Team SGCC

Formula High School: Racing to Learn

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We would like to extend a big thanks to Sugar Grove Custom Cars for being our teams sponsor. Without their help none of this would be possible. Thank you very much!

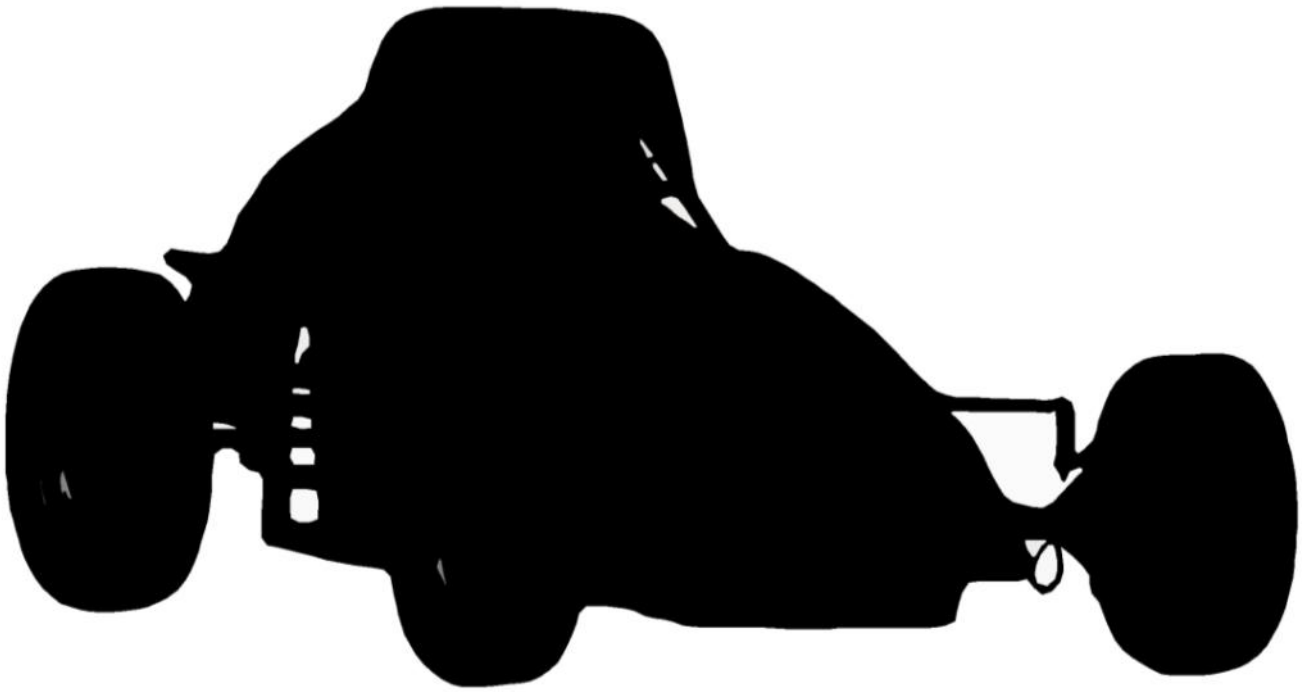
About FHS

Formula High School (FHS) is a program for students who are involved in engineering. In this program, students must start from scratch to build an official Formula High School vehicle. Students are given a 3-D AutoCAD model of the chassis from which they are to build the car off of. The first thing students must do is find sponsors to finance the vehicle. Next, students must order material and parts to construct the vehicle. Starting from ground up, students work their way to a completed car. Working in teams, students must reach a deadline for the vehicles to be done in order for them to compete at the race track. Once at the track students get an opportunity to show off their vehicle. They race against different schools and different teams to see who can get the fastest times, and find out who built the highest quality car.

Formula High School has seven goals that all teams are trying to achieve

- Increase awareness of engineering and technical careers.
- Promoting team work and interpersonal skills among competitors.
- Construction of a product with specific tolerances and deadlines.
- Applying knowledge from other disciplines to an engineering problem.
- Connect the schools and students to their local manufactures.
- Apply the concepts of marketing and increase the students public relation skills.
- Help create the workforce of the future.

(All Goals come directly from www.formulahighschool.com)



Team Members

In order for us to complete this car in a timely fashion, we chose teams to work in. Our team, Team SGCC, consisted of Jim Rettler, Kieran McCabe, Max Kraft, Nate Boulanger, Zach Peters, George Blaney, and Branden Longton. Every member played an important role in this process. We all were taking this class for the first time, so we had to work together to make sure we made a high quality vehicle.

Jim Rettler– Jim played a major role in building the vehicle. Jim probably had the most experience working with vehicles. He welded most of the frame which took the majority of the time. By doing this, it helped improve his welding ability. He also learned a lot of new information from this class. He learned how to wire the vehicle and how to lay out the cars fiberglass body. Jim feels that he has, "learned many things this year that will help him throughout his life."

Kieran McCabe– Kieran was also very experienced working with vehicles. He helped by cutting most of the components that were welded together to make the chassis. He occasionally would weld parts when needed. Kieran also played a major role in building the front axle, the brake system, and the gas and brake pedals. He also assembled the entire choke system and helped wire the car. Kieran feels that this class is a, "once in a lifetime opportunity" and he is, "extremely satisfied with the product."

Max Kraft– Max was very new to working with vehicles, but he quickly learned. He helped make many little tabs and miscellaneous parts for the vehicle. Along with that, some of the major things he helped work on included, the exhaust system, the seat, and the cushion. He also helped make the logos for the car and helped with cutting out material for the chassis. Max is, "very happy" he took this class because he doesn't think he could get the, "hands on training in any other class except this one."

(From Left) Max Kraft, Branden Longton, Zach Peters, Jim Rettler, George Blaney, Kieran McCabe, Nate Boulanger

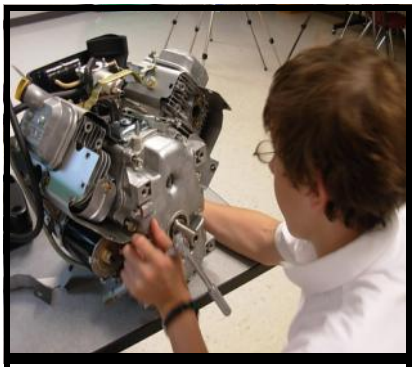
Team Members

Nate Boulanger– Although Nate was relatively new to working on cars, he did his best to jump headfirst into the project. Some of the things Nate worked on included the front axle, designing and constructing the firewall, and working on the design of the engine mount of the vehicle, and help make logos. Nate also spent some of his time cutting and sanding the unfinished body. Nate would just like to say, "thank you to all the sponsors for help making this class possible, it was extremely valuable."

Zach Peters-This was Zach's first year working with vehicles. He started out slow but quickly picked up the concept of making a car. Zach did many tasks which were very important for our teams success. He helped with taking out the governor, and helped cut and measure steel which we used for the chassis. He also helped design the rear end of the car, prepare the body shells for painting, and put the sponsors logos on the car. Zach will, "never forget the experience he had in this class."

George Blaney– Having no prior experience working with cars, George was apprehensive in the beginning of the year. As the year went on however, George became more and more active in the project. George sanded the fiberglass body and also helped with the back axle. He worked on a lot of small projects to help other people with their larger ones, such as creating the front axle supports. George is, "grateful" for having an opportunity to take this class.

Branden Longton– Branden was also another member of the team who was new to working with vehicles, but he did his best to help out wherever he could. Branden did a lot of important computer work for the team. He would take all the pictures and write all of the team updates for our group. He was always trying to be involved in whatever our group was doing. Branden also helped prepare the engine, prepare the body shell for painting, and helped put logos on the completed car. Branden, "enjoyed" his time in this class very much, and "wishes we could do this year all over again."



Branden Longton removing the governor.

Jim Rettler welding the chassis.

Zach Peters cutting material for the chassis.

Building Process

The process of building our vehicle was long, stressful, and difficult, but at the same time it was extremely fun, educational, and rewarding. We started the year off with getting our sponsorship. We decided that Sugar Grove Custom Cars was perfect for us, and requested to have their sponsorship. They accepted, and we were on our way to completing the vehicle. The first task we had, was to modify our governor and throttle on our donated Briggs and Stratton Vanguard 16HP V-Twin engine. While some of our group members ordered parts, others began to build the chassis for the car. The base of our chassis was relatively easy and we experienced very few problems. The biggest setback we had during the construction of our chassis was when one of the two welders that our class used broke down. This slowed the welding, which then slowed the overall building process. Eventually a new donated welder arrived, and things were once again running smoothly.

(From Left) Max, Branden and Jim work on the governor of the engine.

With fewer problems, we had most of our chassis assembled. Since we did not have the equipment needed to get our floor of the vehicle cut at school, we had NWTC cut it for our group. We designed the floor on the Autodesk Inventor software, and then we had it cut out on the water jet cutter. When we got the floor back to school we quickly welded it to the car, and then our chassis was complete. As a team, we then designed and built our back end of the car. It was important that this was extremely accurate, because this is where our engine is held. Everything in the back end was going great until we realized we had a problem with the engine plate. The holes in the plate were not the same distance as the bolts in our backend. Therefore, we had to sand our plate so the bolts and holes would line up and the engine would be able to adjust with no problem.


Our chassis completely welded along with back end attached.

When November rolled around, we realized that we needed to make our body soon. We set up an appointment with the owner of Fiberglass Solutions, Mr. Ken Glowacki, to make our body. At Fiberglass solutions we laid up the entire body with the assistance of Mr. Meyer, and Mr. Glowacki. The process took us about an hour and half to do, but when we were done, we were very confident that the body would turn out excellent. Although laying the body out was easy, trimming it up and making it look good was not. It took us a couple weeks to completely sand it, and have it fit our chassis. We also had to drill around 20 holes on the body so it would stay in place while racing.

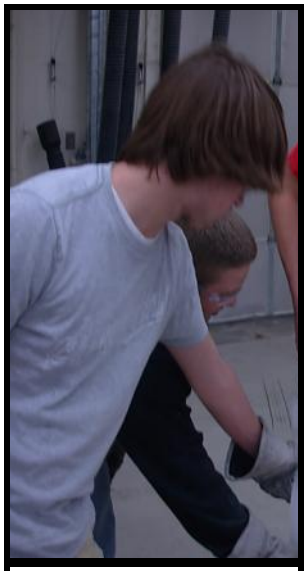

Our chassis in the beginning stages.

Building Process

While some members of our group were working on our body, the rest of them began to assemble the parts to the car. Some things took much more time than others. We quickly got our engine in, along with our brake reservoir and fuel cell mounted. As we were installing our pedals, we had a little trouble trying to get them in the right position. Eventually we figured it out and they work great. As the end of the first semester drew closer, we knew we needed to work faster. We still hadn't finished our front axle or exhaust system. We also had to wire our car and get it running.

Max Kraft helping with the assembly of the chassis

When the second semester started, we quickly got things going. We experienced many problems trying to get our exhaust system right, but we worked them out and installed it to our car. Eventually the parts for our front axle arrived. We quickly finished, by installing it in about week and a half. Once the front axle was installed we began working on the back axle. We experienced fewer problems than we did with the front axle so it went much quicker. We then installed our brakes with very little problems too.


Nate Boulanger working on finishing the body

We had all the parts to our car installed. All we had to do was wire the car up and we could run it. The wiring took us about a week to complete, but we were very excited once it was done because we got to hear our engine run for the first time. Everyone in our group was relieved when we knew that the car we had been building for the past 6 months was finally working. Unfortunately, we were still not done, we still had to get our chassis and body shells painted. We new we had a lot of work yet to do.

When our body shells finally fit our car, we sent them off to get painted by the students of NWTC. Then we began the complete disassembly of our car down to the bare chassis. That process went very quickly, and our car was ready for painting. DeGrave Mediablasting decided that they would like to help sponsor our car. They sand-blasted and painted our entire chassis free of charge. By doing this, Mr. Kerry Degrave saved us time and deserves a huge thanks! DeGrave quickly had our chassis prepared and we picked it up a week after we dropped it off. At nearly the same time we got our chassis back, we also got our body shells back from NWTC. We were able to start reassembling and rewiring the car, along with getting it race ready. This didn't take too long, but race day was quickly approaching and the car was not completely finished.


Members of our team working on the engine

Building Process

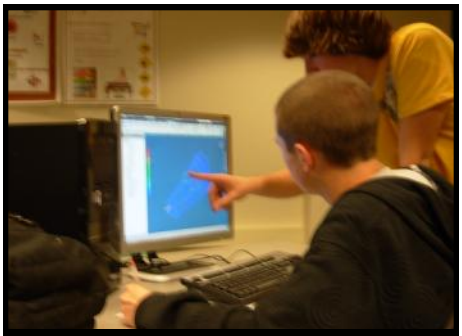
We had to still put the logos on the car, along with some finishing touches. While Jim, Kieran, George, Branden, and Zach applied the finishing touches, Max and Nate worked on designing and printing all of the logos. The logo process at times was confusing, trying to figure out exactly how each of the logos were to be designed. With only two days before race day, the logos were just being printed, and our group had to scramble to get them on the body. With everyone's help, we got the logos on and our car was finally complete.

Our entire group was extremely satisfied with the car we had made. All the hard work that we put into this was well worth it. We spent many long hours on Thursday nights working to complete our vehicle. Many of us in our group also came in during our lunch hours, study hall, and before school. We have made this vehicle to our best ability and we hope all of our sponsors will be proud to have their companies names on our vehicle.

George, Zach, Kieran, and Branden work on preparing the body for painting.

The finished car with no body on.

The pedals before we first had to remove them.



Nate and Zach designing parts on the chassis.

Completed Vehicle

After many months of hard work and preparation our car is finally complete. In these pictures we prepare to load our car up on the trailer prior to taking it to Road America.

Completed Vehicle

Race Day

FHS's 2010 races were held at the Briggs and Stratton Motorplex at Road America in Elkhart Lake, Wisconsin. Throughout the morning, we were hit with a large amount of rain which caused track conditions to be very slick. Although we had wet conditions our drivers managed to have great times on all three different course configurations. The first track configuration of the day that we ran was are worst. Jim Rettler had the best time for our team with a 20.25 second run, this put him in 9th place. As an overall team we took 2nd place on the oval course. The next track was the long road course. As a team, we finished first, making this our best course. Helping us get a first place finish was Jim Rettler. He finished 2nd individually, with a 91.93 second run. Kieran McCabe was right behind him with a 92.56 second run that put him in third place. Also on that course, Max Kraft had a respectable finish. He came in 13th with a time of 99.50. The last course that we ran was the short road course. This was our worst course as a team. We ended up with a 3rd place finish. Once again Jim Rettler and Kieran McCabe led our team.

Overall our race day was a huge success for our team. Of the nine teams competing, we were the only team to place in all three courses. The only problem we experienced was our clutch bolt coming loose. To fix it, we had to keep retightening it after every couple races. Although it was a pain, it worked well enough. With the great race times and the few problems, we feel that we had a great performance at the track.

Race Day

Before running the car, we make some minor adjustments.

An excited Jim Rettler, before he drives the car for the first time.

Kieran McCabe driving the car.

Max Kraft driving the car.

Parts

Part Description	Manufacturer	Model Number	Cost	Qty	Total Cost
Master Cylinder Assembly	California Import Parts	VWC-113-611-015-BH	$39.95	1	$39.95
Brake Fluid Reservoir	California Import Parts	VWC-113-611-301-L	$5.50	1	$5.50
Thrust Washer	California Import Parts	VWC-111-405-661	$1.75	2	$3.50
Ball Joint Eccentric	California Import Parts	VWC-131-498-319	$28.45	1	$28.45
Upper Ball Joint	California Import Parts	VWC-131-405-361-F	$12.95	2	$25.90
Lower Ball Joint	California Import Parts	VWC-131-405-371-G	$12.95	2	$25.90
Disk Brake Conversion Kit Blank Rotors	California Import Parts	ACC-C10-4121	$269.95	1	$269.95
Disk Brake Caliper Used for rear axle	California Import Parts	C13-98-1150-B	$64.95	1	$64.95
Front Brake Rubber Hose	California Import Parts	VWC-311-611-701-B	$9.45	2	$18.90
Dust Cap	California Import Parts	VWC-111-405-692-B	$2.75	2	$5.50
U Joint for Rack and Pinion	California Import Parts	C26-425-160	$24.95	1	$24.95
Splined Shaft for U-Joint	California Import Parts	C26-425-164	$8.50	1	$8.50
Universal Chrome Steering Shaft	California Import Parts	C26-425-011	$32.95	1	$32.95
Chrome Steering Bearing	California Import Parts	C26-425-013	$12.95	1	$12.95
14" Rack and Pinion	California Import Parts	C26-425-150	$99.95	1	$99.95
Quick Release Steering Wheel Hub	California Import Parts	C26-415-100	$16.95	1	$16.95
Brake Hub for 1 1/4" Axle	BMI Karts	600503	$14.95	1	$14.95
Sprocket Hub - 1 1/4" Axle	BMI Karts	600243	$28.95	1	$28.95
35 Series Split Sprocket	BMI Karts	6053**	$14.86	1	$14.86
35 Series RLV Extreme Chain	BMI Karts	400635GG	$14.95	1	$14.95
Steering Wheel 10" DIA	BMI Karts	410200	$21.99	1	$21.99

Parts

Part Description	Manufacturer	Model Number	Cost	Qty Needed	Total Cost
1 1/4"" Tubular Steel Axle Bearing Mount Kit	BMI Karts	400415	$24.95	2	$49.90
44" 1 1/4"" Tubular Chrome Moly Axle	BMI Karts	601444	$43.50	1	$43.50
Gearbox	Hub City	N/A	$265.00	1	$265.00
13 x 6 Steel Wheels 2.5" BS 4 holes on 4" BC	Bassett Racing Wheels	N/A	$65.25	4	$261.00
Formula High School Fiberglass Body Shell	Fiberglass Solutions	N/A	$350.00	1	$350.00
16 HP Briggs V-Twin Engine, with clutch assembly With Shipping	Donated by Briggs and Stratton	N/A	$0.00	1	$0.00
1 1/2" Square Tubing 11 ga 40 feet	SI Metals	N/A	$1.47	40	$58.80
1 1/2" Round Tubing 13 ga 20 feet	SI Metals	N/A	$1.66	20	$33.20
1" Round Tubing 13 ga 40 feet	SI Metals	N/A	$1.19	60	$71.40
RCI Aluminum Fuel Cell	Summit Racing	RCI-2010A	$95.95	1	$95.95
R.J.S. Racing 5 Way Harness	Summit Racing	50502-18-23	$59.95	1	$59.95
Drive Hub 1 1/4" Axle 4 on 4" BC 1/2" Studs and Lug Nuts	Jegs.com	056-9030	$25.99	2	$51.98
Roll Bars	US Auto Force	N/A	$40.00	1	$40.00
Comet TAV 2 Torque Con-verter	Small Engine Suppliers	218352A	$209.95	1	$209.95
12 Tooth Clutch with Drum	600 Racing	N/A	$79.99	1	$79.99
Total Cost					$2451.07

Benefits of FHS

Throughout this year, our team has had the honor of learning and experiencing many things that most high school kids cannot. One major thing we will take away from this program is the time we spent working in a team. Whenever there was a decision to be made, we had to agree on it as a team. Many times we disagreed on how we thought we should do something. We learned that we cannot argue and we must agree on something quickly and in a professional manner. Along with teamwork, we learned many of the basic principals that go into building a motorized vehicle. Our entire group came into this program with very little experience in building Formula High School cars, but we worked very hard, and learned quickly. Some skills we earned in this building process were: welding, bleeding breaks, tire alignment, modifying an engine, wiring of a vehicle, and designing decals. Another major thing we benefited from is getting the experience of working in the "real world". We had the opportunity of ordering parts and communicating with real company owners.

Along with learning many things, we also received a lot of exposure in the public eye. A few times throughout the year we had cameramen and reporters in our room, showing the area community what we were doing. We had reporters from the Green Bay Press Gazette and CBS Channel 5 news interview people from our team and other teams. Along with that, Wisconsin Public Television interviewed students, taped us working, and taped our race day. That was all apart of their series, Blueprinting Wisconsin's Future.

This class was very beneficial to all of our members. We are extremely happy that we had the opportunity to be apart of this program. We will take everything we learned from this class and use it the rest of our lives, no matter what we end up doing.

Sponsors

We would like to give a special thanks to all the sponsors who helped us in the completion of this vehicle. Without their help this would not be possible.
THANK YOU!