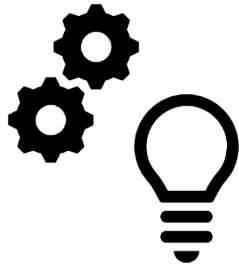


2018-  
2019

983



# Information



## Electric Car at Kennedy

John F. Kennedy High School's electric car program is called Cougar Electric Car Company. Our school and program is located in Cedar Rapids, which is in east-central Iowa. Cougar Electric built its first car in 1998 to take part in the 1998-1999 race season. In 2001, Iowa governor, Tom Vilsack, awarded the FINE (First In Nation in Education) award. We were one of five k12 programs in Iowa to receive this award, as well as the first electric car program in the nation to win a prestigious award in education.

When the program was originally held as an after school class, but starting in 2016, it was added to the normal school day. All of the planning, designing, and assembly are done in the shop by students. The cars are made from aluminum tubing which gets covered in foam padding. The entire car is then covered with painted plastic that has been cut to the necessary shapes and sizes to enclose the car. Finally, each car is decorated with the necessary graphics and a few fun ones. This year, we have added telemetry, which is going smoothly, and will be fully functional by the first race.



## **Skills**

Cougar Electric Company provides an opportunity to learn a variety of soft and Iowa Core skills. Soft skills include problem-solving, communication, and time management. These soft skills as well as the Iowa Core skills below that learned in the program help students in their everyday life and their future.

### **Iowa Core Skills**

- ❖ Manage money efficiently by developing spending plans and selecting the appropriate financial instruments to maintain positive cash flow
- ❖ Demonstrate critical thinking skills using the appropriate tools and resources to plan and conduct research, manage projects, solve problems, and make informed decisions
- ❖ Communicate and work productively with others to increase innovation and work quality
- ❖ Adapt to various roles and responsibilities
- ❖ Changing priorities
- ❖ Demonstrate leadership skills, integrity, ethical behavior, and social responsibility while collaborating to achieve common goals
- ❖ Demonstrate initiative and self-direction while exploring the ways individual talents and skills can be used for productive outcome in personal and professional life
- ❖ Demonstrate productivity and accountability by meeting high expectations
- ❖ Listening to establish, maintain, and enhance relationships
- ❖ Gain knowledge through problem solving
- ❖ Apply and adapt a variety of appropriate strategies to solve problems
- ❖ Understand, analyze, represent, and apply problem (problem solving skills)
- ❖ Understand and interpret descriptive statistics



# Race Schedule

## April 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	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				

April 6<sup>th</sup>, 2019

April 12<sup>th</sup> & 13, 2019

April 26<sup>th</sup> & 27<sup>th</sup>, 2019

April 28<sup>th</sup> & 29<sup>th</sup>, 2019

West Point  
University of Wisconsin Platteville  
Stout  
Autobahn

West Point, Nebraska  
Platteville, Wisconsin  
Menomonie, Wisconsin  
Joliet, Illinois

## May 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
			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	

May 4<sup>th</sup>, 2019

May 10<sup>th</sup>, 2019

May 13<sup>th</sup> & 14<sup>th</sup>, 2019

May 18<sup>th</sup>, 2019

May 19<sup>th</sup>, 2019

Wayne  
Berlin  
Road America  
Hawkeye Downs  
Prairie

Wayne, Nebraska  
Marne, Michigan  
Elkhart, Wisconsin  
Cedar Rapids, Iowa  
Cedar Rapids, Iowa

# Team

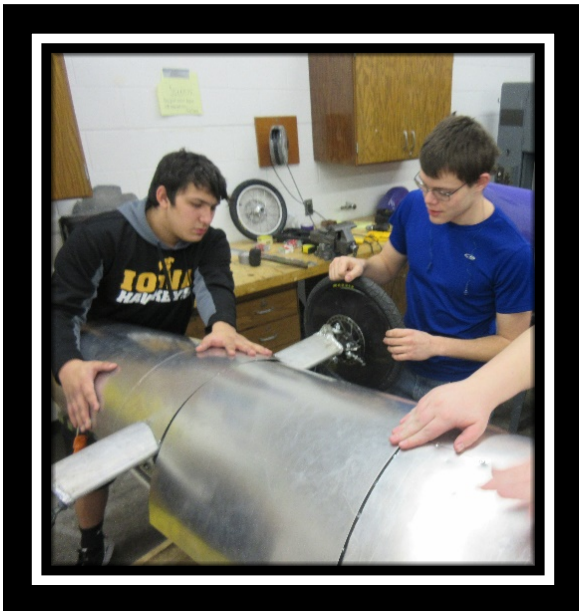


# Departments

## Mechanical engineering

There are several small teams that fall under the overhead title of Mechanical Engineer. They are; Crew Chief, Machinist, and Aerodynamics/Design.

**Aerodynamics and Design-** The job of our aerodynamics and design team is to make 1/10 scale models of our cars, then advise the crew chiefs either where to make their car more aerodynamic, or if the crew chief is making a new car, tell him which parts of other cars to copy and what parts to do differently. They also help the crew chief that is making a new car with his design. The only current member is Lucas Corrigan.



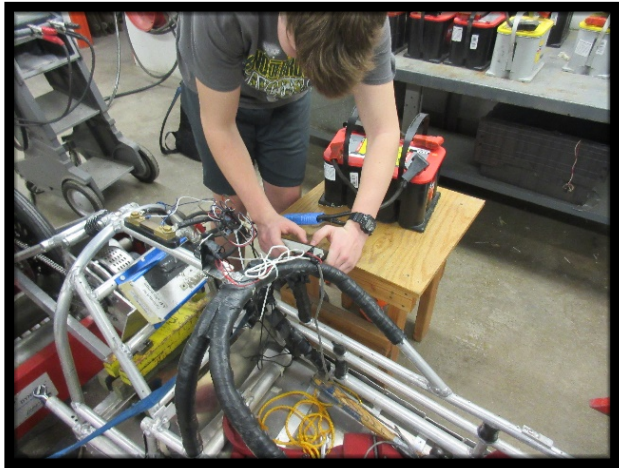
**Crew Chief-** Our crew chiefs are responsible for designing and building their car, or any changes made to it throughout the year. They also work with their drivers at the races to ensure the best possible performance by their car. They also have the unofficial responsibility as class leaders. Our current crew chief for the 983 is John Tedesco, who is mentoring Colin Flannagan; for the 984 is Derek Severson, who is mentoring Jesse Hempstead; and for the 985 Bryan Becker, who is mentoring Isaac Hofferber.

**Machinist-** Our machinists have the duty to work with the crew chiefs to make the parts they need to either improve their cars or the make parts for whatever new car we build that year. Our current machinists are Cody Gibbons and Jakob Davis.



## **Electrical Engineering**

There are two teams that fall under the overhead title of Electrical Engineer. They are Telemetry and Batteries/Trailer Maintenance.

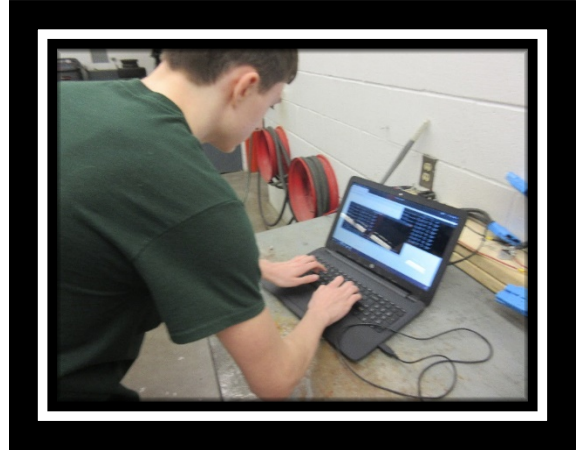


### **Batteries and Trailer**

**Maintenance-** Our battery technicians have several jobs; to take care of the batteries by fully charging them after every race, then freezing the batteries to preserve them; to set up our dyno tester and ensure it is at full performance, then test the old batteries to find out how useable they are for the upcoming season; to keep the trailer clean, neat, and organized at all times; and finally, to care for

the batteries and the trailer at races and other events. Our current battery technician is Noah Wilson, who is mentoring Dennis Davis.

**Telemetry-** Our telemetry team has had the burden this year of creating a car-to-pit communications system so the crew chiefs can look at the laptop and know exactly how many volts we have left, how many amps and amp hours we are running, and how fast we are going. They were originally following a documentation provided by Lakeview, WI, but after numerous problems, decided to start from scratch. The team includes Trever Schoulte, Brian Stubblefield, and Tyler Barz.



### **Promotions and Documentation**

Within Promotions and Documentation, we have three main teams; Promotions, Documentation, and Graphic Design.



**Promotions-** Seeing as how Cougar Electric Car receives no funding directly from Kennedy High School, we have to raise 100% of the funds we need every year to operate, which is in the range of twelve to fourteen thousand dollars. We raise every penny through a number of fundraisers and outreaches, all managed by our promotions department. Our current promotions department

consists of Dylan Davis, with spellcheck by Brian Stubblefield.



**Documentation-** A good documentation book can make the difference between pulling off a win and taking the big L in Electric Car. The job of our documentation writers is to provide that extra push that gave our team the state championship in Nebraska and Wisconsin last year. This year, with a bumper crop of new writers and no old ones, our Documentation team has their work cut out for them. Our team includes Kaleigh Martin, Brian Stubblefield, and Dylan Davis.

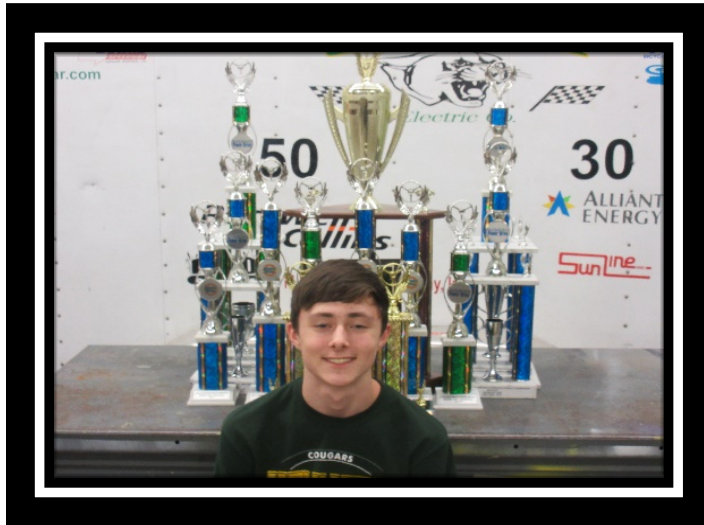


**Graphic Design-** Our cars look great on their own, but our graphics department makes them look even better. The graphics department has numerous jobs, including; T-shirt design and production, number board production, trailer graphics, and car graphics. Our only current graphics specialist is Rodrigo Sagastume.





## Team Members



Like most of the group Tyler Barz is brand new to the team. He is a freshman and is one of the most useful members in our new telemetry team. When Tyler grows up, he doesn't know what he wants to do, but "hopefully something in computer science"

"Work smarter not harder."

Bryan Becker is one of our older team members considering most of our team is in their first year. But Bryan has been with the program for 2 years and both of those years he has been a crew chief for the 985 car. Bryan has been working non-stop to make his car and driver better. When Bryan grows up, he hopes to use what he's learned here in the real world, as a mechanical engineer.

"Shut up and make it work."



Lucas Corrigan is a first timer in the program and has already found something he loves to do. Lucas has joined our aerodynamics and design team. After what he learns this year, he hopes to one day grow up and become an aerospace engineer. He is designing our new 984 car, which will help him greatly at this aspect of his future life.

"I don't hate it, I just don't like it at all and its terrible."

Dennis Davis is yet another first timer. Originally Dennis signed up for graphics but with nothing to do his adviser had placed him on documentation, which he has managed to have changed to batteries. Dennis has not yet figured out what he wants to do when he gets out of school. All Dennis figured out is that he wanted to go into the military, preferably the navy.

“I didn’t sign up for this.”



Dylan Davis is a first timer just like his older brother Dennis Davis. Dylan had initially decided to do promotions and now helps with documentation. He is fairly decent in promotions, seeing as how his first Facebook post got 1,800 hits and is still growing. When Dylan grows up, he hopes to go into professional baseball.

“What are you doing?”

Jakob Davis is a first-year member and works for the team as a Mechanical Engineer. He is a hard worker and is Cody’s assistant in the mechanics part of Electric car. When Jacob grows up, he wants to be a soldier in the Army and fight for our country. When he is sitting around at home, he likes to trap shoot and hunt.

“I’m done with this.”







Colin Flannagan is another first timer in electric car. Colin had little difficulty finding what to do. Colin has been training to be a crew chief for the 983. When Colin grows up, he wants to be an aerospace engineer. Colin's quote has been chosen from the multiple times he has tried to help his driver.

"John, the first one was fine"

Jesse Hempstead is a first semester kid in the class, and he is already doing great. Jesse hunts deer and he enjoys racing. Jesse has loved racing ever since he was a kid. Jesse was born in Iowa, raised in Kentucky, and moved back to Iowa in 3<sup>rd</sup> grade. When Jesse grows up, he wants to be a U.S. soldier. Jesse loves to help other people when it counts.

"If I die driving too fast, don't cry because I was smiling the whole time."



Isaac Hofferber has been in the Electric Car for 1 year and has loved it the whole time. His job in Electric car is assistant crew chief for Bryan Becker and is being a great help. He loves to play basketball and hangout in the park with his friends. When he grows up, he would love to be a computer scientist or play NBA. Isaac is another one of our highly academically qualified students in the Electric car program.

"Just stop, ok. Just stop."

Kaleigh Martin is a new addition to the Documentation team. She loves it in this class room and is easily the best worker in Documentation. She lives at home with her parents, brother and sister. When Kaleigh grows up, she wants to be a teacher. She loves reading, history, and playing with her dog. Kaleigh will also be the driver of the 984 car.

“Life is too important to be taken seriously.”



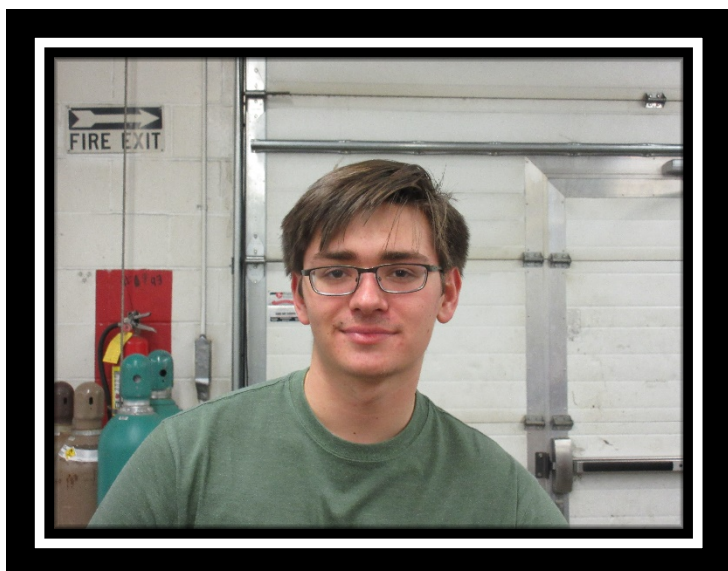
Rodrigo Sagastume, what to say about Rodrigo. Well, Rodrigo has been with the program for three years. Rodrigo has been a graphics apprentice, and/or teacher for all three years. He has also taken up driving the 985 car. When Rodrigo graduates, he wants to become a lawyer or border control. So far in his 2018 year of driving he has only competed in one race and let's leave it at that it could have gone a little better.

“If you're not first your last.”

Trevor Schoulte is another first timer to the program. He is the telemetry team's electrical engineer. He is a senior, and caught senioritis on day 1, but is fighting through it. He plans to become an electrical engineer after college. He enjoys playing with wires in his free time.

“Why was the programmer happy?  
He got arrays (pronounced a raise)”





Derek Severson is the longest standing student member of our program. He is a senior and has been a crew chief with the 984 car all 4 years and is the only crew chief in the program who has built a car from the ground up. He wants to be a mechanical engineer after he gets out of school. He plays guitar in his free time. Over his high school career, he has taken 9 AP classes.

“Don’t panic.”

Elizabeth Severson is Derek Severson’s younger sister. Elizabeth is a sophomore, and a driver for the 985. She is not a part of the Electric Car class because of her tight schedule but helps after school in every way she can. She enjoys welding and might start doing it as a part of the class next year.



“What? There’s another one? Little little Severson!”



Brian Stubblefield is one of our new documentation people. Brian is a freshman and is already one of our top students in documentation. Brian currently has one of the best GPA’s and the number one work ethic. In the future Brian wants to be a part of the Cedar Rapids Fire Department and enjoys helping people. He also helps with telemetry at races, and whenever they need him.

“Knowledge is knowing a tomato is a fruit. Wisdom is not putting it in a fruit salad”



There isn't much to say about John Tedesco. He is a three-year member of the program. He has been a crew chief of the 983 car all three years and started driving this year. John is a picky person but a hard worker when you get to know him. John does not like people touching anything on his car. He gets especially ticked off when other classes touch his car. When John graduates, he wants to be a welder.

"Stop touching that."



Noah Wilson is the leader of our battery team and is probably the most committed freshman. Noah is another one of our amazing students and loves to work hard. In the future Noah would love to be an Air Force electrical engineer and help people when they need. Noah is currently not in a sport but used to play Football and Baseball, and he wrestled.

"You can only play with the hand you're dealt."

Barry Wilson is our instructor in the electric car class. This is Barry's 21<sup>th</sup> year with electric car and he has no plan on stopping. Barry also teaches three other classes not counting electric car (welding, woodworking and auto mechanics). Barry loves to work with kids and joke around a little bit. In his words, he is nothing but our money handler and glorified bus driver.

Phone number is 319-558-1595

"If it isn't done, then why are you standing around here? Get back to work!"





# Community Events



## Community Events

Cougar Electric Car Company takes advantage of every opportunity we get to show off our cars. We have three primary reasons for wanting to present our cars and work to the public as much as possible. The first reason is we believe in showing our love and appreciation to the companies and individuals that have helped our program by providing funding. The second reason is to promote the use of alternative energy. We do this by running our electric cars in parades and explaining how they run and were built. Finally, we use events with the public to recruit potential members, both now and for the future. By allowing little kids to sit in our cars and seeing them run, we are encouraging their interests in the program and hands-on learning. The events include:

- Hiawatha Fun Fest Parade
- Kennedy Club Fair
- Kennedy Homecoming Parade
- Alliant Energy's Rise Event
- Kennedy Incoming Freshmen Event





The Kennedy Cougar Electric Car Team was showing off their electric cars for the upcoming season at the Hiawatha parade. We use parades like this to show off our cars and all the hard work we put into them throughout the year.

Electric Car spreads the word about us at the club fair that takes place at the beginning of every Kennedy school year. The fair is to help students find new passions and join new clubs and organizations. Our main goal is to find kids that are interested in joining Cougar Electric Car and enjoy racing.



Every year, Electric Car participates in the annual homecoming parade. It allows us to spread the word and celebrate our school. The parade is highly attended and is great setting for us to show the cars in action.



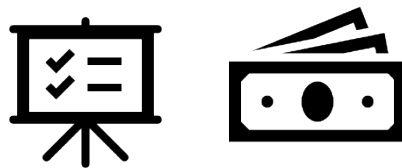
We participate in the Rise Event in downtown Cedar Rapids, at Green Square Park put on by Alliant Energy. We use this event to show our sponsor Alliant Energy we appreciate their support of our program. We also attend this event because we would like to spread the news about

Cougar Electric Car and get more sponsors, or even new participants.

Every February, Kennedy has a freshman orientation for all the incoming ninth graders to understand what they are signing up for when they commit to classes. We take advantage of this and set up a table in the middle of the Main Foyer. We think it went very well this year and that we might have gotten some new recruits.



# Sponsors





## Sponsors

We are very thankful to all of the companies that allow us to go racing each year! Our sponsors support our team in donations ranging from \$500-\$2,000. Without the, we could not go do what we love to do. Many of our sponsors come from students in the program, but we also apply for community grants with major corporations.



IN TOLERANCE  
CONTRACT MANUFACTURING



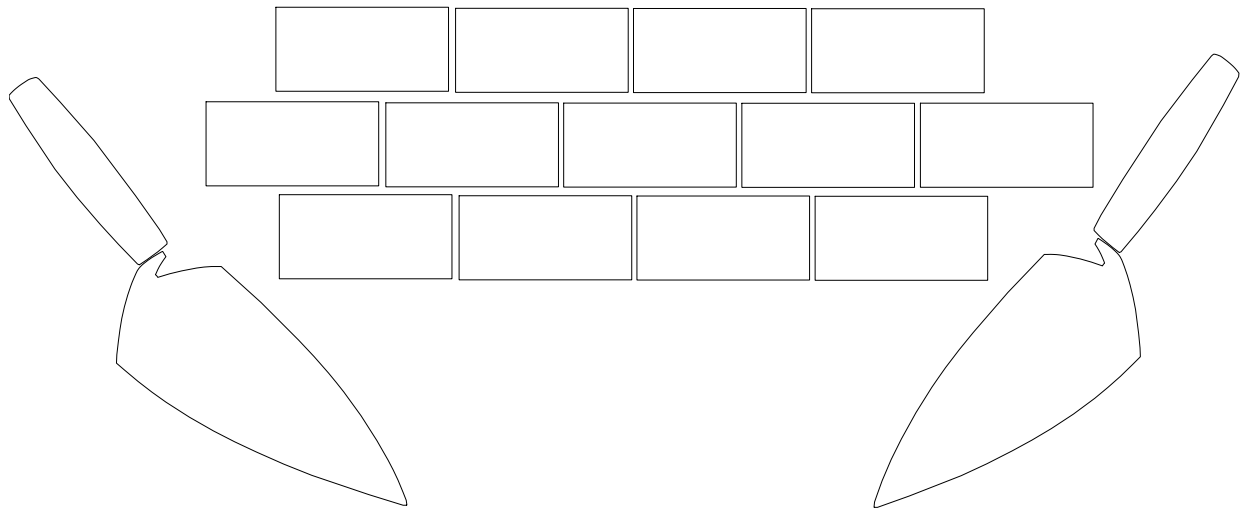
**Collins Aerospace**



Mark Flannagan



# DOYLE



# MASONRY

**TRAVEL**  **LEADERS®**

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DESTINATIONS UNLIMITED

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**Cougar Electric Company  
Budget Estimate  
2018-2019**

<b>A.</b>	<b>Cars</b>	<b>\$1,350.00</b>
	1. One new car	
	a. Chassis	\$400.00
	b. Plastic Body	\$250.00
	c. Painting Car	\$100.00
	2. Update two cars	
	a. Chassis modifications	\$300.00
	b. Body modifications	\$300.00
<b>B.</b>	<b>Batteries</b>	<b>\$1254.00</b>
	1. 6 New Optima (\$209)	\$1,254.00
<b>C.</b>	<b>Telemetry</b>	<b>\$500.00</b>
	1. Parts for Telemetry research	\$500.00
<b>D.</b>	<b>Racing</b>	<b>\$6,290.00</b>
	1. Tires	\$540.00
	2. Tubes	\$50.00
	3. Fuel for Vans	\$3500.00
	4. Misc. Supplies for Hauler & Cars	\$700.00
	5. Motels	\$1500.00
	a. Stout, Autobahn, Road Am (3 nights)	
<b>E.</b>	<b>Speed Trials</b>	<b>\$1400.00</b>
	1. Trophies	\$300.00
	2. Track Rental, Tickets, Power	\$500.00
	3. Ambulance	\$600.00
<b>F.</b>	<b>Graphics</b>	<b>\$750.00</b>
<b>G.</b>	<b>Promotion</b>	<b>\$1837.00</b>
	1. Sponsor Appreciation	\$382.00
	2. Memberships	
	a. Michigan	\$180.00
	b. Wisconsin	\$1050.00
	c. Electrathon America	\$75.00
	3. Miscellaneous	\$150.00
<b>H.</b>	<b>Misc. Shop Supplies</b>	<b>\$1,200.00</b>
<b>Total</b>		<b>\$14,581.00</b>

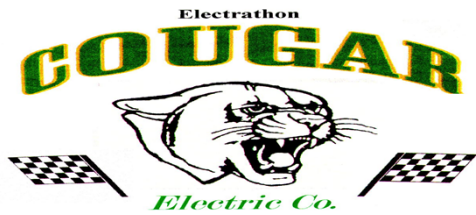
## Fundraising Events

Our annual Cougar Electric Car dinner is a way for us to interact with the students' parents and is a big fundraising event. During the week leading up to the dinner, the students spend every class period cleaning the shop and turning it into a makeshift restaurant. We open the dinner to anyone who wishes to come. To make a profit from this, we charge a small fee, usually around six dollars a person, and ask students to bring in as much food as they can. All we make in profits from this event goes toward the program.



While hosting the Midwest Speed Trials, we offer a concession stand to racers and spectators. A long day of racing and watching little cars drive around and around in circles works up an appetite. Hamburgers, hot dogs, sides, and drinks are all offered. Like the annual dinner, all profits go towards the program.





**John F. Kennedy High School**

**4545 Wenig Road N.E.**

January 28<sup>th</sup>, 2019

Dear Sir or Madam,

Cougar Electric Car is a STEM based program that focuses on the areas of mechanical engineering, electric engineering, and graphic design. Through these programs students get hands on experience in these areas.

The dedicated high school students in this program every year work towards the goals of designing, building, and racing three electrically powered one person cars. These cars are raced in the spring every year. Our electric cars are scored in five areas; design, endurance, braking, handling, and documentation.

The Kennedy High School team has several accomplishments for the 2017-2019 school year. The team competed in Nebraska, Iowa, Wisconsin, and Michigan. The team brought home first, second, and third place in Nebraska. We also took first and second place overall in Wisconsin. Cougar Electric Car attended several community events over the summer such as the Freedom Festival, Hiawatha Fun Fest and Fly-In Breakfast at the Marion airport. Attending community events is a huge part of our history and students love sharing aspects of the program with the public.

Our goals for the 2018-2019 include designing and building a new electric car for the new season as well as modifying the other two cars. Also we plan on updating our technology on calculating aerodynamics and bring more awareness to alternative energy transportation.

We are not funded by Kennedy High School or The Cedar Rapids Community School District. We are supported through sponsorships from community business and we would be honored to include your company in reaching our goals for the 2017-2018 year.

Sincerely,

Pamela Severson  
Promotional Leader  
Cell Phone: (319)-440-7317  
e-mail: [pjsevers@msn.com](mailto:pjsevers@msn.com)

# *Prospectus For Cougar Electric Company 2018-19*

- What We're About
- Accomplishments in the 2018-19 Year
  - Goals for 2018-19 Year
  - Budget Plans for the 2018-19 Year
  - Our 2018-19 Partners and Sponsors
  - 2018-19 Budget Estimate
- What You Will Receive for your Support
  - How to Contact Us





## What We Are All About

Cougar Electric Company is not like most classes offered at the high school level. We have made it our mission to simulate a real-world company.

Students face high-level challenges every day they walk into the classroom. They deal with different types of learning expectations in the field they choose to explore. Our engineers – electrical, chemical, and mechanical - deal with challenges that are so unique sometimes professionals can not offer advice and they have to find their own answers. In their commitment to electric car, all students do their best to further their education by facing challenges that no other high school course can offer.

The company is divided into different teams: promotion, publicity, graphics, mechanical engineering, telemetry, aerodynamic engineering, and electrical engineering. Our teams work with area business professionals and staff who give their time, advice, and most importantly, teach students how to deal with real-world problems.

We hope that after reading about our class you will become as excited as we are to offer this alternative to traditional education. We need your help in order to continue this high level of learning.

## Accomplishments in the 2018-19 Year

This year marked Cougar Electric Car's twenty-first year.

Cougar Electric Company continues to participate in many events. This year we attended events in Wisconsin, Michigan, Iowa, and Nebraska. Below is the list of 2019 competition events that we had the opportunity, the ones bolded are the ones we plan to attend.

DATE	EVENT	LOCATION
<b>April 6<sup>th</sup></b>	<b>West Point</b>	<b>West Point, Nebraska</b>
<b>April, 12<sup>th</sup> &amp; 13<sup>th</sup></b>	<b>University of Wisconsin Platteville</b>	<b>Platteville, Wisconsin</b>
April, 13 <sup>th</sup>	Lincoln	Lincoln, Nebraska
<b>April 26<sup>th</sup> &amp; 27<sup>th</sup></b>	<b>Stout/Hastings</b>	<b>Stout, Wisconsin/ Hasting Nebraska</b>
<b>April 28<sup>th</sup> &amp; 29<sup>th</sup></b>	<b>Autobahn</b>	<b>Joliet, Illinois</b>
<b>May 4<sup>th</sup></b>	<b>Wayne</b>	<b>Wayne, Nebraska</b>
<b>May 10<sup>th</sup></b>	<b>Berlin</b>	<b>Marne, Michigan</b>
<b>May 13<sup>th</sup> &amp; 14<sup>th</sup></b>	<b>Road America</b>	<b>Elkhart, Wisconsin</b>
<b>May 18<sup>th</sup></b>	<b>Hawkeye Downs</b>	<b>Cedar Rapids, Iowa</b>
<b>May 19<sup>th</sup></b>	<b>Prairie</b>	<b>Cedar Rapids, Iowa</b>

Promotional Events that Cougar Electric attended in 2018 included: Cedar Rapids Freedom Festival Parade, Marion Fly-in Breakfast, Hiawatha Fun Fest Parade, Open Mind Open Doors Exposition, as well as Kennedy's Homecoming Parade, and the Kennedy Open House.



## Goals for 2018-19 Year

In order to be successful in competition, a team must not only create a car which can go the greatest distance in an hour, but it must also do well at the other components of the competition – maneuverability, braking, design, and documentation.

- Promote alternative energy use
- Create three new cars, using new designs to become more efficient
- Make 1 major modifications our old car
- Race in Iowa, Michigan, Wisconsin and Nebraska competitions
- Sponsor the Iowa competitions
- Participate in local community events





## Partners and Sponsors

Cougar Electric Co. relies on sponsors and partners to realize its goals.

Partners offer money and advice for all facets of the company or competition events. Sponsors offer the money to build, compete, and promote the program.

Our 2019 partners and sponsors are listed below



**Collins Aerospace**



Mark Flannagan

**Cougar Electric Company  
Budget Estimate  
2018-2019**

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<b>H.</b>	<b>Misc. Shop Supplies</b>	<b>\$1,200.00</b>
<b>Total</b>		<b>\$14,581.00</b>



## Budget Plans for the 2018-19 Year

As of now we are still looking to find a new towing van. The van we have now is becoming less reliable. We are looking to put \$5,000 more than our annual budget away to go towards a replacement.

Kennedy continues to be the sponsoring organization for electric car competition in Iowa. Since then we have been solely sponsoring the challenge, and we are looking for an outside sponsor to take over.

There seems to be a somewhat stronger focus on technical education in surrounding states. Cougar Electric continues to look at additional traveling to surrounding states, especially Nebraska, Michigan, and Illinois.



## We Need Your Interest

Work has already begun for 2017. We are in the midst of ....

- Attending several fall shows and educational activities
- Designing a new 2018 car
- Planning changes on two existing cars
- Planning the Iowa program
- Planning to use both the wind tunnel and chassis dyno in design

These are lofty goals and they will cost money. We enjoy seeing you become part of this learning process. We hope you consider becoming a sponsor or partner when contacted by our promotion team. A financial plan for the year is included with this prospectus. We accept any size donation. Sponsor dollars are the only way that the goals that we have can be reached. **It is also tax deductible!**

## What You Will Receive for Your Support

Sponsors receive logo recognition on primary areas of race cars. Partners are also recognized on each car on the sides of the nose (the middle of each side is reserved for the number of the car). Your company's logo will be prominently displayed on both sides of the trailer as the sponsor of the chosen car. A strong effort is made to have the car and trailer out in public regularly; our goal is to have more than 50,000 people see the program each year. We accomplish this by attending six or more races throughout the Midwest. We attend competitions from April to October. We also attend all possible public festivals and parades in the Cedar Rapids area, including all public educational events in and related to Kennedy High School. We actively solicit opportunities to have the program highlighted in school and area media. We have been on TV and in the newspaper in the past and look to increase that exposure.

By supporting our company, you are making a difference in how students develop their knowledge of the world. It is hard to replicate a business-type atmosphere for students before they graduate. By participating in real-world education early, students are challenged in several personal development areas including teamwork (with students and adults), goal setting, problem solving, and skill development. They may even be introduced to their future career. Several graduates have gone on to careers similar to their involvement in Cougar Electric Company. Thank you for your interest. Please give us a call or e-mail us if you have any questions or if you need any other information.



## How to Contact Us

School: Kennedy High School  
c/o Barry Wilson (Advisor)  
4545 Wenig Rd. NE  
Cedar Rapids, IA 52402

Phone: Barry Wilson (Advisor)  
(319) 558-1595 (school number)

E-mail: [bwilson@cr.k12.ia.us](mailto:bwilson@cr.k12.ia.us)

Website: [www.cougarelectriccar.com](http://www.cougarelectriccar.com)

Facebook: Kennedy Electric Car Company

# Design



## **Design**

We take a lot into consideration when designing a car. Numerous measurements are taken from the driver, such as their weight, height, and how wide their hips and shoulders are. These numbers, along with the weight of various car parts, are used to calculate the center of balance, the center of gravity, and static stability of the car. This all helps the crew chief to properly design a car that will meet the goals and visions they set.

When the 983 car was being redesigned, the main goal was to make the car smaller and lighter than last year. It helped that we were doing it around the smallest driver we had at the time. To eliminate some of the weight cars normally carry, the swing arm was designed without a spring on it. The spring acted as suspension in last year's design, but the suspension was deemed unnecessary as it was only used at one race and was removed this year.

The 983's crew chief John was happy with last year's overall shape and kept the car's nose up to put more air under the car, rather than on the sides to hit the wheel and axle. A new nose was considered after the old one was damaged at a race in October, but after numerous attempts at a redesign, John decided to remake the old design.

## **Center of balance**

The center of balance tells us how well a car will take a corner. It is calculated by measuring the weight of various components of the car and how far they are from the back axle. The numbers are then averaged to get the center of balance. If the center of balance is too close to the front or back of the car, then the car will not handle very well and is at risk of flipping when taking a corner.

## **Center of gravity**

The center of gravity is another number calculated from various measurements throughout the car that determines how a car will handle a turn. It is calculated by measuring the weight of different components of the car, such as the batteries, and the vertical distance from the ground to the center of those parts. The weights and heights are then averaged to give the center of gravity. Ideally, this will be lower than the center of the front wheels so that the car doesn't tip. If it is above the center of the front wheels, the car is at risk to flip when taking a corner.

## **Static stability**

Static stability is where the center of balance and center of gravity meet.

This number determines the car's overall likelihood of flipping and/or rolling during a race. Center of balance can be compared to a horizontal line running along the car and center of gravity would be a vertical line.

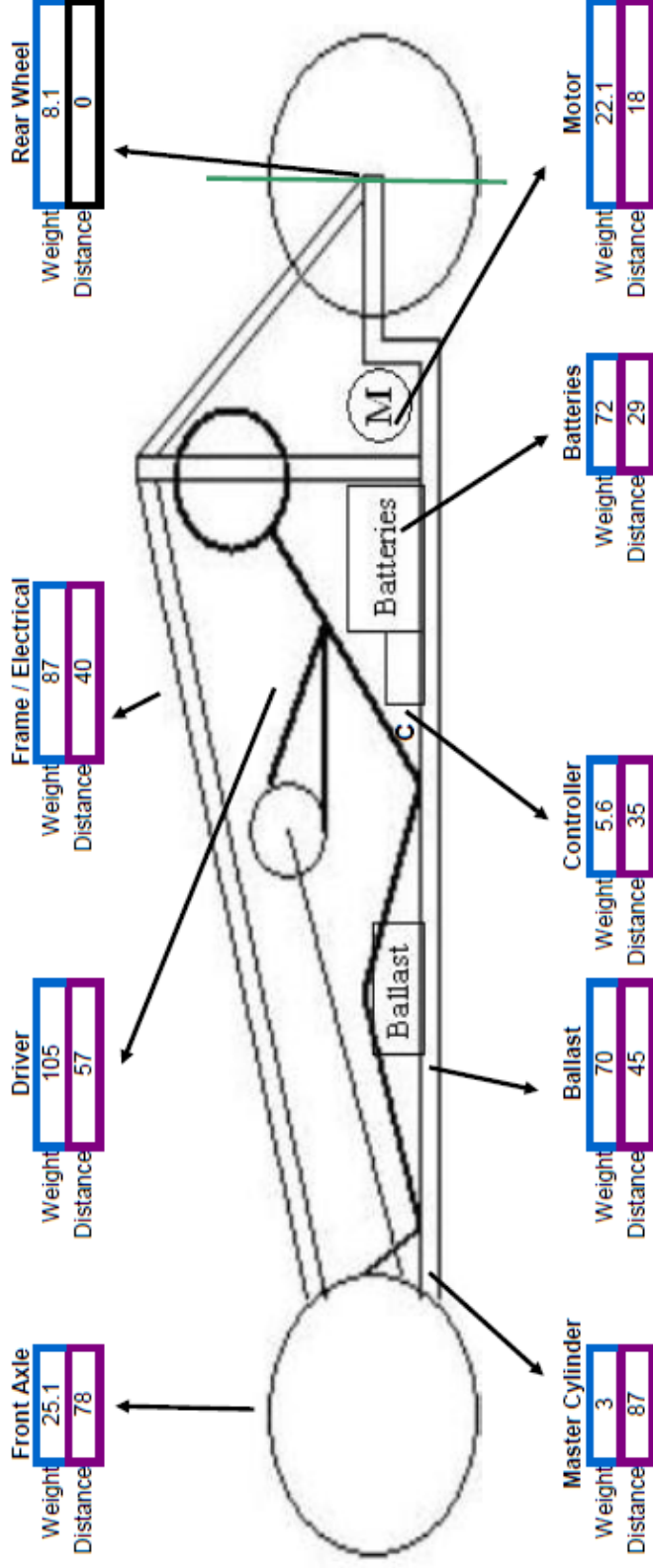
Static stability is where these two lines intersect. The point of intersection moves when the car accelerates or brakes, or turns left or right. If that point goes beyond the front wheel while turning, the car will flip. The higher the number is, the less likely the car is to flip. A number of at least 1 or higher means the car is almost guaranteed to not flip.



# Center of Balance

Car # A30  
 Date: 4/8/2019  
 Car # \_\_\_\_\_

1. Record the weight of each component in corresponding box. (See the chart to the right)
2. Measure from the back axle to the center of the component then record in the box.



Weight values will automatically transfer to Center of Gravity sheet.

## Center of Balance

Front % 56.44%  
 Rear % 43.56%

Center of Balance 17516 in/lbs

Total Weight 397.9 lbs

Center of Balance 44.02  
 Inches From Rear Axle

Notes:

## Center of Balance

### Conversion Chart

1/16"	0.0625
1/8"	0.125
3/16"	0.1875
1/4"	0.25
5/16"	0.3125
3/8"	0.375
7/16"	0.4375
1/2"	0.50
9/16"	0.5625
5/8"	0.625
11/16"	0.6875
3/4"	0.75
13/16"	0.8125
7/8"	0.875
15/16"	0.9375

### Component Weight Averages

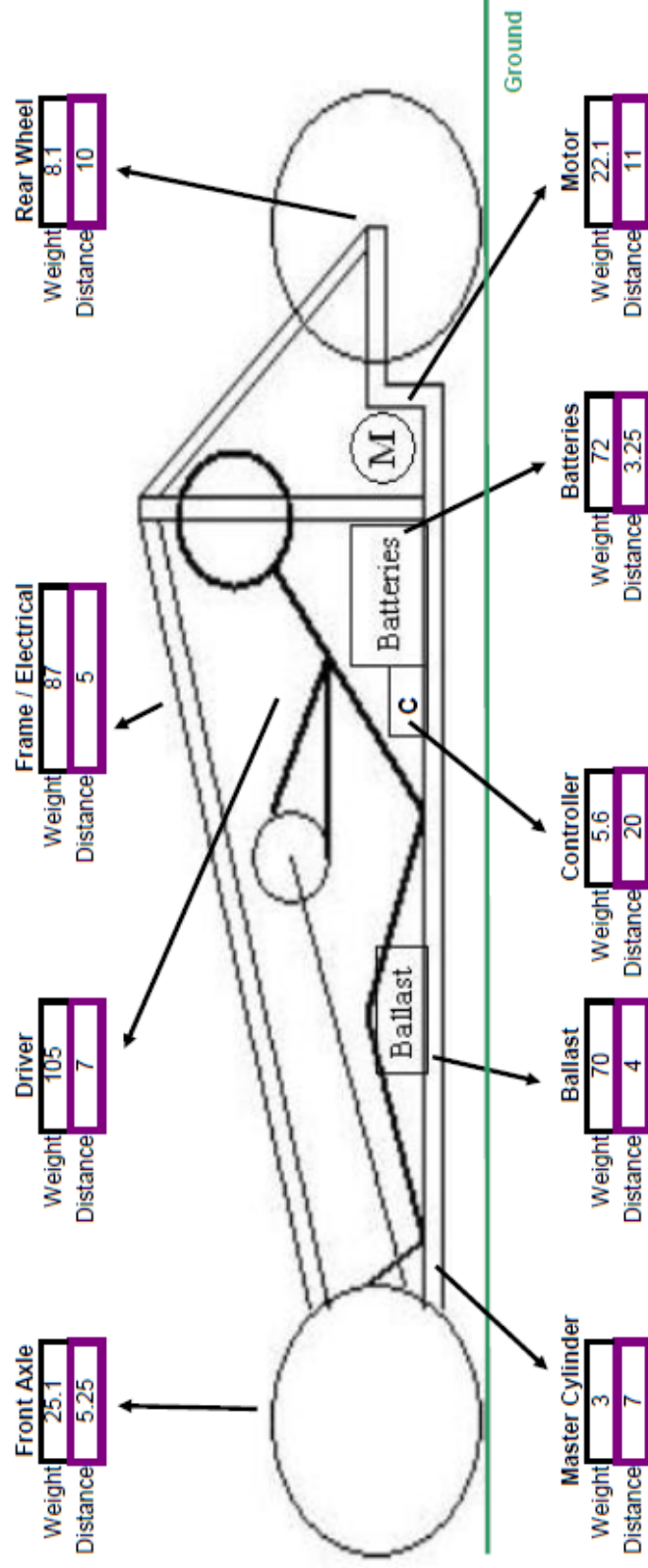
1	Etek Motor with Sprocket	22.1 lbs
1	7080 Modified Motor / Etek-R with sprocket	28.4 lbs
1	Alltrax Controller	5.6 lbs
1	Curtis Controller	4.2 lbs
1	20" Spoked Rear Wheel, Sprocket, & Chain	8.1 lbs
2	20" Front Wheels, Brakes, Axle, & Steering	29.3 lbs
2	20" Tomos Front Wheels, Brakes, Axle & Steering	32.3 lbs
2	16" Front Wheels, Brakes Axle & Steering	25.1 lbs
2	Optima Batteries	67.3 lbs
1	Master Cylinder and Fluid	3 lbs
1	Driver	180 lbs
1	Ballast	As Needed
1	Frame and Body balance out naturally	NA

This is a template worksheet so copies of this sheet will be created when saving, to protect the original. It is also automatically be date stamped and protected to prevent altering of the formulas.

## Center of Gravity

Car # A30  
 Date: 4/8/2019  
 Student: \_\_\_\_\_

3. Measure the distance in inches from center of gravity of the part to ground. Record in the box.



### Center of Gravity

Center of Gravity 2273 in/lbs

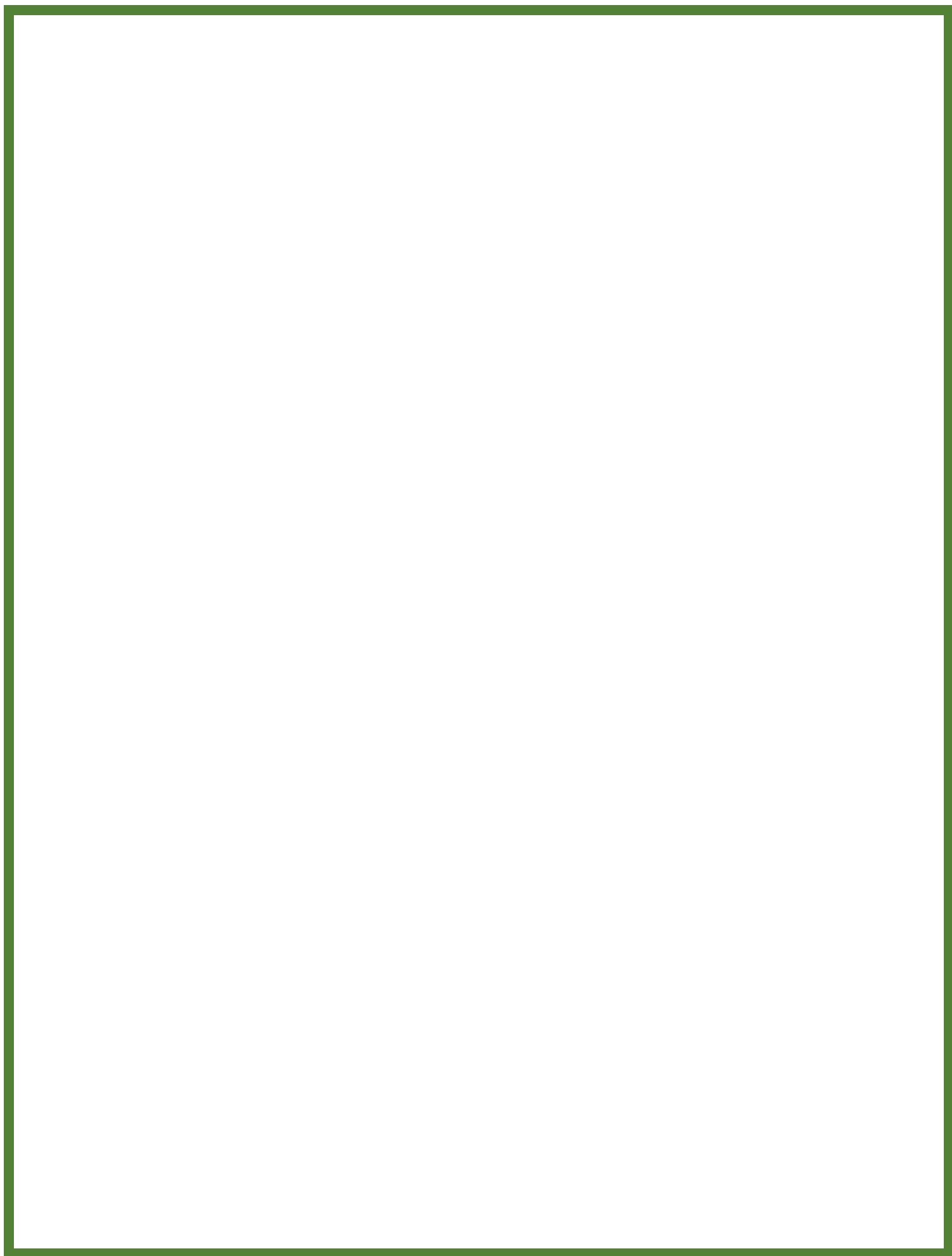
5.71

Total Weight 397.9 lbs

Inches off the Ground

Install all components as low as possible.  
 Center of Gravity maximum 10" (lower the better)

Notes: \_\_\_\_\_



## Center of Gravity

Conversion Chart

1/16"	0.0625
1/8"	0.125
3/16"	0.1875
1/4"	0.25
5/16"	0.3125
3/8"	0.375
7/16"	0.4375
1/2"	0.50
9/16"	0.5625
5/8"	0.625
11/16"	0.6875
3/4"	0.75
13/16"	0.8125
7/8"	0.875
15/16"	0.9375

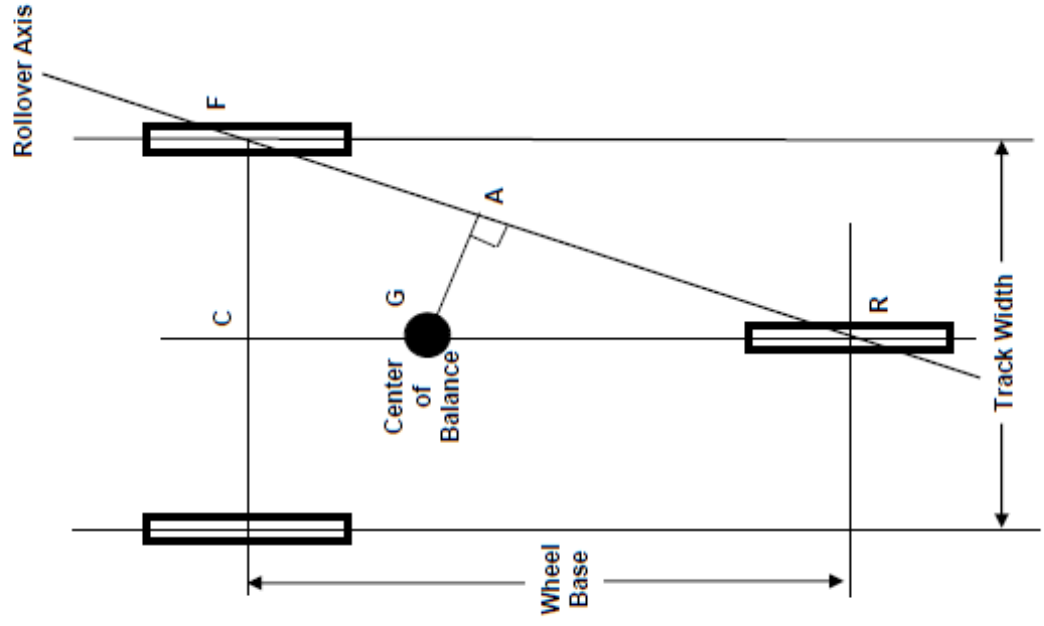
Component Weight Averages

1	Etek Motor with Sprocket	22.1 lbs
1	7080 Modified Motor / Etek-R with sprocket	28.4 lbs
1	Alltrax Controller	5.6 lbs
1	Curtis Controller	4.2 lbs
1	20" Spoked Rear Wheel, Sprocket, & Chain	8.1 lbs
2	20" Front Wheels, Brakes, Axle, & Steering	29.3 lbs
2	20" Tomos Front Wheels, Brakes, Axle & Steering	32.3 lbs
2	16" Front Wheels, Brakes Axle & Steering	25.1 lbs
2	Optima Batteries	67.3 lbs
1	Master Cylinder and Fluid	3 lbs
1	Driver	180 lbs
1	Ballast	As Needed
1	Frame and Body balance out naturally	NA



## Static Stability

Car # A30  
 Date: 4/8/2019  
 Student: \_\_\_\_\_



4. Record the Track Width in the box.

40	Track Width
78	Wheel Base
44.02	Center of Balance Distance from Rear Wheel
5.71	Center of Gravity
20	CF
78	RC
44.02	GR
80.523	RF
10.934	GA
1.91	Static Stability Factor

Short track cars should be close to 1.5 SSF.  
 Long track cars should be at or greater than 1.0 SSF.  
 Use steering blocks to improve driver Safety.

Notes:

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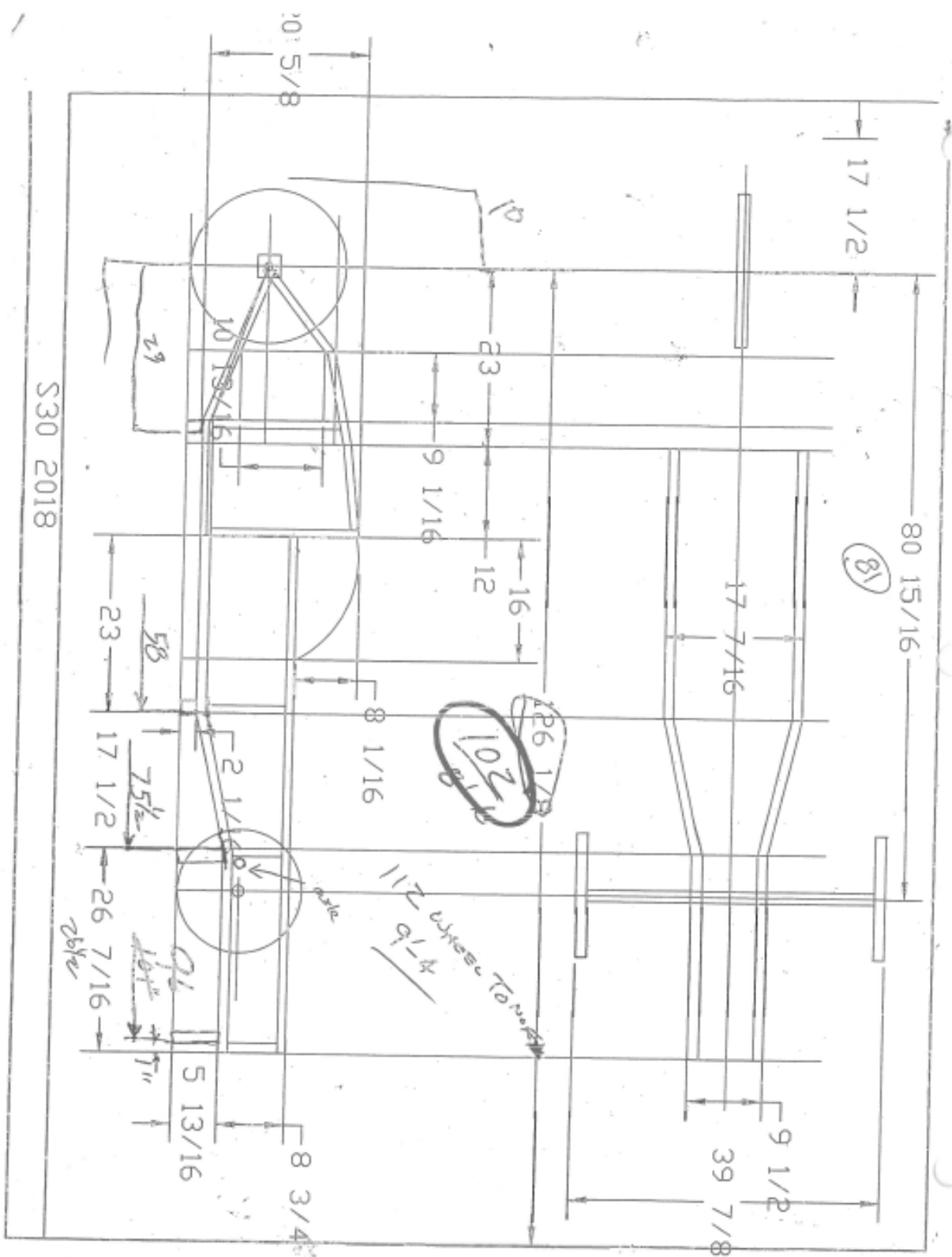
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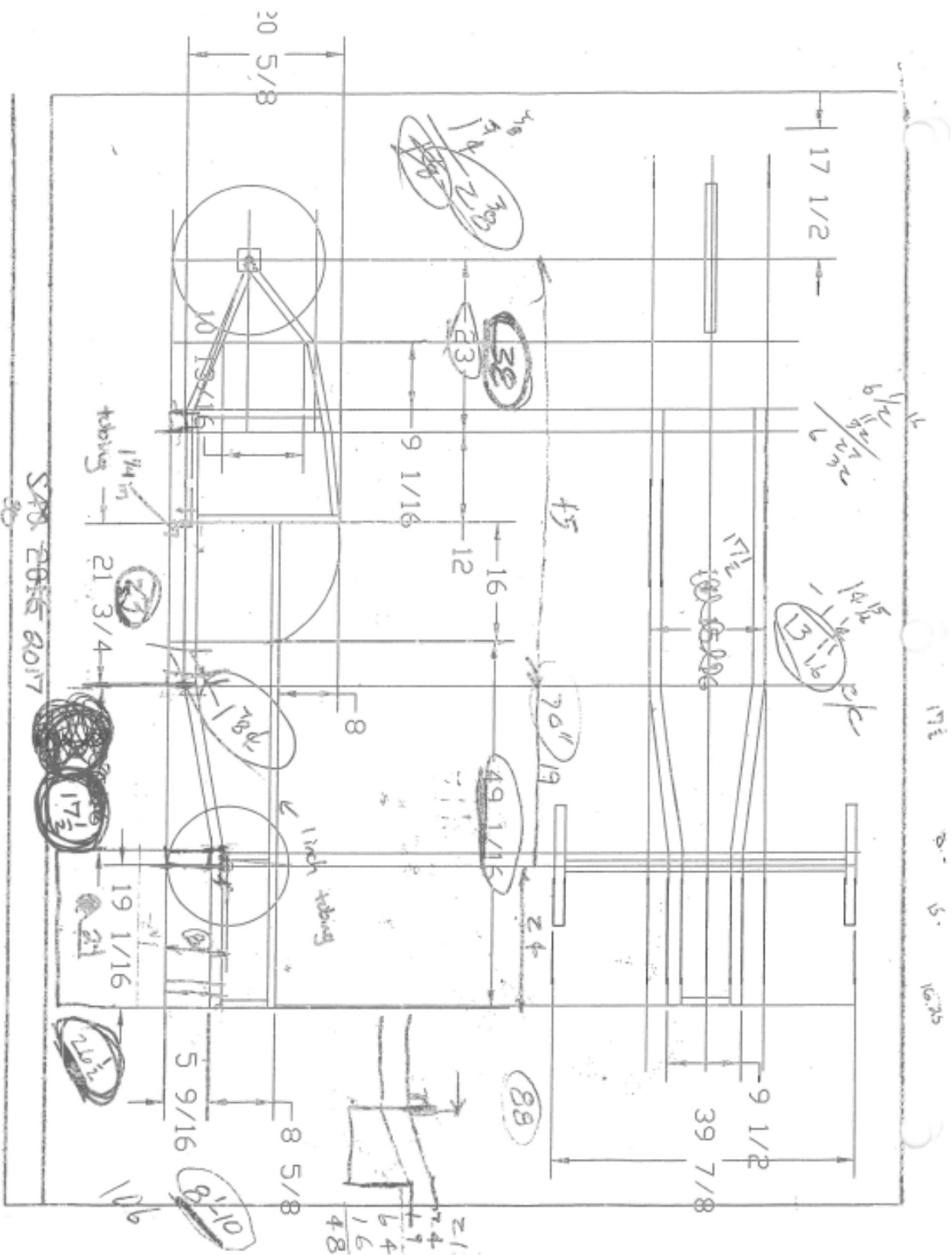


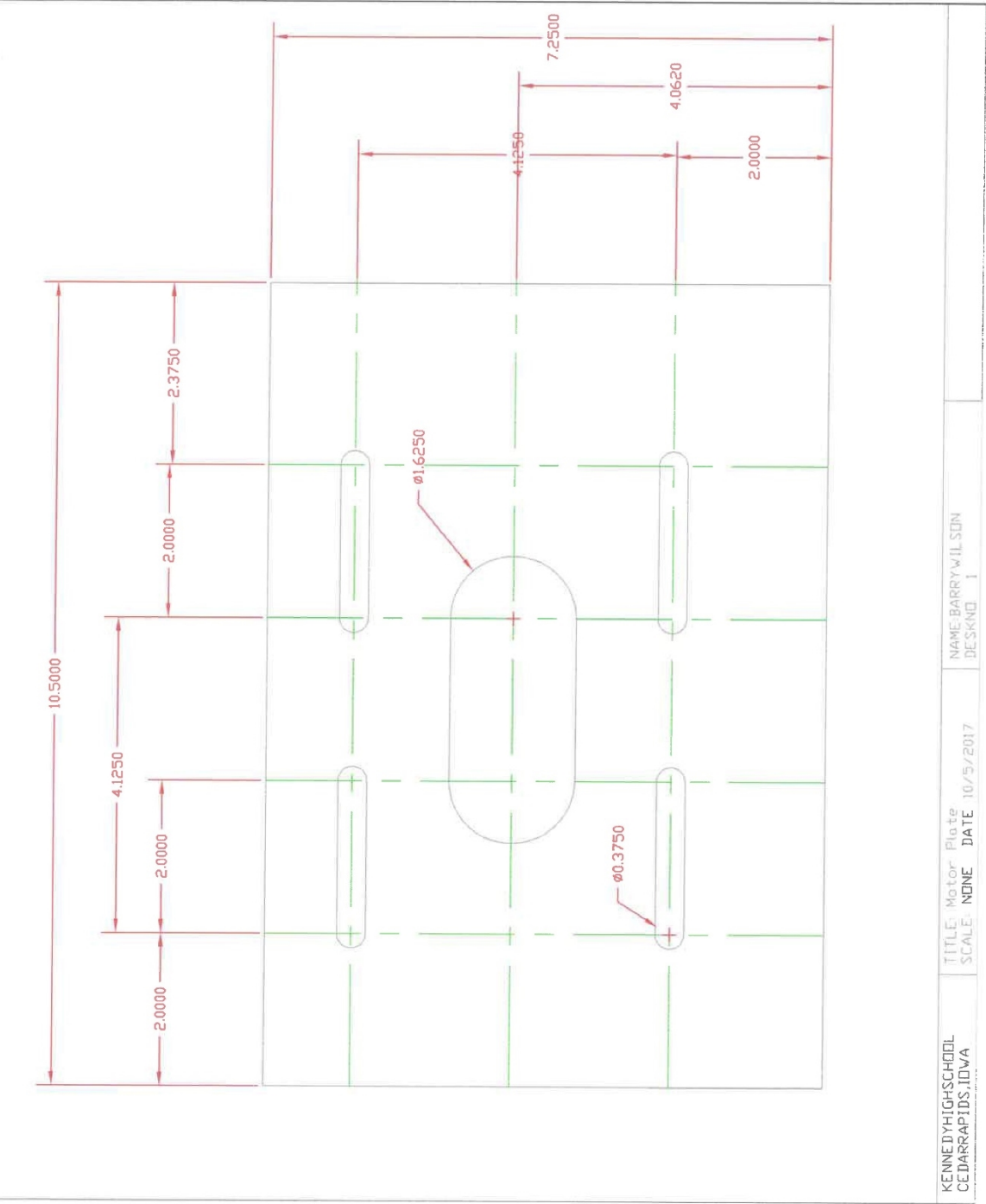
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## Parts List

**Team - Cougar Electric Company - Kennedy High School**

**Car Number: A30**

**Time period: Sept 2018 - May 2019**

<b>Part</b>	<b>Vender</b>	<b>Price</b>
Frame	Storm Steel	\$219.23
Floor Pan	Storm Steel	\$45.00
Seat	Fabric	\$5.00
Padding	Ace Hardware	\$5.00
Circuit Breaker	Del City	\$25.14
Key Switches	EV Parts	\$27.68
Mirrors	O'Reilly Auto Parts	\$5.50
Motor	Etech	\$310.00
Controller	EV Parts	\$399.00
Pot box	EV Parts	\$26.50
Analyst	Grin Technologies	\$299.95
Sprockets	Rieken's Racing	\$32.28
Cog	Hall Bicycle	\$6.95
Rear Gear Adapter	Rieken's Racing	\$30.00
Chain	Rieken's Racing	\$6.00
Batteries	Advance Auto	\$635.00
Peddles	Rieken's Racing	\$11.00
Shell	Home Built	\$100.00
Paint	Ace Hardware	\$25.00
Rims & Hubs	Hall Bicycle	\$375.00
Disc brakes	Hall Bicycle	\$205.50
Tires & Tubes	Hall Bicycle	\$36.75
Tie Rods & Ends	Rieken's Racing	\$35.00
Steering Assembly	EV Parts	\$97.00
Wires	Brenneman & Associates	\$20.00
Misc Parts	Ace Hardware	\$25.00
Graphics	Cougar Graphics	\$20.00
<b>Total Cost of Parts</b>		<b>\$3,028.48</b>

# Chassis



## **Chassis**

The 983, being in its second year of racing, modifications had to be made. The first major change to the chassis was the introduction of a new tail. The removal of suspension this year called for a new tail design. The previous tail was molded, replacing it this year is a hand crafted design. This was accomplished by taking strips of aluminum, riveting them together, and then forming a sheet of plastic around the skeleton.

The second of the two changes made was the extension of the car by three inches. To add to the car John, the crew chief/driver, cut off the old nose and added spacers to give himself more room for his feet and the pedals.

## **Suspension**

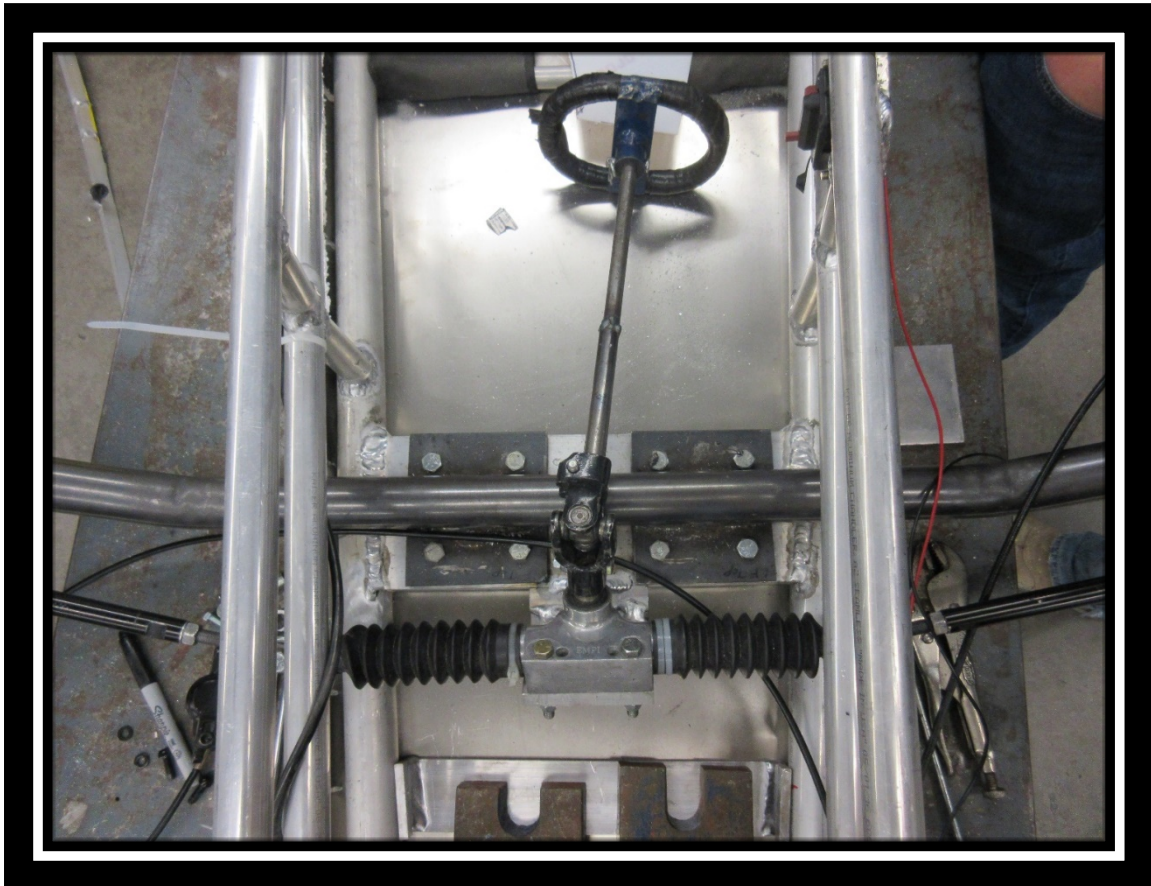
This year suspension was abandoned altogether. One of the goals for the 983 car this year was to be lighter, the suspension was added weight and as it was only used at one of our races it deemed unnecessary and subsequently removed.

## **Frame**

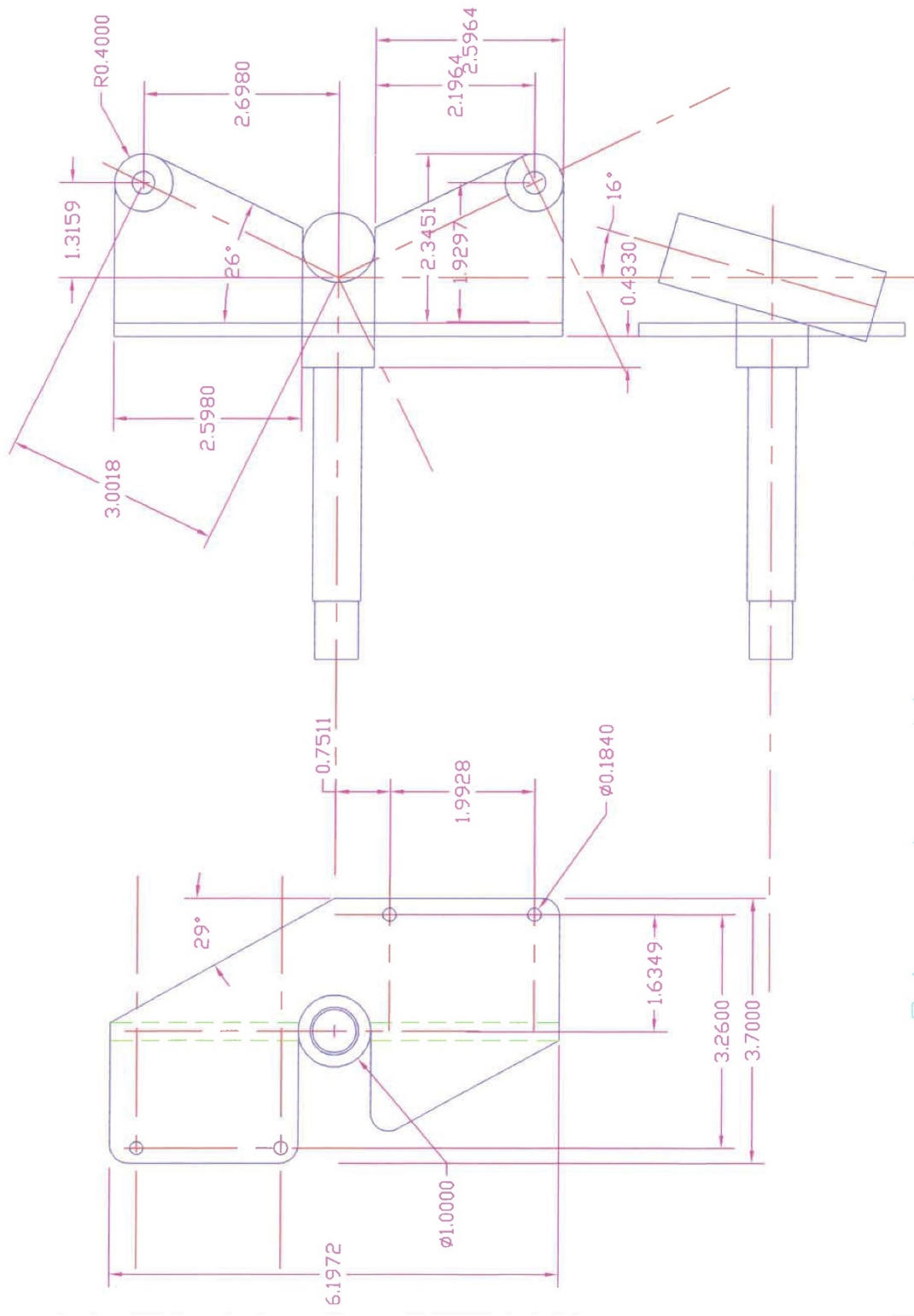
The 983 car has frame that consists of one inch and one-and-a-half-inch aluminum tubing. One and a half inch tubing is used for the bottom rail to create a sturdy base, while the thinner one-inch bars are used everywhere else to save space.

## Steering

We use a rack and pinion steering system in all of our cars. Turning the wheel causes the pinion gear- located at the end of the steering column to turn. This then causes the rack gear to move which then turns the wheels.







Steering Knuckle

## Wheels

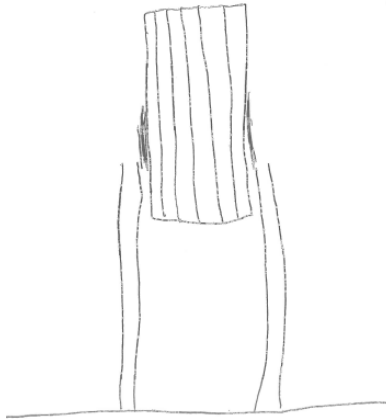
We use two different sized wheels to on our cars to get better performance. Sixteen-inch wheels are used on for the front because their increased durability allows them to withstand more force when taking corners. A twenty-inch wheel is used on the back because it is larger and allows for gears to be changed easily. We get all our wheels and chains from our partner, Hall Bicycle.



Front sixteen-inch wheel



Rear twenty-inch wheel



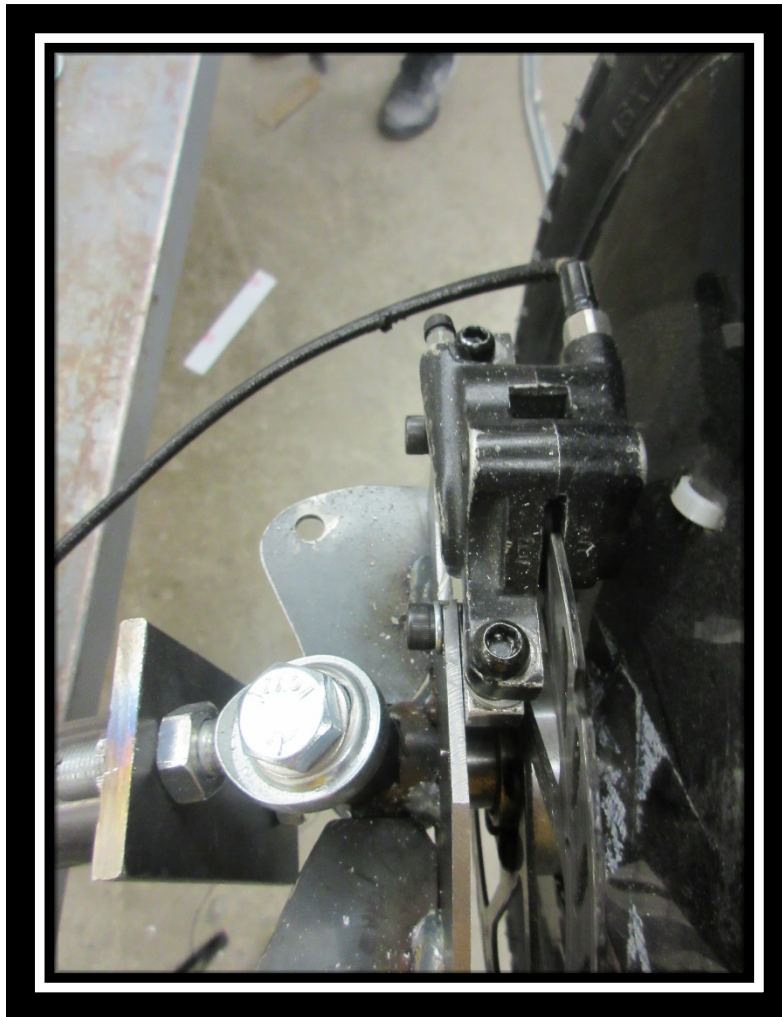
## **Tire Pressure**

The crew chief adjusts the tire pressure for each race based on the weather and track type. In hot weather a lower pressure is preferred as to balance out the extra pressure that will build as the tire heats up. The opposite is done in cold weather, the crew chiefs adding more air into the tires to compensate the lack of pressure from heat. On speedways we aim to have the rolling resistance as low as possible. To accomplish this we run a higher psi, generally 90-95 psi in hot weather and 105 psi in cold. On road courses our goal is to have good traction. To achieve this we run a lower psi. Weather doesn't play a role in choosing the pressure in this case as there is a lot of stopping and starting. For these courses the suggested running psi is 85-90.

## Brakes

We use a disc brake system in all of our cars because they provide the best braking quality available to us. Due to their higher quality, they are among the more expensive brake systems, but thanks to our partnership with Hall Bicycle, we can buy them at a discounted price.

We use hydraulic disk brakes on the car for many reasons. They are more effective in rainy conditions because they have holes in them, which stops water from collecting on them. They also don't lock up as easily as other brakes do, allowing for the driver to stop in a timelier fashion.



## Electrical Systems

There is a rather complex electrical system in our cars, but everything is of course attached to the battery. One of the many systems in the car is the motor. The motor has two wires, one connecting to the B+ terminal. This provides power to the motor and a ground so that current flow has a complete path.

Another system is the kill switch. The interior kill switch acts as a circuit breaker for the car, preventing more than 150 amps being drawn from the battery. The interior switch has two wires running to it; one that goes to the battery providing power, and the other to the external kill switch so that they can communicate. The exterior switch has two wires as well; the one to the interior switch and one to the B+ on the mother board. How this works as a whole, is power flows from the battery to the internal kill switch. When more than 150 amps flows through it or the driver turns it off, it sends a signal to the external kill switch which lets the mother board know to turn off the car.

Another system is the throttle. The throttle has a total of four wires; one to the pot toggle switch, one to the pot, and two to the motherboard. Power is received through the motherboard based on the conditions of the throttle pedal. When the pot is turned on, current flows through the pot series, controlling how much power is given to the throttle and therefore how much power is sent back through the motherboard to the motor. If the pot is turned off, the throttle position controls how much current is sent through the system. Both of these options control how fast the motor rotates and fast the car is going.

The cycle analyst has a system in the car as well. It has two wires to the logger, one to a wheel speed sensor, and two chunter wires. The cycle analyst is what tells the drivers how fast they're going, how many amps they're drawing, and what their battery state is. The telemetry system is hooked up to the cycle analyst in place of the cycle analogger



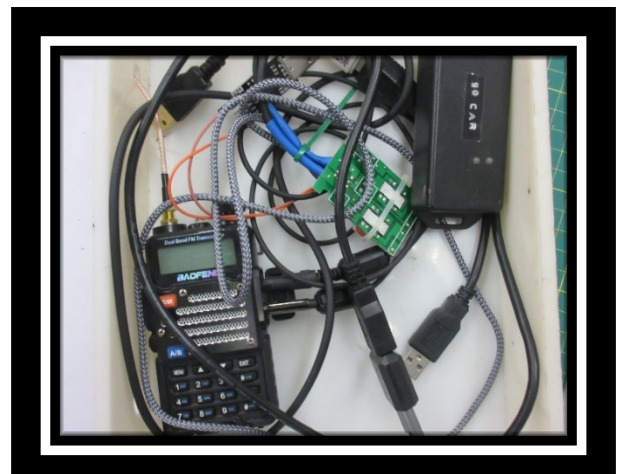
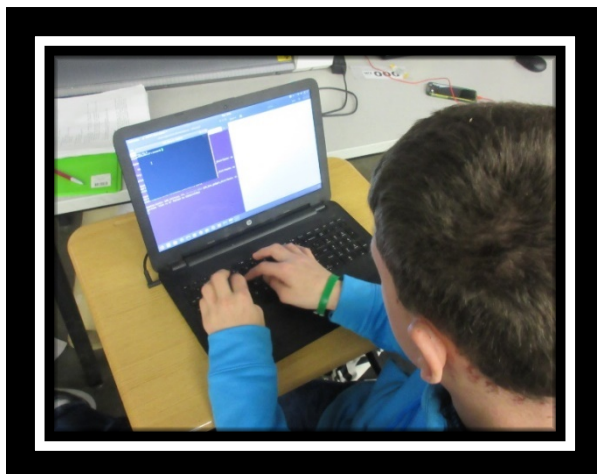
to record and transmit the data from the car to the pit PC for the crew chiefs to use.

A big part of all the systems is the motherboard. It receives electrical signals from pretty much every electrical component in the car. A final system in the car is the brake light system. This system is pretty simple; the driver hits the brake pedal which closes a circuit and turns the brake lights on. When the driver lets off, the lights turn off.

# Telemetry

Telemetry has been brought back as a separate team this year, after Barry came across a promising telemetry documentation to use. On telemetry, we have software engineer Tyler Barz, electrical engineer Trevor Shoulte, and jack-of-all-trades Brian Stubblefield.

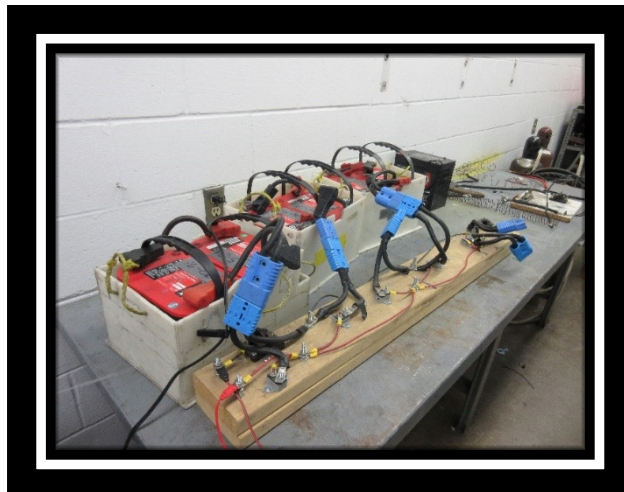
The team has been hard at work to get the system up and running. It's a basic program that just uses two python scripts, one on the Raspberry Pi and the other is the VPS which is viewed on our computer. The client.py is hosted on our VPS and just binds the IP and the port which the server.py connects to that same IP and port, then replays the data over a raw socket. The server.py gets the data off the cycle analyst and then encodes it and sends it to the client.py which then decodes the data turning it into plain text. They had this basic idea after their first attempt not working out at, they had thought it was going to work, they originally used a lot of equipment, things such as GPSD, Ham Radios, etc. They thought that was too much of a hassle after it didn't work and took up too much space. This new idea just uses the Raspberry Pi and a serial to USB converter. It runs on the Internet, using PuTTY to set everything up, then the car is connected to a mobile hotspot, and it transmits to the PC.



## Batteries

Batteries are tested and maintained by our trailer and battery maintenance crew of Noah Wilson and Dennis Davis, headed by freshman Noah Wilson. The batteries team oversees putting together sets, or pairings of batteries that will produce and maintain the most amperage. Last year we had some difficulties with batteries not holding a charge very long, so we purchased three sets of brand-new Optima Red Top batteries. These batteries preformed wonderfully at the end of last season, so to conserve them they were put in a freezer over the summer and into the fall. The hope was to keep the batteries in a new-like state for longer. Batteries were pulled from the freezer in February to thaw and then hooked to a battery maintainer.

Noah and Dennis are responsible for making three sets for each car. The first set is our oldest, worst-performing batteries, these we run as our “setups” as they typically will only last for the events prior to the endurance race such as inspections, braking, handling, and test laps (if allowed at the course). After these batteries are spent, we place our “heat one” batteries in the car. It is up to the crew chief whether they run their “A” set or “B” set. The “A” sets are the best batteries we own and should produce the best outcome for that car in a race. “B” sets are still good enough to get you around the track for the 60-90 minutes, however the “A” sets will typically yield the best results.



Our trailer is equipped with battery maintainers and chargers. Sets of batteries are placed in their respective plastic tote and can be slid in and out of the shelves with the help of a large screwdriver. In the trailer we also use battery heaters, if allowed by the organization's rules. We heat the batteries because cold batteries don't perform well.



### Battery Certification Sheet

Battery Information			
Battery Number	Type of Battery	Date Purchased	Weight (lbs)
18-01	Optima Red Top SC35	2018	33
18-02	Optima RedTop SC35	2018	33
18-03	Optima Red Top SC35	2018	33
18-04	Optima Red Top SC35	2018	33
18-05	Optima Red Top SC35	2018	33
18-06	Optima Red Top SC35	2018	33
16-02	Optima Yellow Top D35	2016	33
17-01	Optima Red Top 75/25	2017	33
17-03	Optima Red Top 75/25	2017	33
16-12	Optima Red Top SC35	2015	33
16-09	Optima Red Top SC35	2015	33
16-10	Optima Red Top SC35	2015	33
19-01	Optima Red Top SC35	2019	33
19-02	Optima Yellow Top D35	2019	37
19-03	Optima Red Top SC35	2019	33
19-04	Optima Yellow Top D35	2019	37
19-05	Optima Red Top SC35	2019	33
19-06	Optima YellowTop D35	2019	37

**Kennedy High School**

Team Name

**Barry Wilson**

Advisor Name

*Barry Wilson 4/1/19*

Advisor's signature & date

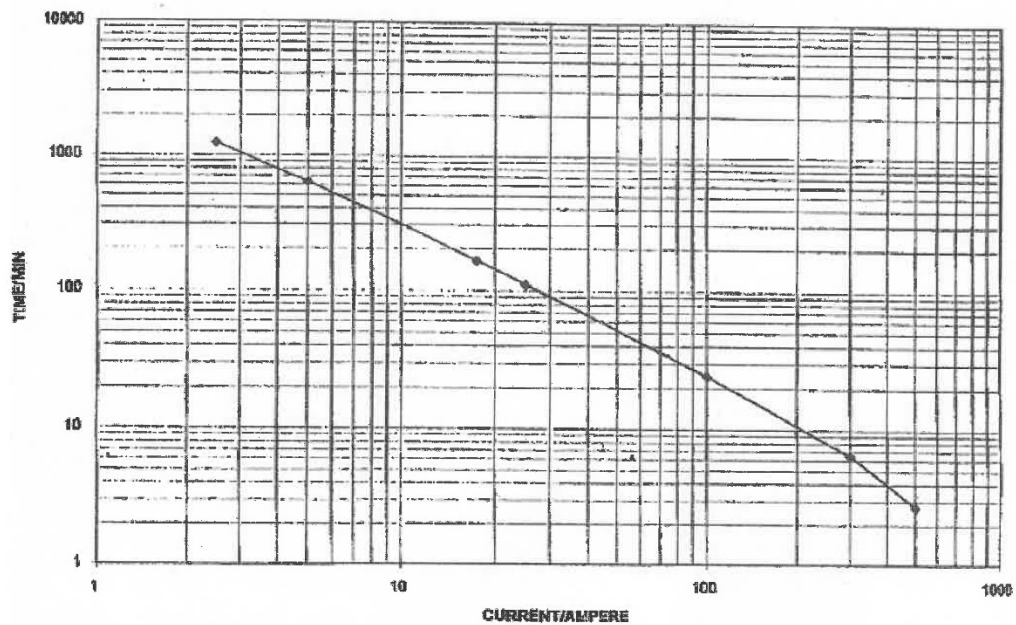
A Sets	
B Sets	
Setups	



## Optima Batteries Graph 2

### Optima Reserve Capacity Peukert Graph

PEUKERT CURVE - OPTIMA DEEP CYCLE



# Gearing

## Why gear?

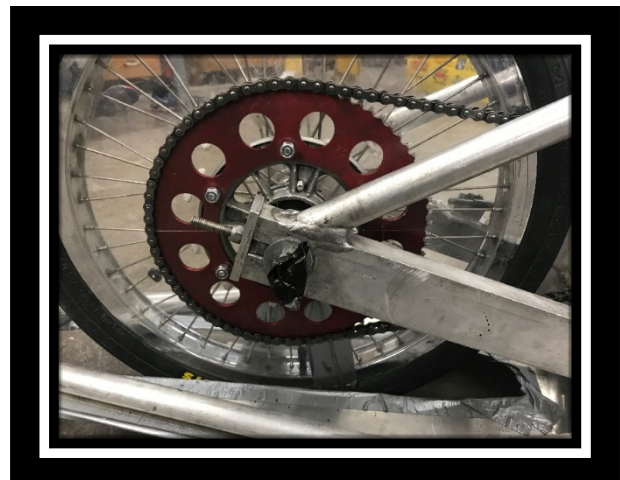
Gearing is one of the most important specifications on the car when competing. Gearing sets the top speed of the car, as well as determining how many amps must be drawn to reach and maintain that speed. It also allows us to adjust the car to various tracks.

## What is gearing?

Gearing is the process of changing the ratio between the drive shaft on the motor and the wheel. This process changes not only how fast the car can go, but how much wear and tear is put on the batteries. The difference in gears affects how many amps are drawn to reach the top speed. This is important because as more amps are drawn, the batteries losses voltage.

## How do I gear a car?

To gear a car, you first need to determine the correct gear ratio. Once you have done that, you gather the correct gear sizes for that ratio. If gears are already on the car, they first get removed. Once the car is free of gears, the new gears can be put on the motor and rear wheel. The wheel gears are much larger than the motor gear, and they are connected by a chain.



## **How do I know what to gear the car at?**

The first piece of information needed to gear a car is the average number of amps drawn from the batteries. This lets you know how hard you can push the car during a race. On a flat track, such as Hawkeye Downs Speedway, top speed is maintainable, meaning you can go faster. On a road course, one with hills or tight corners, top speed is harder to maintain so a gear that requires pulling fewer amps to reach to speed will work better.



## **What is “getting on top of the gear”?**

Getting on top of the gear refers to overcoming or going faster than the top speed for the gear. When this happens, the number of amps needed to maintain top speed decreases. In some cases, it can drop as much as five amps.

## **What happens if you gear too high?**

Gearing too high causes the motor to overheat and your speed to drop up to 50%. In most cases, speed increases again once the motor has cooled off. However, top speed may not be reached again, as the speed is now reliant on how many amps are left in the batteries.

**2014 Briggs Gear Ratios  
20 Inch Wheel  
1668 RPM**

<b>Wheel Gear</b>	<b>Motor Gear</b>	<b>Actual Ratio</b>	<b>Speed</b>
<b>114</b>	<b>17</b>	<b>6.705</b>	<b>14.79</b>
	<b>22</b>	<b>5.18</b>	<b>49.15</b>
	<b>24</b>	<b>4.75</b>	<b>20.88</b>
	<b>26</b>	<b>4.385</b>	<b>22.62</b>
	<b>27</b>	<b>4.222</b>	<b>23.49</b>
	<b>28</b>	<b>4.071</b>	<b>24.36</b>
	<b>30</b>	<b>3.800</b>	<b>26.10</b>
	<b>32</b>	<b>3.562</b>	<b>27.84</b>
	<b>35</b>	<b>3.257</b>	<b>30.45</b>
	<b>38</b>	<b>3.00</b>	<b>33.06</b>
<b>100</b>	<b>17</b>	<b>5.88</b>	<b>16.86</b>
	<b>22</b>	<b>4.54</b>	<b>21.85</b>
	<b>24</b>	<b>4.16</b>	<b>23.84</b>
	<b>26</b>	<b>3.846</b>	<b>25.79</b>
	<b>27</b>	<b>3.703</b>	<b>26.78</b>
	<b>28</b>	<b>3.571</b>	<b>27.77</b>
	<b>30</b>	<b>3.333</b>	<b>29.76</b>
	<b>32</b>	<b>3.125</b>	<b>31.79</b>
	<b>35</b>	<b>2.857</b>	<b>34.72</b>
	<b>38</b>	<b>2.632</b>	<b>37.68</b>
<b>95</b>	<b>17</b>	<b>5.588</b>	<b>17.75</b>
	<b>22</b>	<b>4.318</b>	<b>22.97</b>
	<b>24</b>	<b>3.958</b>	<b>25.06</b>
	<b>26</b>	<b>3.654</b>	<b>27.14</b>
	<b>27</b>	<b>3.518</b>	<b>28.19</b>
	<b>28</b>	<b>3.393</b>	<b>29.23</b>
	<b>30</b>	<b>3.167</b>	<b>31.32</b>
	<b>32</b>	<b>2.968</b>	<b>33.92</b>
	<b>35</b>	<b>2.714</b>	<b>36.54</b>
	<b>38</b>	<b>2.500</b>	<b>39.67</b>
<b>93</b>	<b>17</b>	<b>5.470</b>	<b>18.13</b>
	<b>22</b>	<b>4.227</b>	<b>23.46</b>
	<b>24</b>	<b>3.875</b>	<b>25.59</b>
	<b>26</b>	<b>3.577</b>	<b>27.73</b>
	<b>27</b>	<b>3.444</b>	<b>28.80</b>
	<b>28</b>	<b>3.321</b>	<b>29.86</b>
	<b>30</b>	<b>3.100</b>	<b>31.99</b>
	<b>32</b>	<b>2.906</b>	<b>33.92</b>
	<b>35</b>	<b>2.657</b>	<b>36.54</b>
	<b>38</b>	<b>2.447</b>	<b>39.67</b>

85	17	5.000	19.83
	22	3.86	25.69
	24	3.541	28.01
	23	3.69	26.88
	25	3.400	29.17
	26	3.269	30.34
	27	3.148	31.57
	28	3.036	32.67
	30	2.833	35.01
	32	2.656	37.34
	35	2.429	40.83
83	38	2.237	44.34
	17	4.882	20.31
	22	3.773	26.29
	23	3.608	27.49
	24	3.458	28.68
	25	3.32	29.87
	26	3.192	31.07
	27	3.074	32.26
	28	2.964	33.47
	30	2.767	35.85
	32	2.594	38.24
79	35	2.371	41.83
	38	2.184	45.41
	17	4.647	21.34
	22	3.591	27.62
	24	3.292	30.13
	26	3.038	32.65
	27	2.925	33.91
	28	2.821	35.16
	30	2.633	37.67
	32	2.468	40.19
	35	2.257	43.95
73	38	2.079	47.71
	17	4.294	23.10
	22	3.318	29.89
	24	3.042	32.60
	26	2.808	35.32
	27	2.703	36.69
	28	2.536	39.11
	30	2.433	40.77
	32	2.281	44.88
	35	2.086	47.55
	38	1.921	51.63



72	17	4.235	23.42
	22	3.273	30.30
	24	3.000	33.06
	26	2.769	35.82
	27	2.666	37.20
	28	2.571	38.58
	30	2.400	41.33
	32	2.250	44.08
	35	2.057	48.22
71	17	4.176	23.75
	22	3.227	30.74
	24	2.958	33.53
	26	2.730	36.33
	27	2.629	37.73
	28	2.536	39.11
	30	2.367	41.90
	32	2.218	44.72
	35	2.029	48.88
69	38	1.868	53.10
	17	4.058	24.44
	22	3.136	31.63
	24	2.875	34.50
	26	2.654	37.37
	27	2.555	38.82
	28	2.464	40.25
	30	2.300	43.12
	32	2.156	46.00
67	35	1.971	50.32
	38	1.816	54.62
	17	3.941	25.17
	22	3.045	32.57
	24	2.791	35.54
	26	2.577	38.49
	27	2.481	39.98
	28	2.393	41.45
	30	2.233	44.42
	32	2.093	47.39
	35	1.914	51.82
	38	1.763	56.26

65	17	3.823	25.94
	22	2.954	33.58
	24	2.708	36.63
	26	2.500	39.67
	27	2.407	41.21
	28	2.321	42.74
	30	2.167	45.77
	32	2.031	48.84
	35	1.857	53.42
	38	1.711	57.97
63	17	3.705	26.77
	22	2.863	34.64
	24	2.625	37.78
	26	2.423	40.93
	27	2.333	42.52
	28	2.250	44.08
	30	2.100	47.23
	32	1.968	50.40
	35	1.800	55.12
	38	1.658	59.82
61	17	3.588	27.64
	22	2.772	35.78
	24	2.541	39.03
	26	2.346	42.28
	27	2.259	43.91
	28	2.179	45.52
	30	2.033	48.79
	32	1.906	52.04
	35	1.743	56.91
	38	1.605	61.80
59	17	3.470	28.58
	22	2.681	36.99
	24	2.458	40.35
	26	2.269	43.71
	27	2.185	45.39
	28	2.107	47.07
	30	1.967	50.43
	32	1.781	55.69
	35	1.686	58.83
	38	1.553	63.87
57	17	3.352	29.59
	22	2.590	38.29
	24	2.375	41.77
	26	2.192	45.25
	27	2.111	46.98

	28	2.036	48.72
	30	1.900	52.21
	32	1.781	55.69
	35	1.629	60.89
	38	1.500	66.13
55	17	3.235	30.66
	22	2.500	39.67
	24	2.292	43.27
	26	2.115	46.90
	27	2.037	48.69
	28	1.964	50.50
	30	1.833	54.11
	32	1.718	57.74
	35	1.571	63.14
	38	1.447	68.55
53	17	3.117	31.82
	22	2.409	41.18
	24	2.208	44.92
	26	2.038	48.67
	27	1.962	50.55
	28	1.892	52.42
	30	1.766	56.17
	32	1.656	59.90
	35	1.514	65.51

**RPM / Ratio x RollOut / 12 / 5280 x 60 = Speed**

**Roll Out for 20 Inch Wheel = 62.8**

**Constant / Ratio = Speed**

**Constant = 99.1954**

**RPM for Briggs =1668**

# Body



## Shell

The 983 car's frame is enclosed by 0.03-inch polycarbonate (plastic) and 0.06-inch aluminum sheets.

### Why plastic?

The 0.03-inch polycarbonate is a thin, lightweight cover that is easily replaceable, weather resistant, and greatly improves aerodynamics. The plastic is applied in panels, so if one area experiences damage just that area would need to be replaced. This plastic does not absorb water and can be treated with Rain X to repel precipitation. A smooth glossy finish allows the air to glide down the sides of the car, not pocketing the air.





## **How is it applied?**

Plastic panels are riveted on with one-eighth-inch diameter rivets. Wheel covers are plastic circles attached to the spokes of the wheels in a cone-like shape, nine zip-ties securely fasten the covers to the inside and outside of the wheel

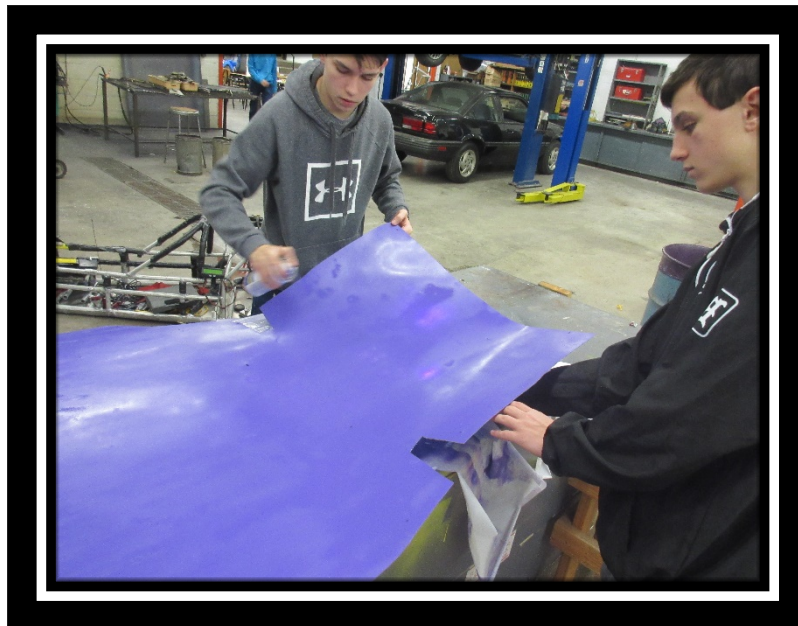
## **Foam Padding**

Thin, grey foam tubes are applied to the car's frame from the firewall forward. The foam is a safety feature. In the case of an accident, the foam is supposed to absorb some of the force as opposed to the driver's body hitting the aluminum tubes directly. The foam tubes are secured with electrical tape and help hide electrical wires.



## Graphics

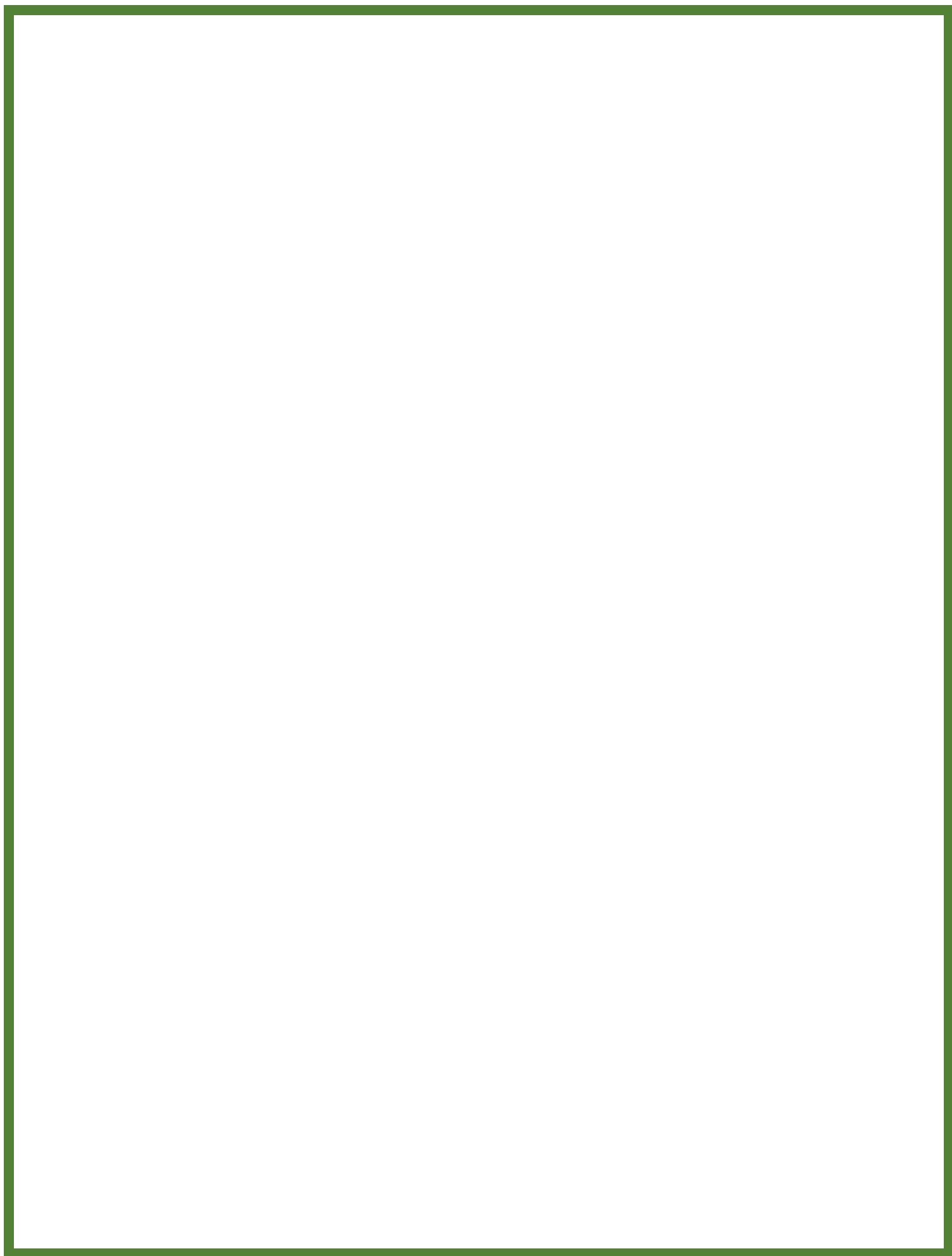
Required graphics include car numbers, a three-inch red triangle pointing towards the exterior on/off switch, and a 'push here' graphic directing inspections personnel where to apply pressure. Everything else is up to the team's imagination and creativity. This year the 983's crew chief John and his assistant Colin have painted their car "grape" just like last year.



## Aerodynamics

In aerodynamics our lead Lucas Corrigan creates foam models of our cars and then tests them in a wind tunnel, to find what the drag coefficient, and lift/downforce is on all the cars to then figure out what features and design aspects can be used to design a more aerodynamically efficient shape. The process then repeats with the creation of a new foam model, testing, and improving, until he can find the best design.





# Testing

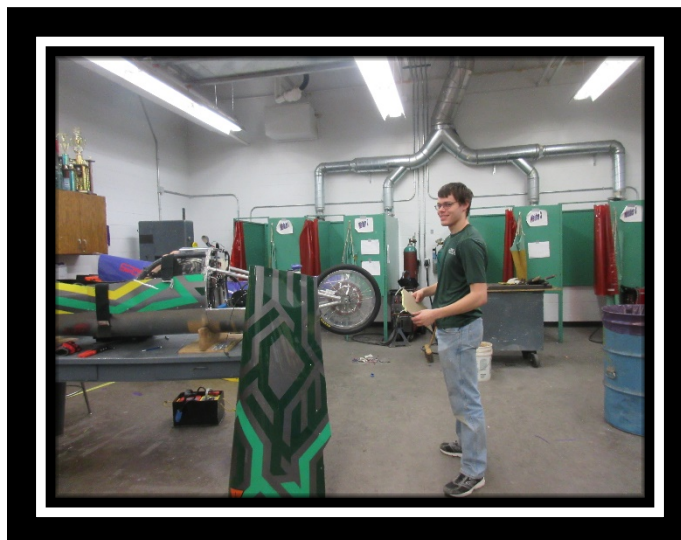




## Testing

Throughout the year, we do a lot of testing on the cars and the parts that make up the car. Because the battery testing is such a long process, it runs from when school starts in the fall until the start of the race season. As a part of this testing, all three cars are taken to a test track to get actual running data from the batteries. Frequent testing also done throughout the year by the aerodynamics team during the design process of the car. We also do our best to get cars out to a parking lot or test track at least once before racing to get an idea of how they will run and look for any last-minute improvements. This also provides an opportunity to see how well the cars perform in breaking and handling, as well as giving the drivers some practice laps. Testing is important for keeping our drivers from getting rusty, as well as allowing new drivers to get used to their car prior to the first race.

We also do exit and vision testing with drivers. For safety purposes, drivers must be able to exit the car unaided in less than 20 seconds. If a driver fails this, they are not permitted to race because in the event of an emergency, the driver will need to be able to exit the car swiftly. Vision is also important because the driver needs to be able to see the cars around them so that no one gets hurt during a race. We test this by holding a clipboard up to see if it is visible in the driver's mirrors.



Windtunnel Testing 2018-19

Car #	Wind Speed	Lift + Down -	Drag	Comments
2018 (50) A	24.4	-0.08	0.38	Air falls to side at about half way up the canopy. Air starting under the car stays under
2018 (30)	31.3	-0.08	0.4	Air falls to side at about 1/3 of the canopy. Air under the car stays under
Show Car	30.9	-0.3	0.55	Air slowly drifts to the side of the car and then falls to the side where the wheel covers end. Air under stays under with very low turbulence
2019 (40) B	30.8	-0.05	0.28	Air started at the top of the Car. Starts to fall to the sides at about halfway up the canopy. Air started under the car will stay there all the way back. 30.3% improve over 50 Car
40 Dream C 2019	31.8	-0.25	0.17	The car is narrower but taller.  49% improvement over 50 car

# Safety



## Safety

To insure the safety of our drivers, we apply the rules put in place by the four different organizations we race under (EVERON, Iowa, NECA, and Challenge USA). New rules are instated frequently, and we must adjust to the changes.

### Driver

Drivers must wear either a DOT approved full-faced helmet or an open-faced helmet with safety glasses when driving the car. This ensures the protection of the head and eyes in the event of an accident. Gloves are also required to be worn by the driver. Gloves protect the driver's hands in the event of a rollover accident or any situation where their hands could come in contact with the ground causing injury. Similarly, long pants and sleeves are needed to protect the driver's body in the event of contact with the ground or debris that may enter the car. Closed-toe, leather shoes are required at races within Nebraska and we chose to follow this rule at all our races. The protection they provide is essential to the driver's feet, which reside at the very front of the car.



## Car

A five-point safety harness is used to secure the driver in the car- one point at each shoulder, one point at each side of the hip, and one point between the legs that all connect at the waist. The metal tubing used for the frontal impact and roll bars, in place to protect the driver in the case of a collision or rollover, are padded with foam tubing to protect the driver from sharp metal edges. The firewall is in place between the motor and the driver and the car's motor. Firewalls must be capable of withstanding one hundred pounds of force so that in the case of an accident the driver's head does not move. The barrier also protects the driver from the chain and motor.





# Course Maps



## Where we race:

Cougar Electric Car is the only electric car team to race in five states. We attend two races in Nebraska, two in Iowa, one in Michigan, one in Illinois, and three races in Wisconsin. All of the tracks provide different racing conditions with races lasting either 60 or 90 minutes.

### West Point, Nebraska

April 6<sup>th</sup>, 2019

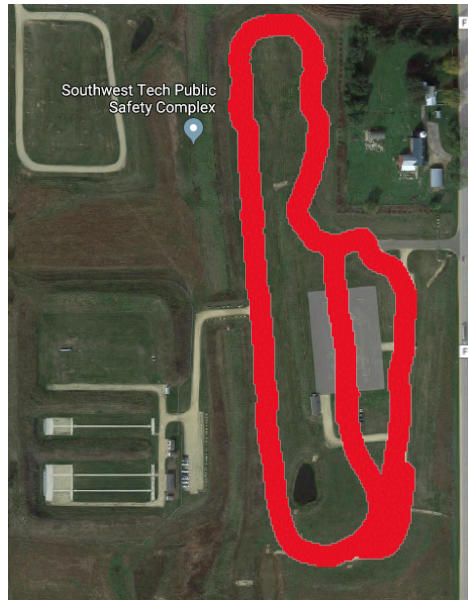


West Point, NE – Cuming County Fairgrounds in West Point, NE is the first EVERON race. While we have been to this location many times, this is a new course. Instead of four 90-degree turns, this new course only has one. We look forward to running on this new course.

**University of Wisconsin Platteville**

**Platteville, Wisconsin**

**April 12<sup>th</sup>, 2019 and April 13<sup>th</sup>, 2019**



Platteville, WI- This is our first year racing in Platteville and we aren't entirely sure what to expect. The breaking and handling is held at a separate location then we move to the track, which is pictured to the right. The track looks to be an elongated misshapen oval, with the probable route in red and a possible change in yellow.

**Stout**

**Menomonie, Wisconsin**

**April 26<sup>th</sup>, 2019 and April 27<sup>th</sup>, 2019**

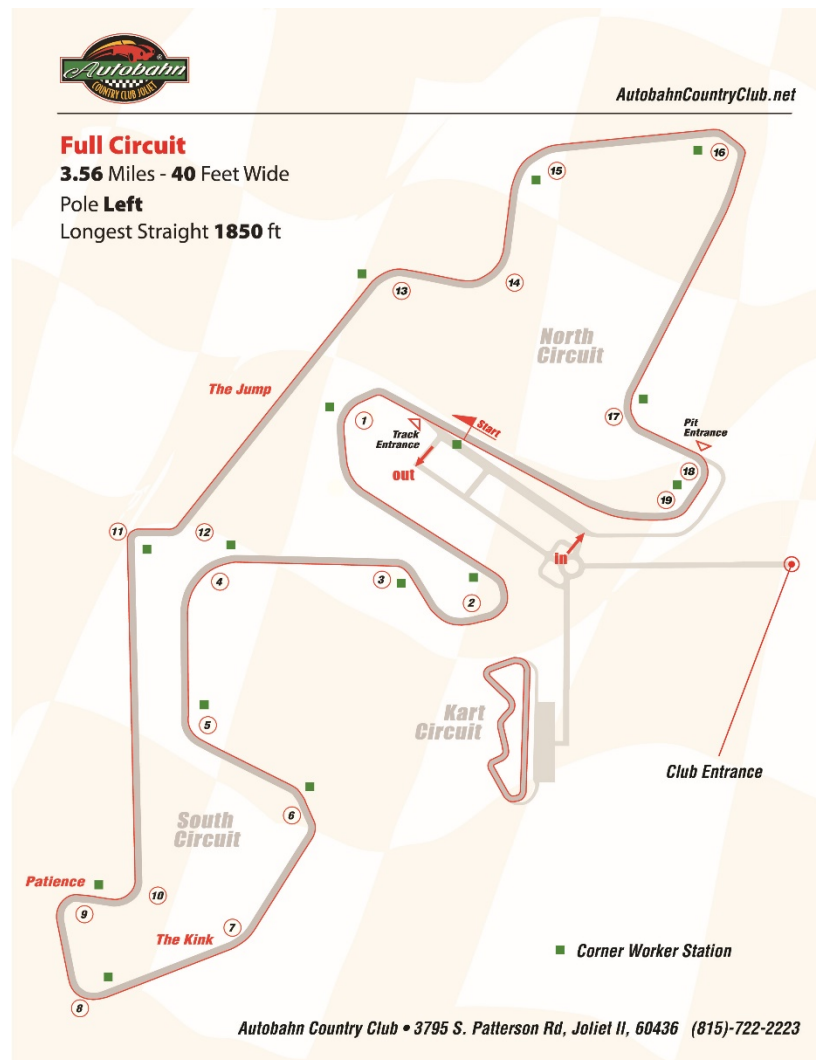


Menomonie, WI – This is the north set of runways at the local airport. Last year was our first time running here. All four corners can be challenging with traffic. As the first race in Wisconsin last year, we learned that electric cars do not do well in the snow. Drivers quickly learned not to attempt short cuts (keep it on the pavement).

# Autobahn

Joliet, Illinois

April 28<sup>th</sup>, 2019 and April 29<sup>th</sup>, 2019



Joliet, IL – Last year was our first year at this course as well. Race organizers split the course so we ran only the South portion of the track (approx. 2 miles). While the goal is not to break down, it is a long way back to the pits when it happens here.



# Wayne, Nebraska

May 4<sup>th</sup>, 2019

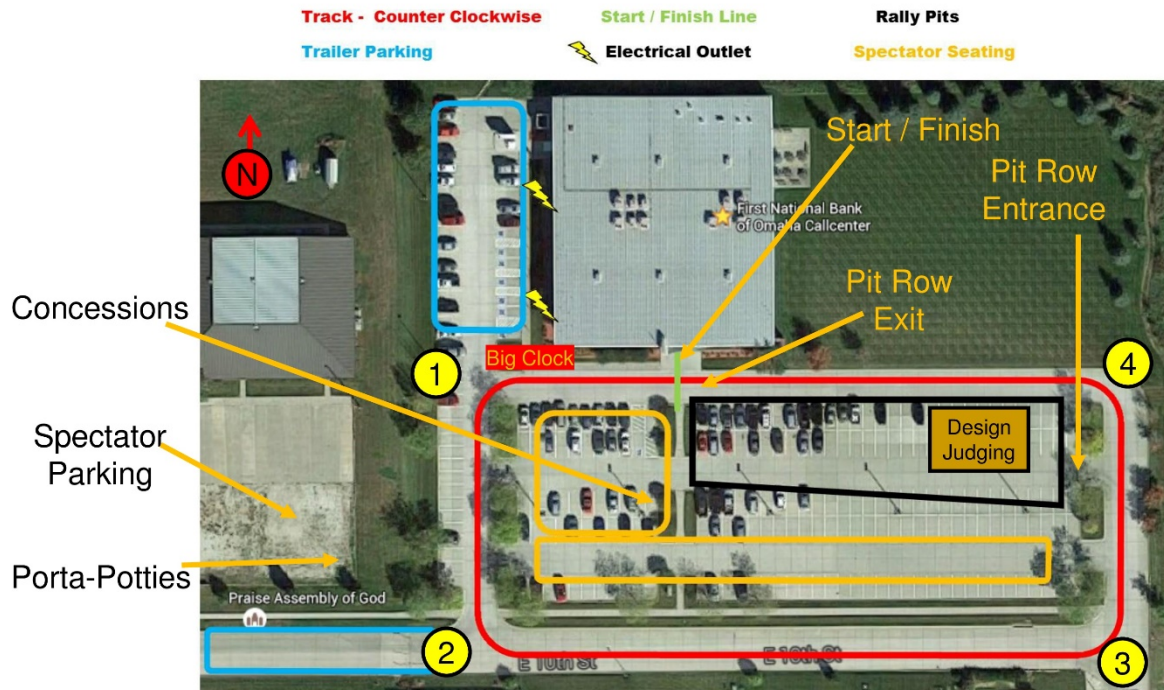
First National Bank of Omaha Call Center  
1110 East 10<sup>th</sup> Street  
Wayne NE

90-Minute Heats

① = Turn Number

1 Lap = 0.3 miles

Please only have one vehicle / trailer in "trailer parking" area. Additional vehicles can be parked in gravel parking lot to the west of the track.

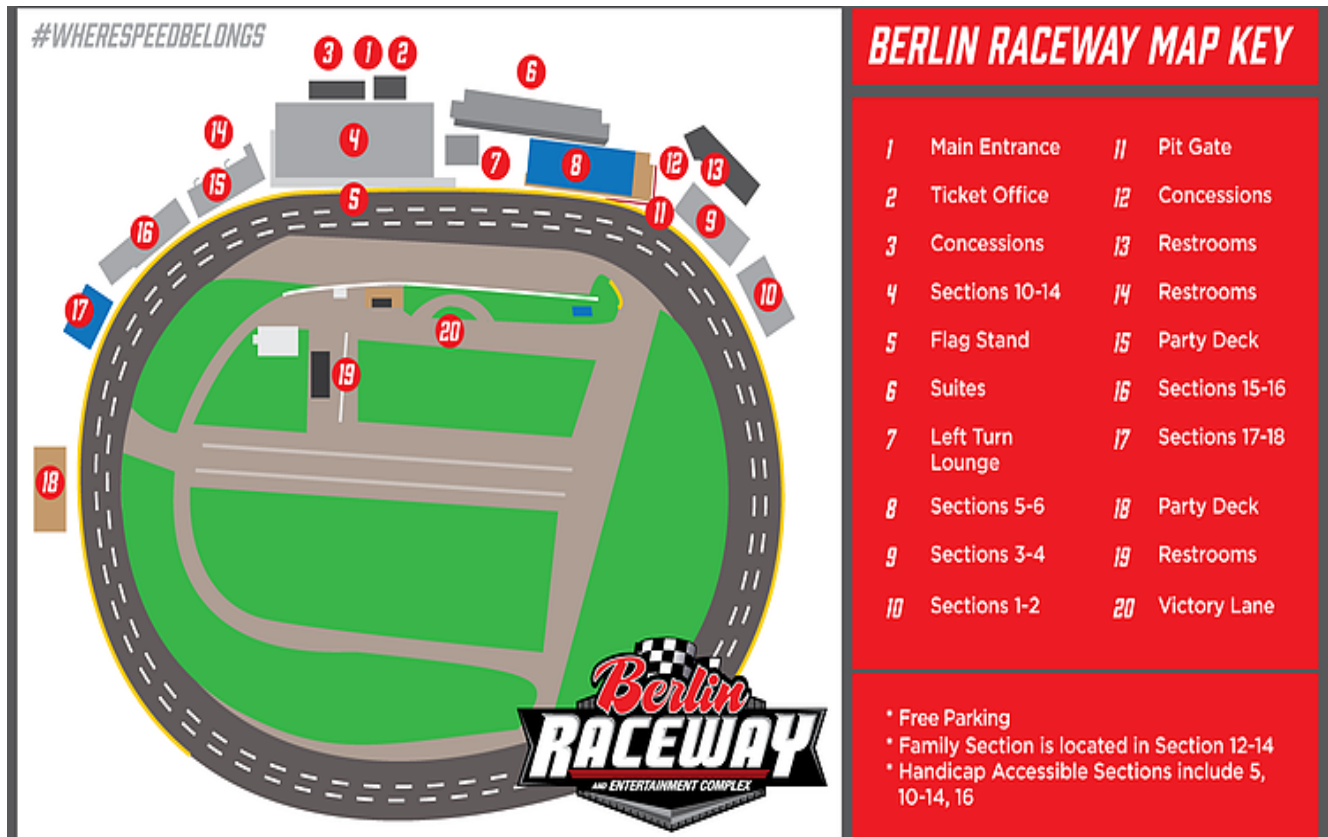


Wayne, NE – Wayne is an EVERON race in Wayne, NE. The track is a tight rectangle around the bank's parking lot. Pits are located in the middle of the parking lot. Wayne is a 90-minute race with two mandatory driver changes/ pit stops. Obstacles include gutter drains and curbs.

**Berlin**

**Marne, Michigan**

**May 10<sup>th</sup>, 2019**



Marne, MI— Berlin Raceway in a 7/16-mile, stock car, asphalt oval with pit lanes in the center. The oval is three lanes wide all the way around and is banked in the corners. This track is the most perfect rack we race on. It averages 4mph faster than Hawkeye Downs (our other speedway).

# Road America

## Elkhart, Wisconsin

May 13<sup>th</sup>, 2019 and May 14<sup>th</sup>, 2019



Elkhart, WI – Road America’s track is 4.05 miles long, making it the longest course on which we will race. This course qualifies as a road course, consisting of right and left turns. Braking and handling takes place in a parking lot near the pits.

## **Hawkeye Downs**

**Cedar Rapids, Iowa**

**May 18<sup>th</sup>, 2019**



Cedar Rapids, IA – Hawkeye Downs Speedway is a 1/2-mile, asphalt, oval. This track is not perfectly graded, the back straightaway is uphill, and there are numerous larger cracks in the surface of the asphalt. Pits are located right in front of the lap counters and trailers are parked on the small 1/8-mile oval. Braking and Handling competitions are also held on the front and back straightaways.



## Prairie

Cedar Rapids, Iowa

May 19<sup>th</sup>, 2019



Cedar Rapids, IA – Prairie Point Middle School is our last race of the season. We race on the road surrounding the school and pit in the parking lot adjacent to the track. Difficulties with this track are turns 1 and 4, storm drains along the backstretch, and the final leg of the track is a slight uphill. Turns 1 and 4 can be dangerous, because they are very sharp and tight turns, when cars wreck on this track it typically on one of these two turns. Storm drains located on the back half of the track are marked with cones for students to avoid hitting and damaging their cars.