

# TEAM CULVER'S FINAL REPORT

# 6<sup>th</sup> Hour Team Roster



- *Zak Roeser - 2 years CAD classes, motorsports experience*
- *Sam Sconzert— 1 year of CAD experience, 1 year of Welding, 1 year of Small Engines*
- *Adam Jonet - 2 year of CAD classes*
- *Nathan Loberger - 1 year of CAD classes*



# Challenge

*Our challenge is to create a prototype formula car that not only meets Formula High School (FHS) standards but also brings about a new standard of high performance to FHS. The design must be adaptive to a variety of drivers, have simple operating conditions, put safety first protecting the driver from even the most devastating crash, and utilize sponsorship resources to create a superior car.*

# Practical Applications of Prototype

*Formula High School is a program designed to help engineering students learn about the basics of the manufacturing process. The program was started in 2008 by Mr. Meyer and Mr. Bessel. This program has multiple objectives to further student learning. First, students must apply their knowledge from other disciplines to the concepts of marketing, increasing public relations, and primarily increasing engineering skills. We learn how to operate machines, develop CAD models and work as a team. This formula car can be applied not only for its learning capabilities, but also for recreational purposes.*



# Frame Constraints

**Wheelbase:** 81" – 87" measured from center of front spindle to center of rear axle.

**Width:** 50" to 58" measured to the outside edge of the mounted tire.

**Max Overall Length:** 144" including body shell.

**Ground Clearance:** 2" MIN – 6" MAX

**Chassis:** All teams must use the supplied chassis model as the base for their vehicle. Chassis **MUST** be constructed to the chassis model within 1" of specifications. All frame members shown on the model must be present in the completed chassis.

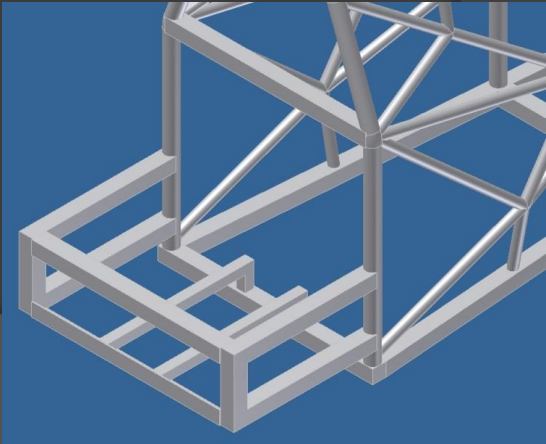
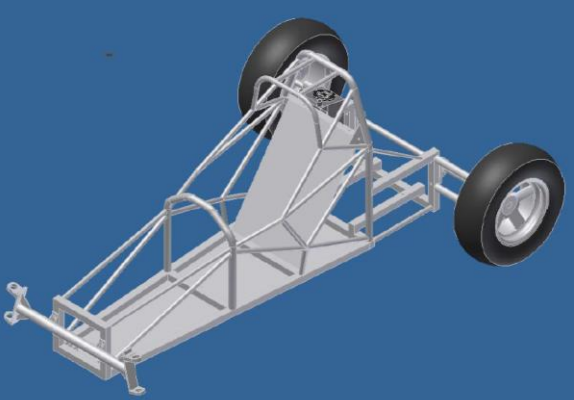
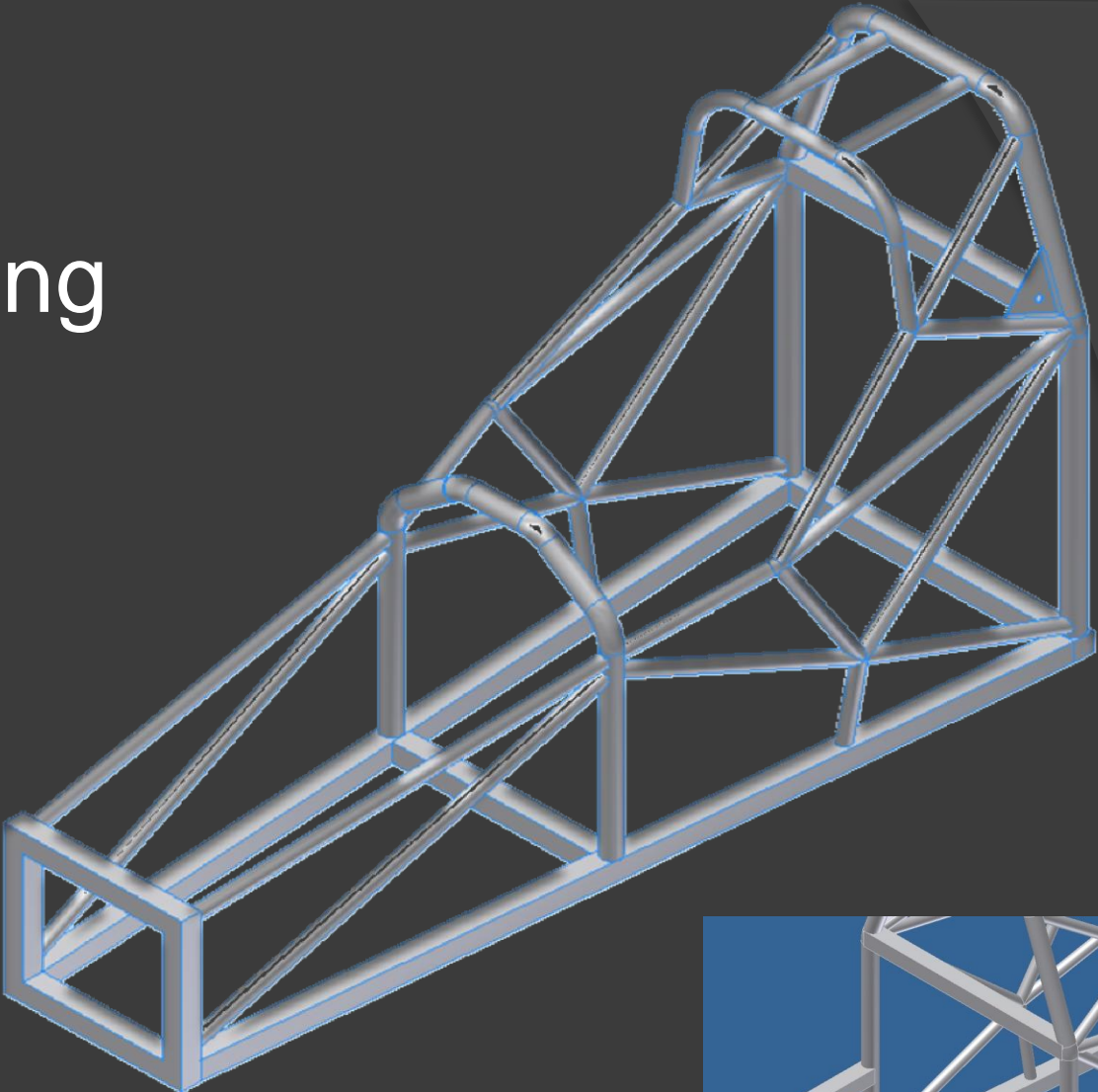
**Roll Bar Tubing:** 1 ½" round mild steel tubing, 0.083" (14ga) wall thickness. Roll bar tubing must be a single continuous piece. **NO SPLICING ALLOWED.** Driver's helmet should not be excessively forward of the roll bar protection when seated in the vehicle.

**Bracing:** 1" round mild steel tubing, 0.083" (14ga) wall thickness.

**Floor:** 0.0747" (14ga) mild steel sheet, stitch welded to the bottom frame rails. The minimum weld stitch pitch should be no more than 1-3.



# CAD Modeling





# Stages of Assembly

- ① Design and model frame (as per FHS standards)
- ② Custom cut and assemble basic frame
- ③ Design an assembly for: Front axle, steering, brake/gas pedal, battery mount, interchangeable seat system, firewall, engine mount, axle mount, gearbox mount, and electrical systems.
- ④ Map out parts using CAD, paper models, diagrams and sketches.
- ⑤ Order necessary parts, create custom parts.
- ⑥ Create assembly of frame, send off for paint.
- ⑦ Lay out fiberglass body of car, send off for paint
- ⑧ Final assembly of vehicle, test runs to test performance and make final adjustments.



# Gantt Chart

## September 2010 - October 2010

September 2010							October 2010						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
			1	2	3	4						1	2
5	6	7	8	9	10	11	3	4	5	6	7	8	9
12	13	14	15	16	17	18	10	11	12	13	14	15	16
19	20	21	22	23	24	25	17	18	19	20	21	22	23
26	27	28	29	30			24	25	26	27	28	29	30
							31						

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
August, 29	30	31	September, 1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
			Team planning and basic frame design (Preble)			
26	27	28	29	30	October, 1	2
Team planning and basic frame design (Preble)				FHS approved frame build (Preble)		



# October 2010 - November 2010

October 2010							November 2010						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
					1	2	1	2	3	4	5	6	
3	4	5	6	7	8	9	7	8	9	10	11	12	13
10	11	12	13	14	15	16	14	15	16	17	18	19	20
17	18	19	20	21	22	23	21	22	23	24	25	26	27
24	25	26	27	28	29	30	28	29	30				
31													

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
September, 26	27	28	29	30	October, 1	2
Team planning and basic frame design (Preble)				FHS approved frame build (Preble)		
3	4	5	6	7	8	9
FHS approved frame build (Preble)						
10	11	12	13	14	15	16
FHS approved frame build (Preble)						
17	18	19	20	21	22	23
FHS approved frame build (Preble)						
24	25	26	27	28	29	30
Front axle assembly (Preble)						
31	November, 1	2	3	4	5	6
Front axle assembly (Preble)						
		Professional advice from race				

# November 2010 - December 2010

October 2010							November 2010						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
					1	2	1	2	3	4	5	6	
3	4	5	6	7	8	9	7	8	9	10	11	12	13
10	11	12	13	14	15	16	14	15	16	17	18	19	20
17	18	19	20	21	22	23	21	22	23	24	25	26	27
24	25	26	27	28	29	30	28	29	30				
31													

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
October, 31	November, 1	2	3	4	5	6
Front axle assembly (Preble)						
		Professional advice from race				
7	8	9	10	11	12	13
Front axle assembly (Preble)			Front assembly (Preble)			
14	15	16	17	18	19	20
Front assembly (Preble)						
21	22	23	24	25	26	27
Front assembly (Preble)						
28	29	30	December, 1	2	3	4
Front assembly (Preble)			Seating and steering assembly			

# December 2010 - January 2011

November 2010

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

December 2010

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
November, 28	29	30	December, 1	2	3	
Front assembly (Preble)			Seating and steering assembly			
5	6	7	8	9	10	11
Seating and steering assembly						
12	13	14	15	16	17	18
Seating and steering assembly						
19	20	21	22	23	24	25
Seating and steering assembly						
26	27	28	29	30	31	January, 1



# January 2011 - February 2011

December 2010

	S	M	T	W	T	F	S
49				1	2	3	4
50	5	6	7	8	9	10	11
51	12	13	14	15	16	17	18
52	19	20	21	22	23	24	25
1	26	27	28	29	30	31	

January 2011

	S	M	T	W	T	F	S
1							1
2	2	3	4	5	6	7	8
3	9	10	11	12	13	14	15
4	16	17	18	19	20	21	22
5	23	24	25	26	27	28	29
6	30	31					

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
December, 26	27	28	29	30	31	January, 1
2	3	4	5	6	7	8
Rear end design (Preble)						
		Professional advice from race			Tires shaved and rims painted (Pomp's)	
9	10	11	12	13	14	15
Rear end design (Preble)						
Tires shaved and rims painted (Pomp's)						
16	17	18	19	20	21	22
Rear end design (Preble)			Rear end assembly			
Tires shaved and rims painted (Pomp's)						
23	24	25	26	27	28	29
Rear end assembly						
30	31	February, 1	2	3	4	5
Rear end assembly						

# February 2011 - March 2011

January 2011							February 2011								
S	M	T	W	T	F	S	S	M	T	W	T	F	S		
1						1	6		1	2	3	4	5		
2	2	3	4	5	6	7	8	7	6	7	8	9	10	11	12
3	9	10	11	12	13	14	15	8	13	14	15	16	17	18	19
4	16	17	18	19	20	21	22	9	20	21	22	23	24	25	26
5	23	24	25	26	27	28	29	10	27	28					
6	30	31													

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
January, 30	31	February, 1	2	3	4	5
Rear end assembly						
6	7	8	9	10	11	12
Rear end assembly				Wiring/electrical (Preble)		
13	14	15	16	17	18	19
Wiring/electrical (Preble)						
			Ceramic coated exhaust (Classic Coatings)			
20	21	22	23	24	25	26
Ceramic coated exhaust (Classic Coatings)						
Wiring/electrical (Preble)		Disassemble and prep frame for paint (Preble)				
27	28	March, 1	2	3	4	5
Disassemble and prep frame for paint (Preble)						
Ceramic coated exhaust (Classic Coatings)						
			Bearings processed (UDL process) (Boca Bearing)			

# March 2011 - April 2011

February 2011							March 2011						
S	M	T	W	T	F	S	S	M	T	W	T	F	S
		1	2	3	4	5			1	2	3	4	5
6	7	8	9	10	11	12	6	7	8	9	10	11	12
13	14	15	16	17	18	19	13	14	15	16	17	18	19
20	21	22	23	24	25	26	20	21	22	23	24	25	26
27	28						27	28	29	30	31		

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
February, 27	28	March, 1	2	3	4	5
Disassemble and prep frame for paint						
Ceramic coated exhaust (Classic Coatings)						
			Bearings processed (UDL process) (Boca Bearing)			
6	7	8	9	10	11	12
Bearings processed (UDL process) (Boca Bearing)						
Disassemble and prep frame for paint (Preble)				Frame Being Painted (DeGrave)		
				Layed out fiberglass body (Fiberglass Solutions)		
13	14	15	16	17	18	19
Frame Being Painted (DeGrave)						
Layed out fiberglass body (Fiberglass Solutions)						
Bearings processed (UDL process) (Boca Bearing)						
20	21	22	23	24	25	26
Frame Being Painted (DeGrave)						
Layed out fiberglass body (Fiberglass Solutions)				Sent body to paint (Clancy's Automotive)		
27	28	29	30	31	April, 1	2
Sent body to paint (Clancy's Automotive)						Body cleaned up fitted, vinyls
Frame Being Painted (DeGrave)				Final frame assembly (Preble)		
				Professional help and advice		



# April 2011 - May 2011

March 2011							April 2011								
S	M	T	W	T	F	S	S	M	T	W	T	F	S		
		1	2	3	4	5						1	2		
10	6	7	8	9	10	11	12	14	3	4	5	6	7	8	9
11	13	14	15	16	17	18	19	15	10	11	12	13	14	15	16
12	20	21	22	23	24	25	26	16	17	18	19	20	21	22	23
13	27	28	29	30	31			17	24	25	26	27	28	29	30
14								18							

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
March, 27	28	29	30	31	April, 1	2
Sent body to paint (Clancy's Automotive)						Body cleaned up fitted, vinyls
Frame Being Painted (DeGrave)					Final frame assembly (Preble)	
Professional help and advice						
3	4	5	6	7	8	9
Final frame assembly (Preble)						
Body cleaned up fitted, vinyls placed (Preble/ Zak Roeser's Home)						
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

# Performance Parts Unique to this Build

## ⦿ Ultra Dry Lube (UDL) Bearings

- Low Co-efficient of Friction (0.030)
- Extensively modified lamellar composition of Tungsten Disulfide.
- Anti-Galling / Anti-Seizing



## ⦿ Shaved Tires

- Tires were shaved to decrease outer diameter weight (approx 1.5lbs per tire)
- Increased grip



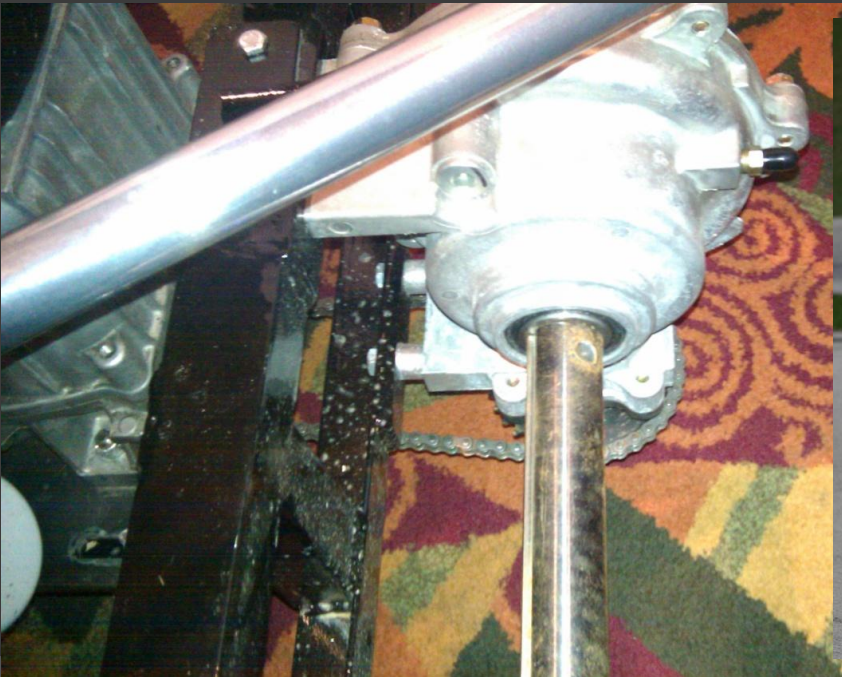
## ⦿ Ceramic Coated Exhaust

- Less heat on nearby mechanical components
- Increased heat dissipation increases performance



# Performance Parts Unique to this Build Cont.

- ◎ Rear Locking Differential
  - Allows rear wheels to rotate independently
  - Provides increased handling and performance when turning





# Prototype Ergonomics

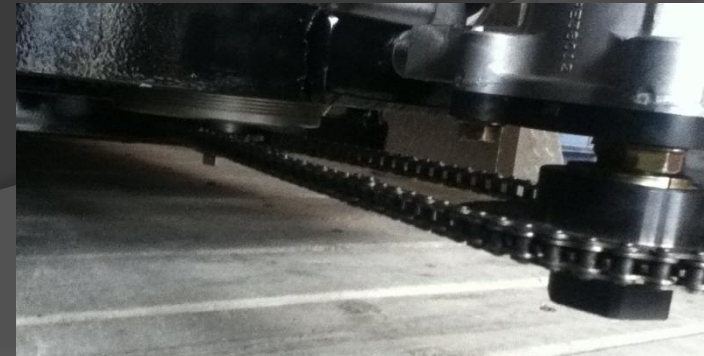
- ⦿ Professional seat used to increase driver comfort.
- ⦿ Interchangeable seat system to accommodate for taller drivers.
- ⦿ Steering may be adjusted for smaller drivers.
- ⦿ 5-point seatbelt system maximizes safety
- ⦿ All functions for ignition and operation are easily accessible for simple operation.
- ⦿ All components are located away from leg and arm space to minimize any possible discomfort or safety risks.
- ⦿ All ignition components are clearly marked for easy understanding.
- ⦿ Official's safety switch and key slot are easily located and clearly labeled for adult supervision and guidance while driving.



[Click for Movie](#)

# Gear Ratio Calculations

- Aimed for an 8:1 gear ratio
- Calculated overall gear ratio to 8.06:1
- 3.82:1 gear ratio for rear differential
- Determining number of teeth needed for clutch and sprocket:
  - Rear Differential Gear Ratio= 3.82:1
  - $8/3.82 = 2.09$  gear ratio for Drive/Driven shaft
  - $(18 \times 2.09) = 37.70$  ,or 38 tooth sprocket



# Fiberglass Body Fabrication

- Model and mold provided by SugarGroveCustomCars.com. Based off of the “Mystique.”



- Fiberglass body created entirely by students, painted by Clancy's Auto.

# Business and Industry Involvement

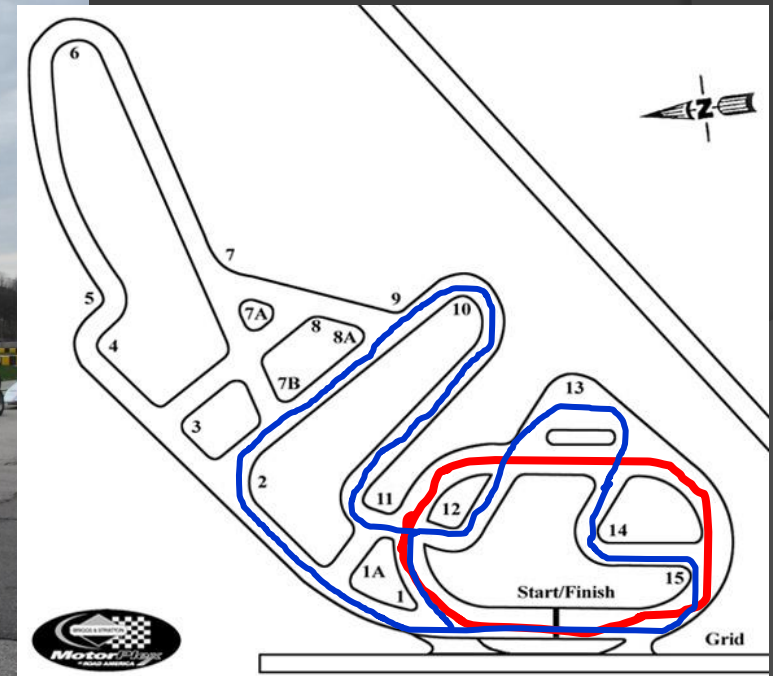
- Culver's
  - Provided the funding for many parts, our main sponsor
- Clancy Automotive
  - Painted fiberglass body
- Fiberglass Solutions, Inc.
  - Provided fabrication of fiberglass body
- Gandrud Auto Group
  - Purchased clutch
- Boca Bearings
  - Provided specialized bearings
- Degrave Mediablasting & Painting LLC.
  - Painted frame of car
- Classic Coatings Inc.
  - Provided specialized exhaust performance coating





# Race Day Results

Driver (6 <sup>th</sup> hr only)	Zak Roeser	Nathan Loberger	6 <sup>th</sup> Hr. Avg.	Track Record
<b>Best Oval</b>	18.56 sec	18.44 sec	18.50 sec	17.38 sec
<b>Best Road</b>	53.45 sec	58.35 sec	55.90 sec	49.81 sec

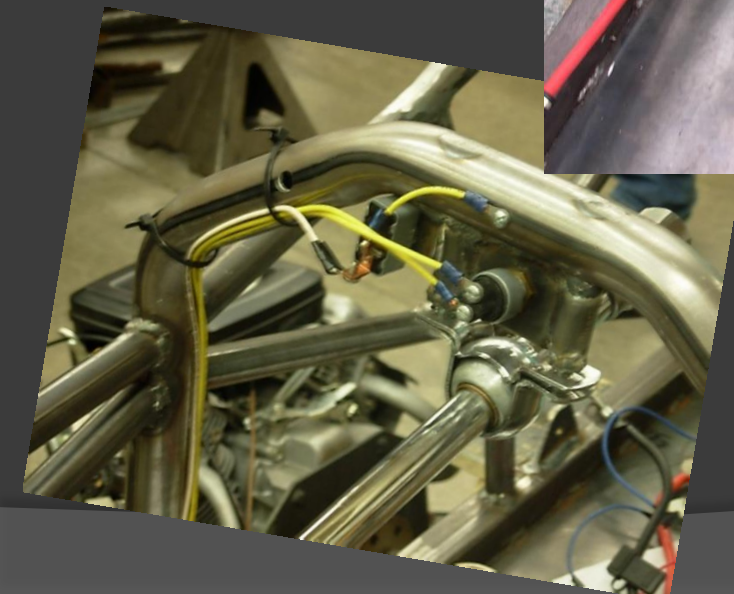
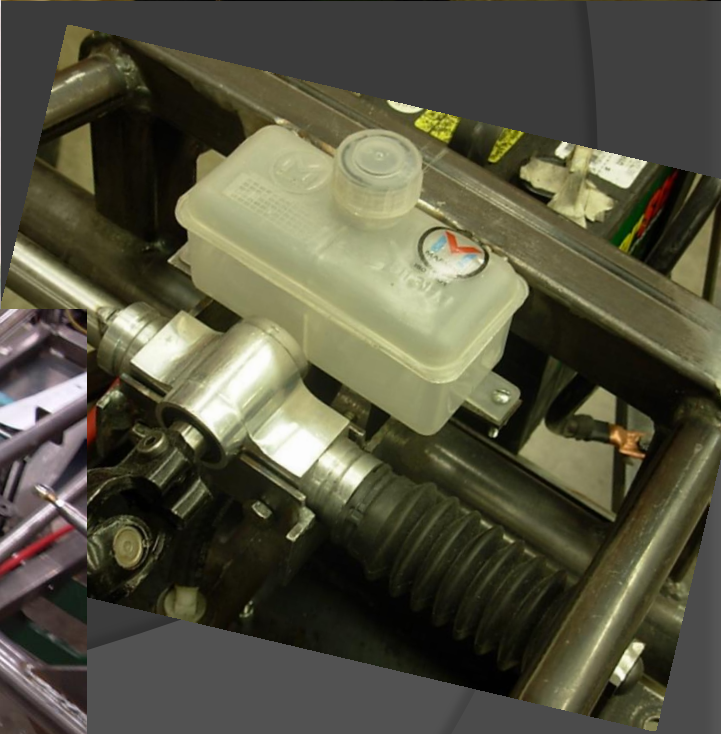
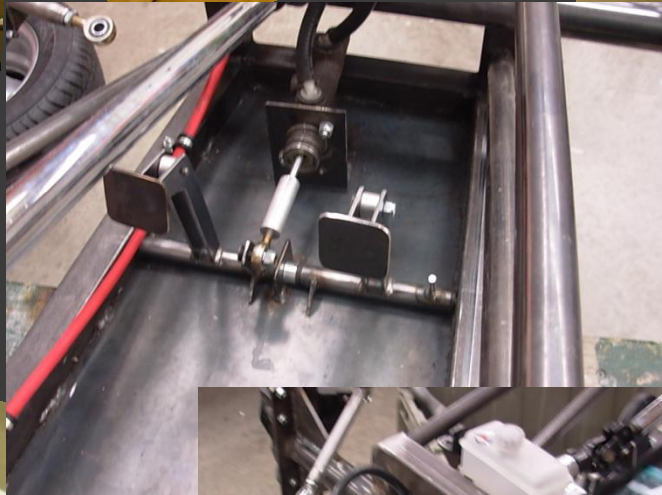
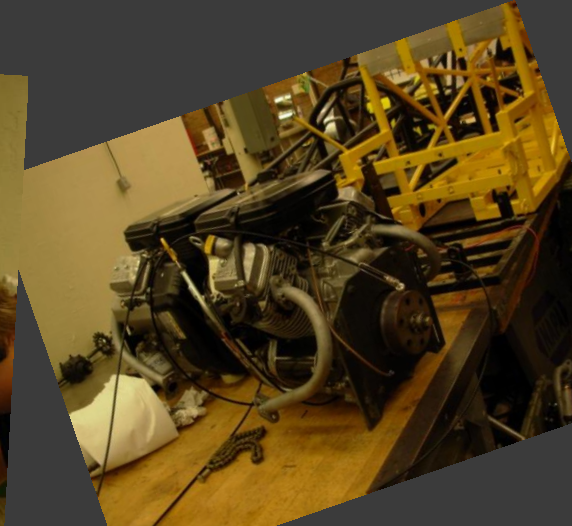




# Additional Build Pictures











Missing from Photo: Sam Sconzert





# Clancy's Auto



We would like to extend a thank you to all our sponsors for all they did to make this



project happen.

Special Thanks to:

Jeremie Meyer  
Kip May  
John Roeser

