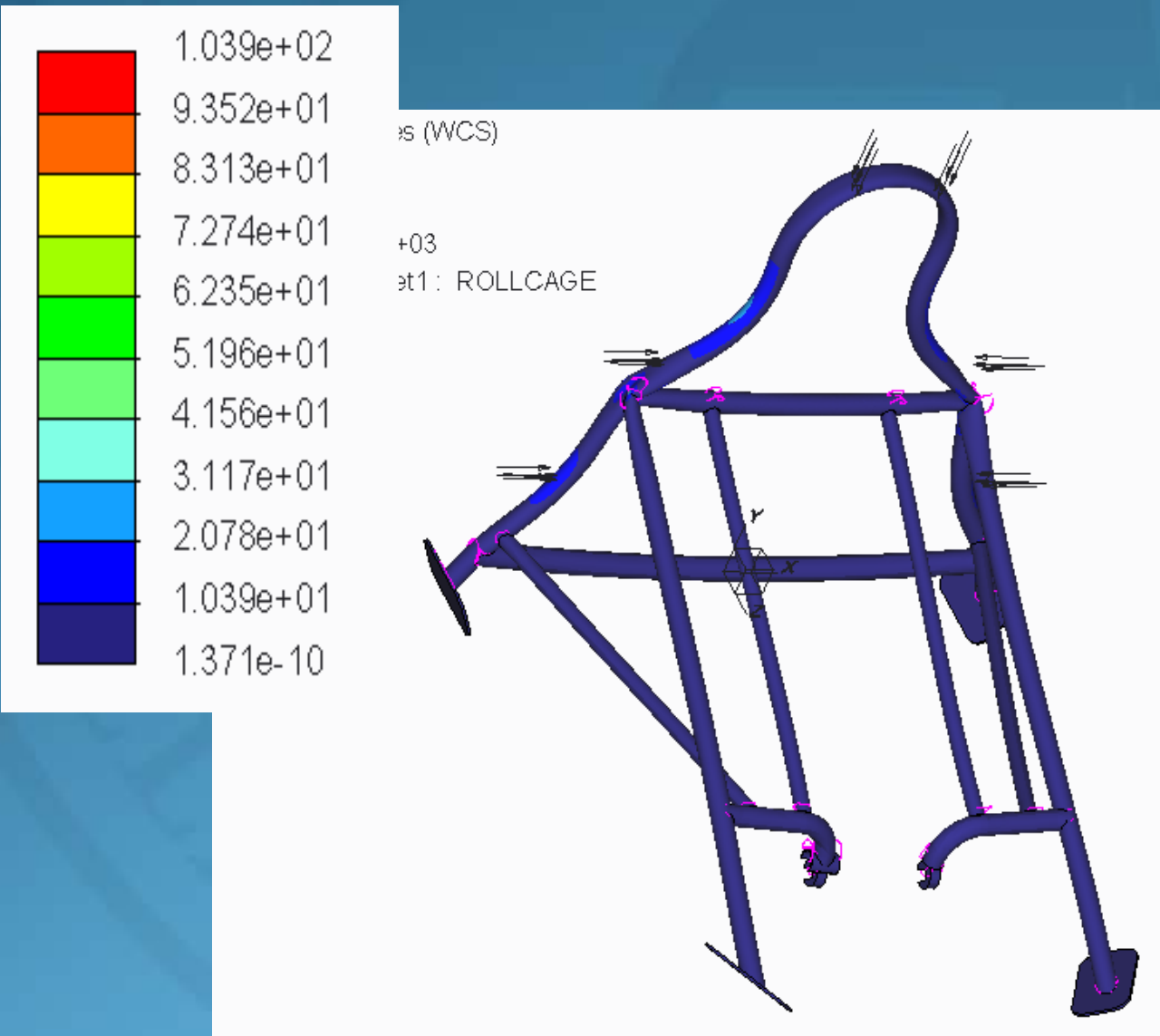


Roll Bar

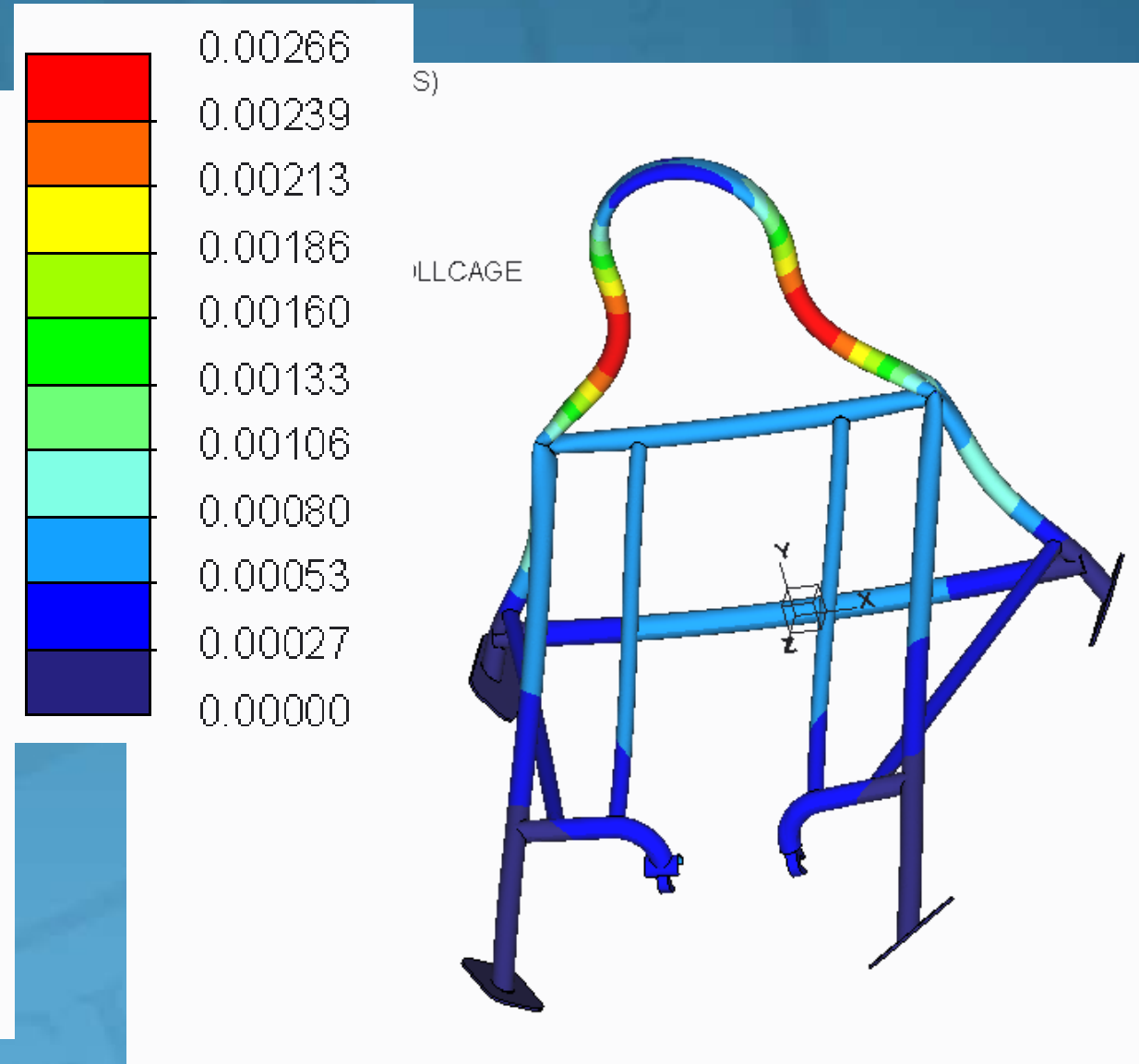
- Must be able to withstand 700N of force in all direction
- Must be at least 5cm above the head of the driver when sitting.



Roll Bar Tests and Results

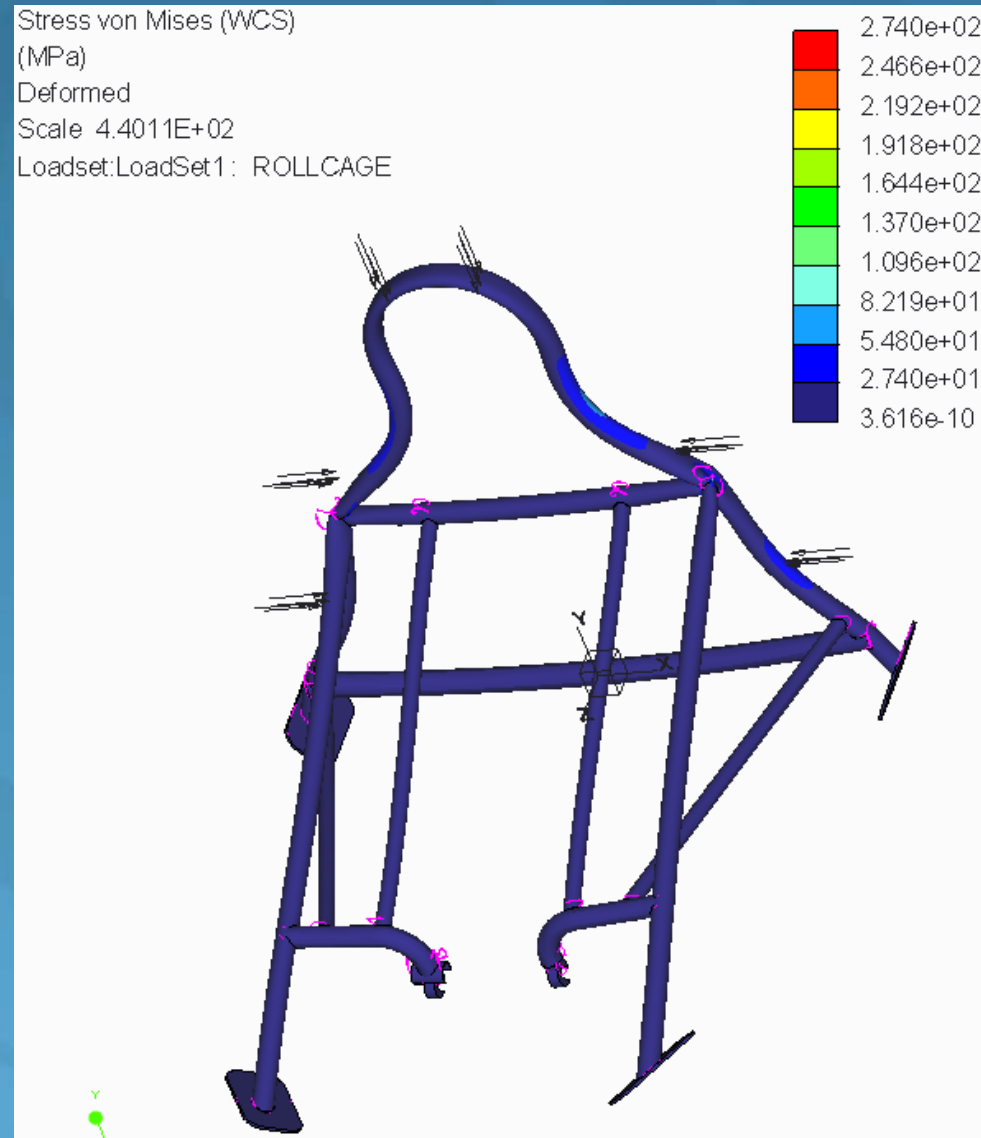


Static Analysis: Stress von Mises (Mpa)



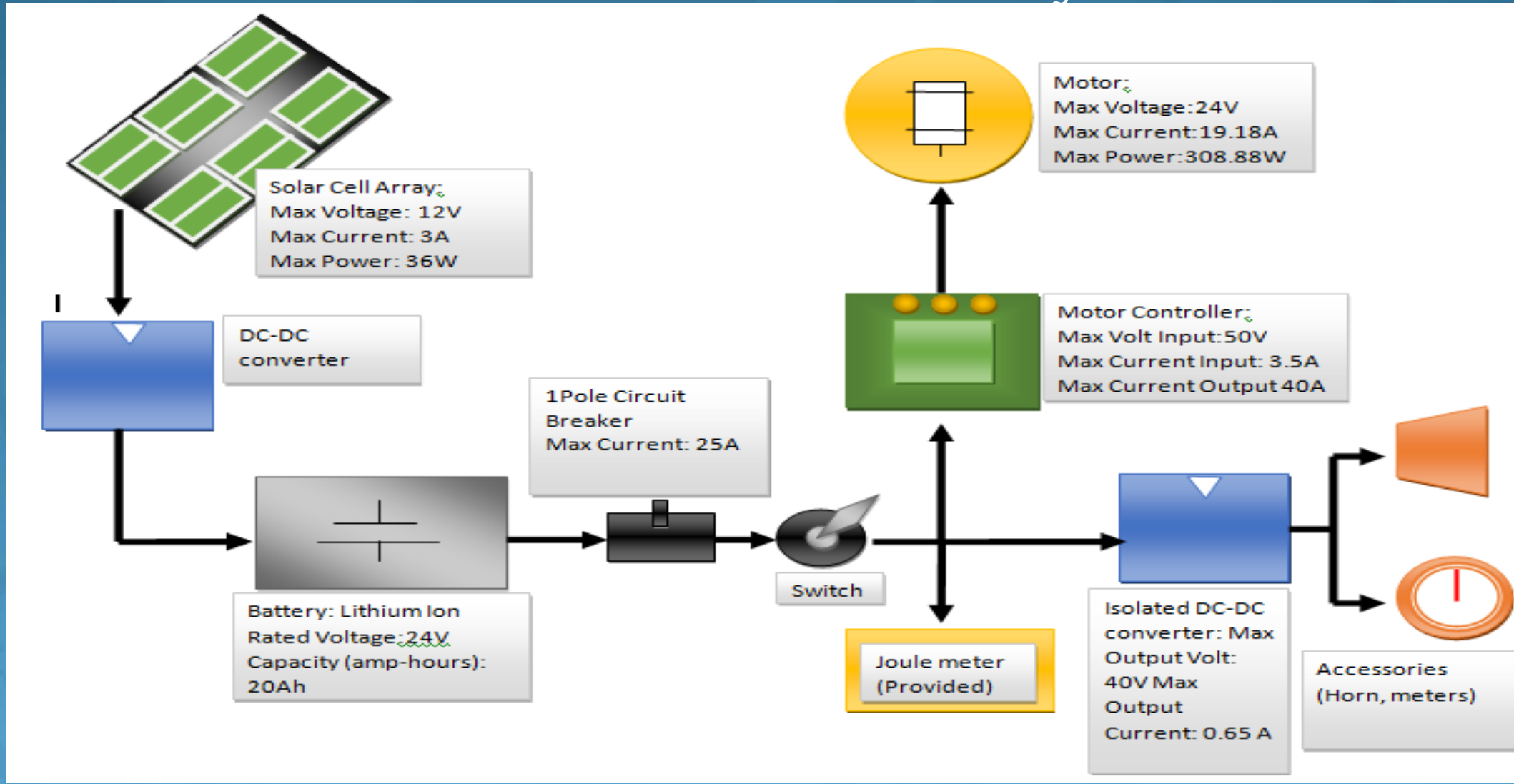
Static Analysis: Displacement (in)

Roll Bar Tests and Results



Dynamic Analysis: Stress von Mises (MPa)

Overview of Electrical System



Introduction

Requirements

Scheduling

Concept
GenerationME
OverviewEE
OverviewSafety
& Req Tests

Budget

Isolated DC-DC Converter

- Converter chosen Texas Instruments LM25017
- Minimum input voltage 9V and maximum input voltage is 48V
- Minimum output voltage 1.25V with a maximum output voltage 40V
- Maximum output current of 0.65A
- Powers all instrumentation



Isolated DC-DC Converter Tests and Results

Desired

- Odometer Test to ensure the odometer is properly functioning.
- Ventilation system test ensure the ventilation system is working according to the specifications.

Required

- Once the isolated DC-DC converter is finished
 - Electric horn will be tested using a decibel meter.
 - When complete the electric horn will be implemented into the chassis.

Motor's Controller



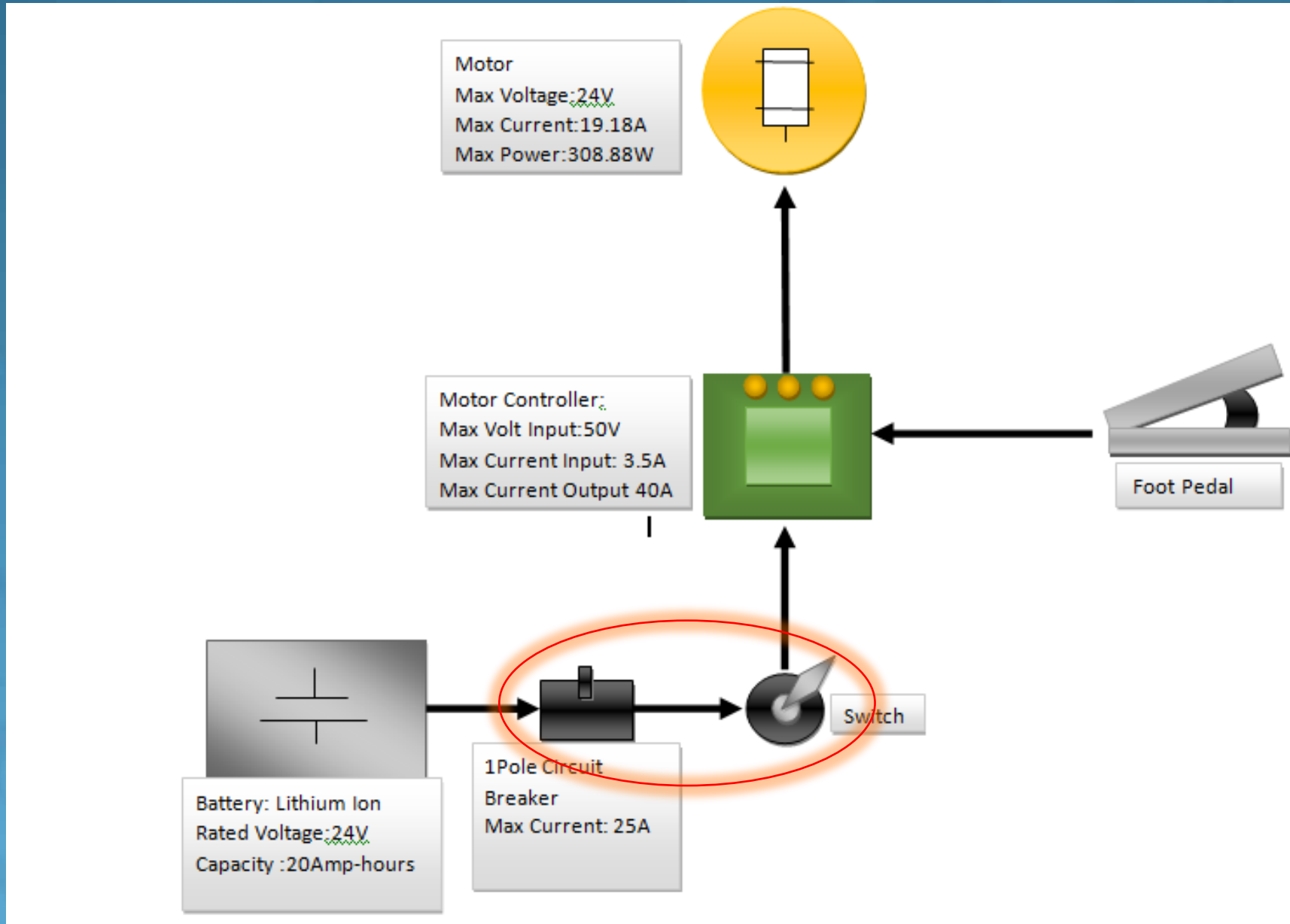
- Drive motors up to 50V and 40A
- Familiarity with Center for Advance Power Systems
- Screw terminals
 - Easy connection with motor's phases
 - Easy connection with battery

Motor Controller Tests and Result

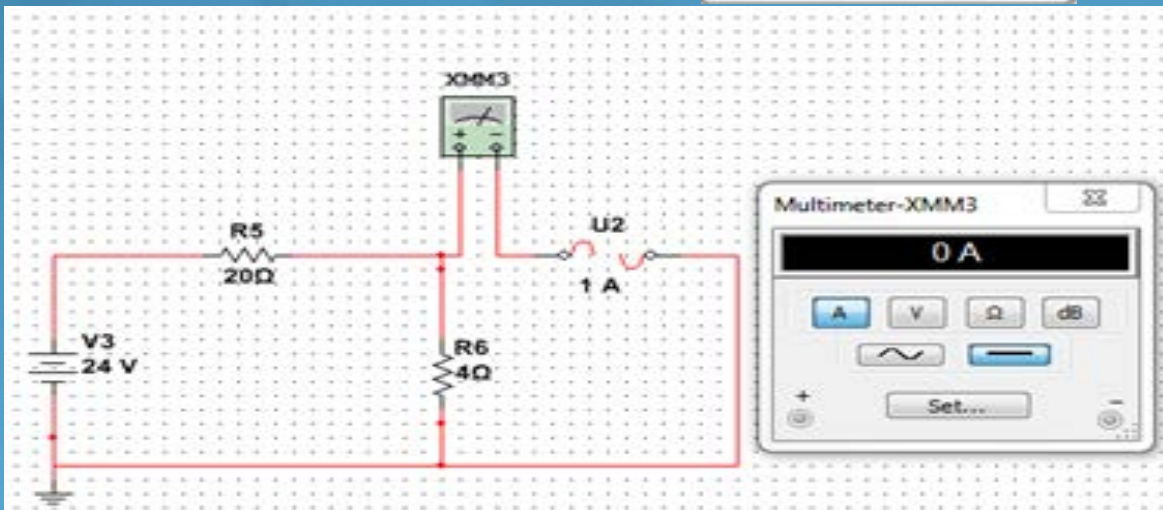
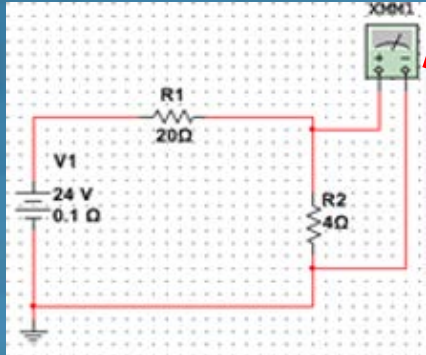
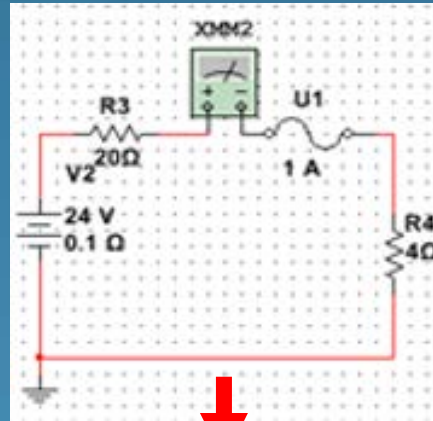
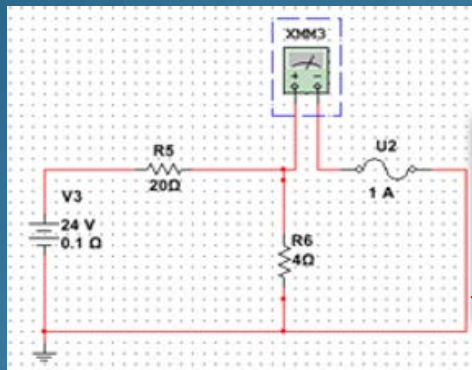
- TI InstaSPIN software
 - Identify motor parameters
 - Type in desired speed for motor in rpm
- Program controller to read input from foot pedal to drive motor
 - Using Code Composer Studio
 - C++ language



Propulsion And Emergency Shutdown System



Emergency Shutdown Tests and Results



- Model battery to find circuit breaker current rating
 - Fail
- Competition rules has no specifications on max current rating in system
 - Use max current rating for the motor as max current before emergency shutdown automatically activates

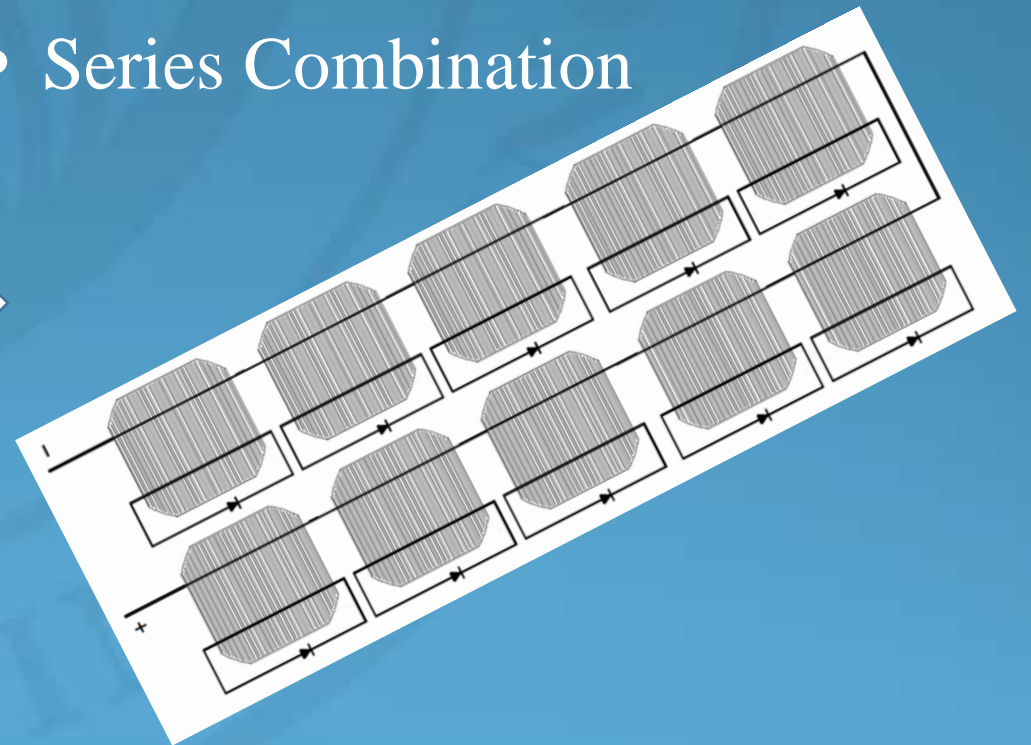
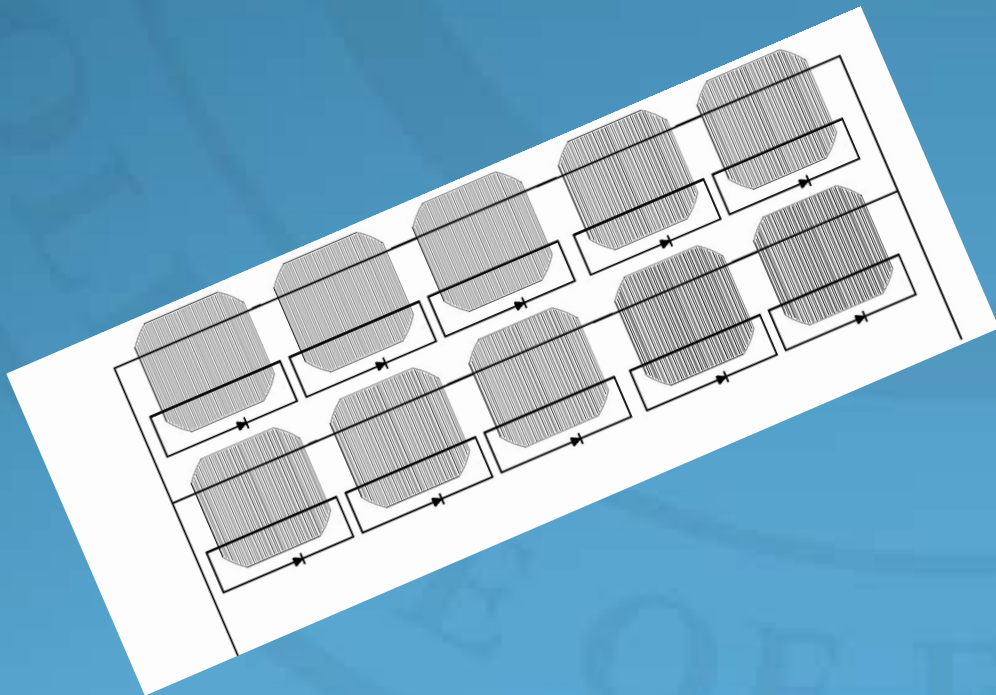
Solar Panel

Old array

- Diode boxes unnecessarily large
- Excessive wiring
- Output not suitable

New array

- Output of 12V
- Combination of cells
- Will charge battery using 1 DC-DC boost converter
- Series Combination



Solar Panel Tests and Results

Completed

- New Array
 - Confirmed 9V Output
 - With only 5 Cells
- DC-DC boost converter
 - I/O combinations
- New Cells
 - 0.56V
 - 1.76A

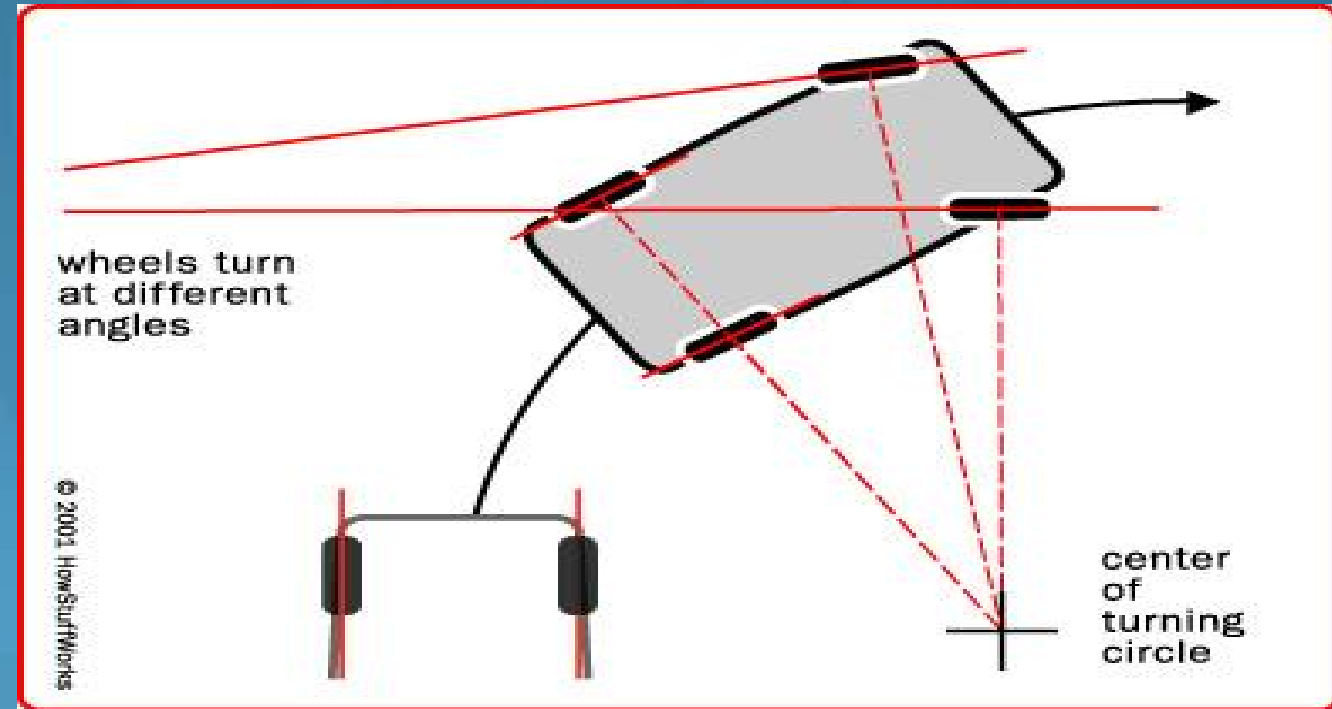
Planned

- Completed Array
 - Max power during optimum conditions
- Integration with DC-DC Boost converter
 - Typical output
- Charging system
 - Attach solar array and DC-DC boost converter
 - Measure Battery level

Safety and Requirement Tests

Requirements:

- Radius of curvature test
- Five point harness test
- Front, and rear brake test
- 10 second escape plan
- 5 point Harness



"How Car Steering Works." [HowStuffWorks](http://auto.howstuffworks.com/steering1.htm). 14 Feb. 2014
<<http://auto.howstuffworks.com/steering1.htm>>.

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Concept
Generation

ME
Overview

EE
Overview

Safety
& Req Tests

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Budget Update

Product	Vendor	Amount	Total Cost	Description
TI DRV8301 69M Kit	Mouser	1	328.90	Motor Controller
A 7Y55-PS11250 Ball Bearings	SDP/SI	4	95.12	Propulsion System
4130 Alloy Steel Round Tube	McMaster-Carr	4	172.60	Roll Bar
6061, Flat, 1 1/2 x 3 in, 1 ft	Grangier	1	35.85	Roll Hoop
6061, Blank, 1/4 x 12 x 12 in	Grangier	2	156.50	Roll Bar
Racing Seat	Summit Racing	1	52.97	Seating
Steering Wheel	Summit Racing	1	40.95	Steering System
Seat Brackets	Summit Racing	1	44.97	Seating
Rack And Pinion 14"	SandParts	1	97.00	Steering System
Tierod Kit	SandParts	1	52.31	Steering System
Front Wheel System	Univ. Cycles	2	452.96	Steering System
			Total:	\$1,530.13

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Requirements

Scheduling

Concept
GenerationME
OverviewEE
OverviewSafety
& Req Tests

Budget

Questions

