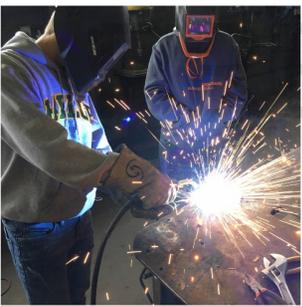




*Covenant Christian Academy 2017  
Solar Car Team*



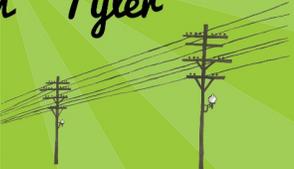
# THE POWER OF TEAMWORK



*Jake \* Morgan \**

*Kaya \* Jake \* Issac*

*\* Steven \* Tyler*

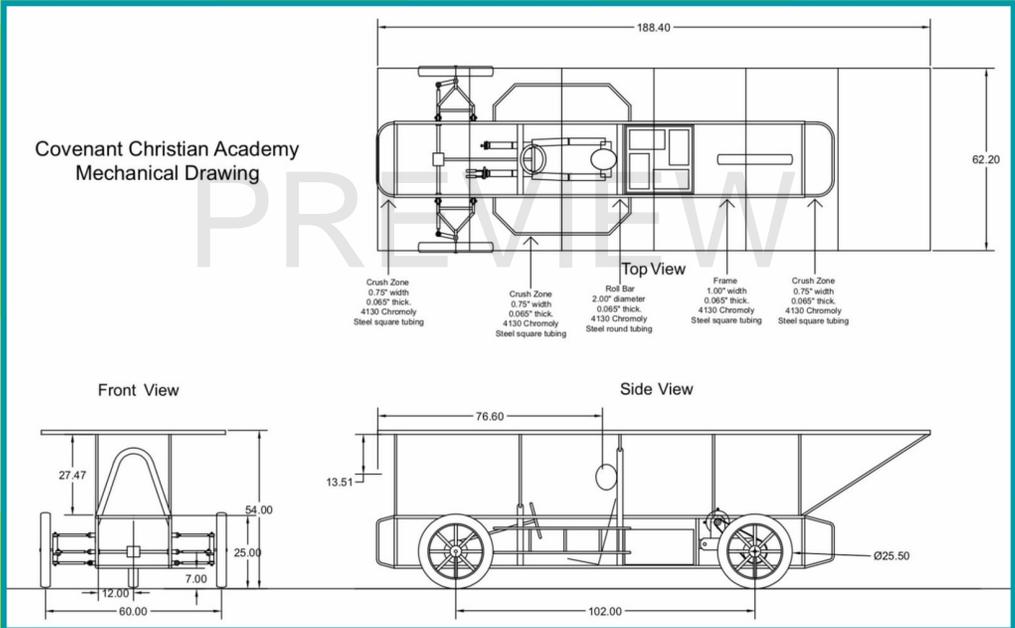


*First team meeting,  
on January 22nd,  
included  
introductions, reading  
overview of Solar  
Car Challenge rules  
and requirements, and  
setting expectations  
and receiving  
assignments.*



*CCA 2017  
Solar Car Team:  
Jake Caramay,  
Morgan Caramay,  
Jake Eudaly,  
Kaya Lane,  
Issac Fuller,  
Steven Roe, and  
Tyler Tarkington.  
sponsored by  
Shannon Caramay.*

*Our Solar Car Design Schematics:*







*Issac practices welding.*



*February 25*

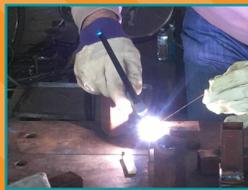


*Jake practices MIG & TIG welding, although he had some prior experience with arc welding.*



*February 25*





*Shannon learns to MIG & TIG welding. Over 30 years earlier, his father had taught him to arc weld very in shop class in high school.*

*Jake continues to practice welding.*

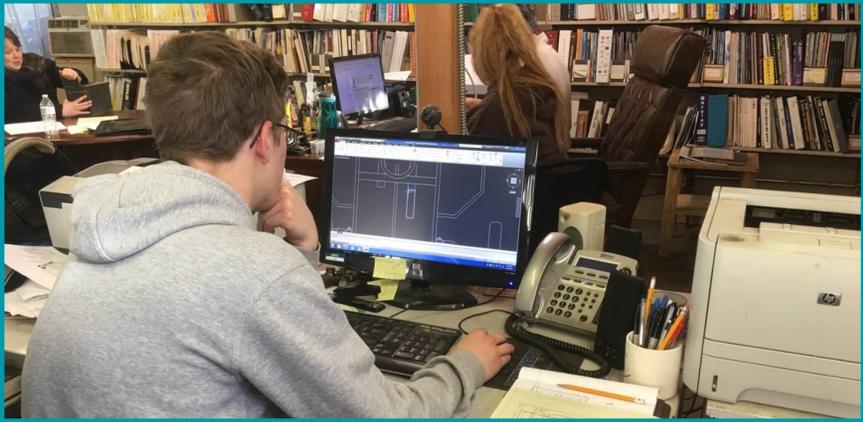


*February 25*

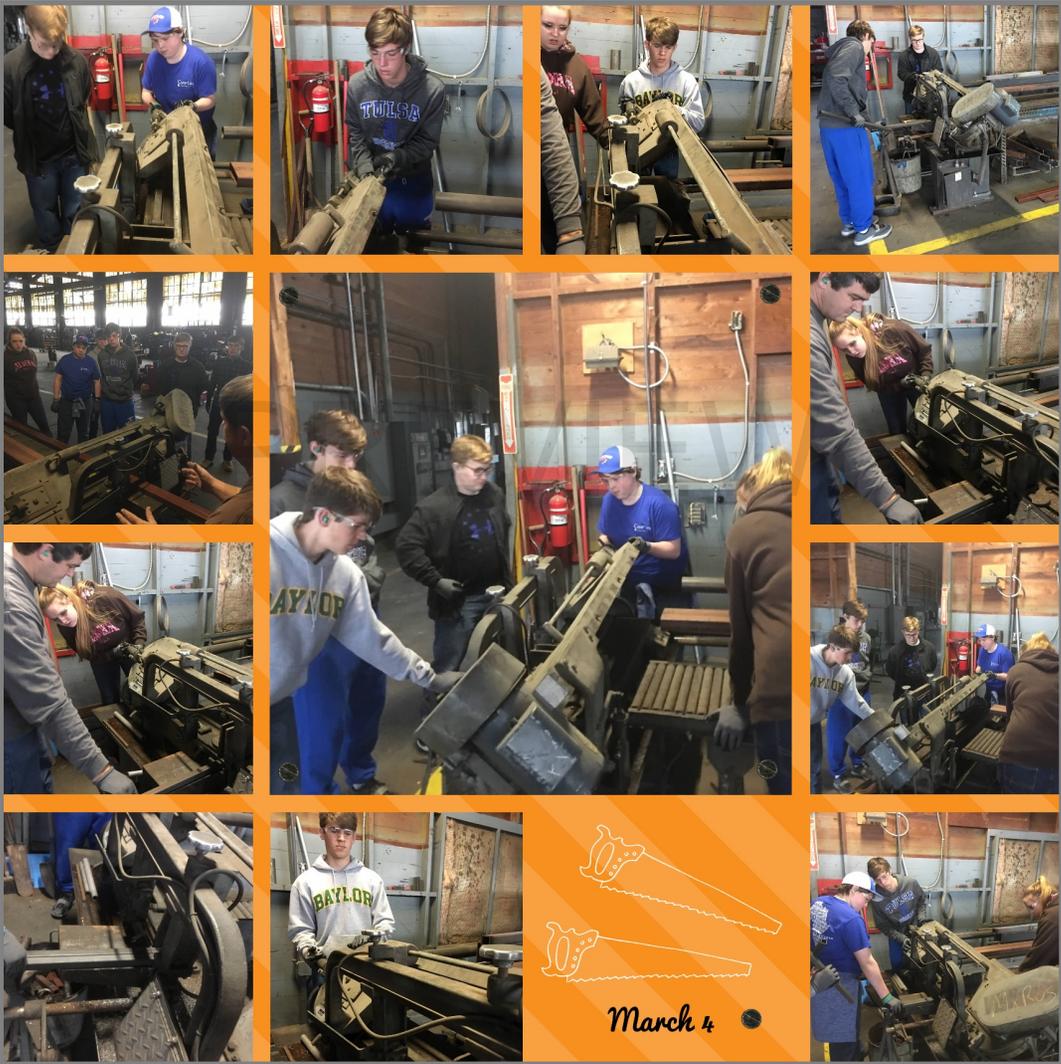




*Issac looks over the schematics of our Solar Car design.*



*February 25*



*Everyone had the chance to use the band saw to cut the metal tubing into pieces for our frame.*



*March 4*

*Next, we had the opportunity to test our welding skills.*



*March 4*



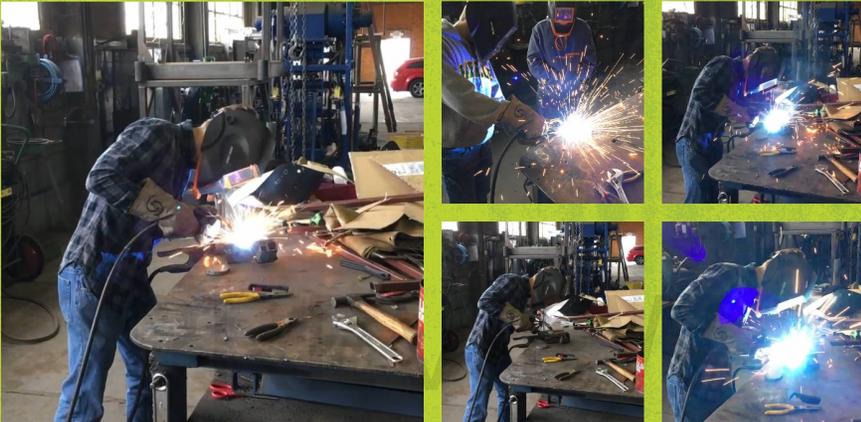
*We created the roll bar using a pipe bender and slowly bent the bar into the desired shape, using a cardboard template.*



*March 11*



March 11



*We use the tube bender to shape the roll bar and continue welding practice.*



*Issac and Steven continue welding the frame.*



March 11



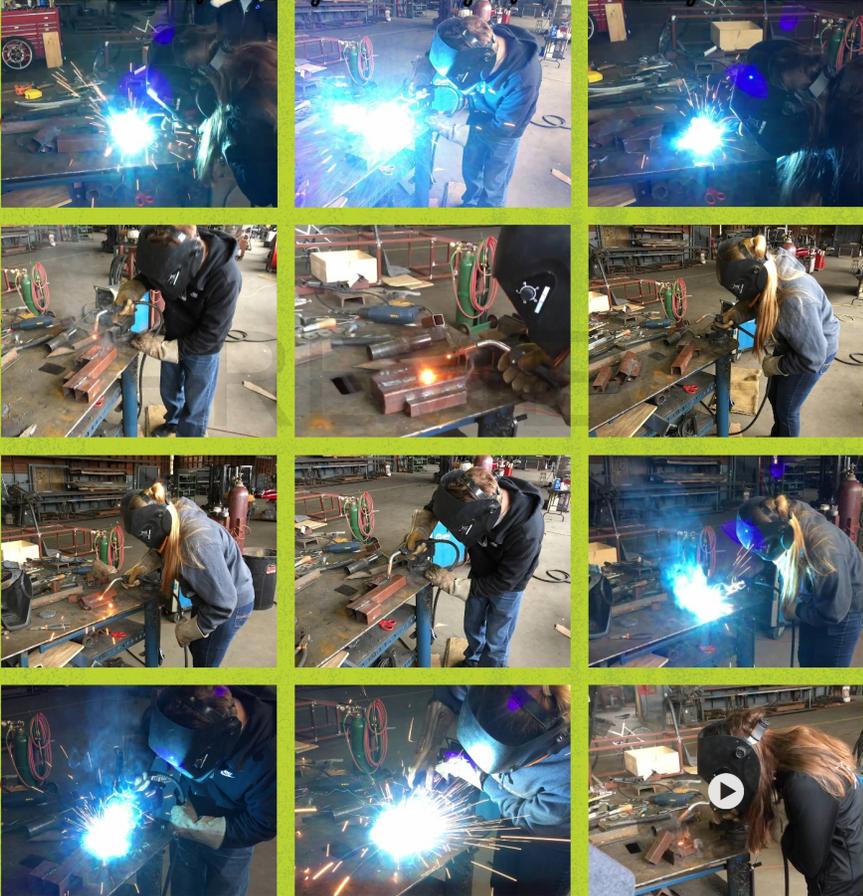


*Steven and Jake  
continue to practice their  
welding and then weld the  
frame together.*

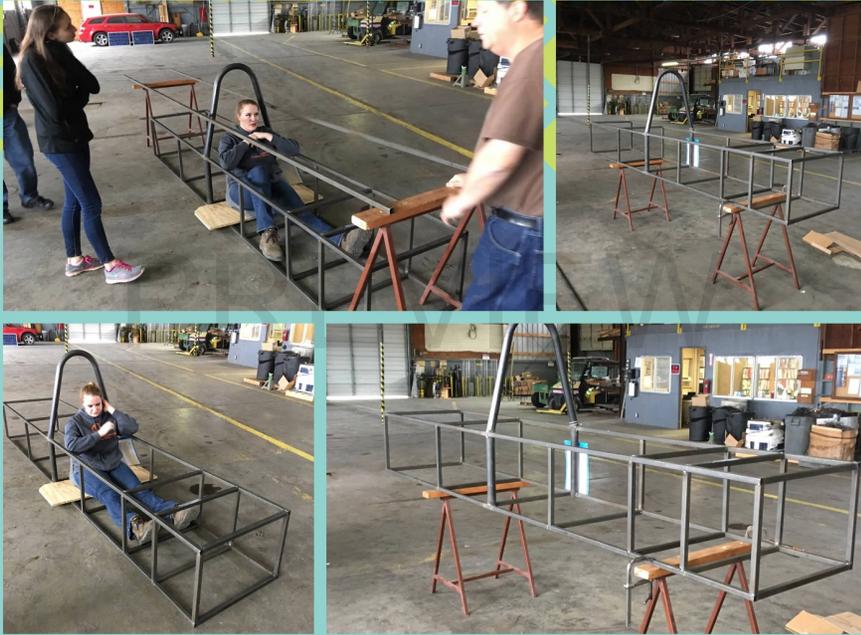
*March 11*



*Stephen, Kaya, and Morgan practice welding.*



*March 12*



*Morgan and Kaya test out the roll bar clearance around the driver. Everyone can sit in the vehicle and stretch out their legs.*

*March 12*

March 18



*Morgan and Jake are drilling some of the suspension attachments...*



March 18



*Jake and Tyler grind the edges of the frame smooth.*

*The team builds and paints the floor and battery box, and installs a temporary seat.*



*April 1*





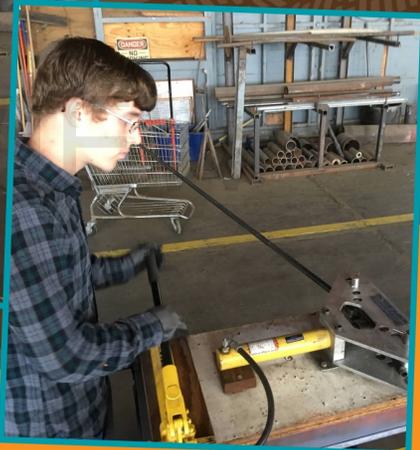
*Steven, Morgan, Jake, Issac, and Jake E test the framed car.*

*April 1*





*Issac creates the double wishbone front suspension from 1" pipe on the pipe bending machine.*



*April 8*

*Jake and Tyler continue to grind the welds on the frame and prepare for suspension installation.*

*April 9*



*Steven, Morgan, and Jake install the suspension.*



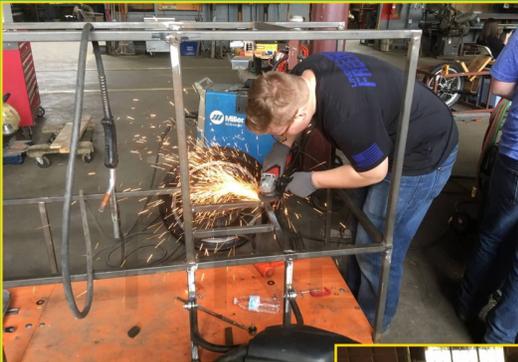
*April 15*





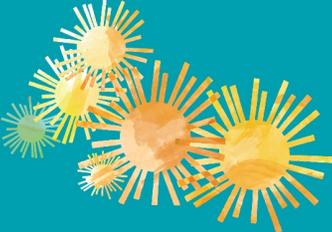
*Jake and Steven are assembling the braking system. April 29*





April 29

*Stephen and Jake E  
are grinding more of  
the frame welds until  
smooth.*





*Mr. Mark shows  
Steven how the lathe  
works.*



*May 6*

*Jake is grinding frame  
welds smooth.*



*May 7*





*Jake is grinding the frame welds smooth, which is a big job.*



*May 7*

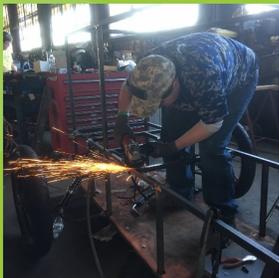




*Jake is adding the steering wheel and testing out the steering system. We have ability to turn the wheels!*



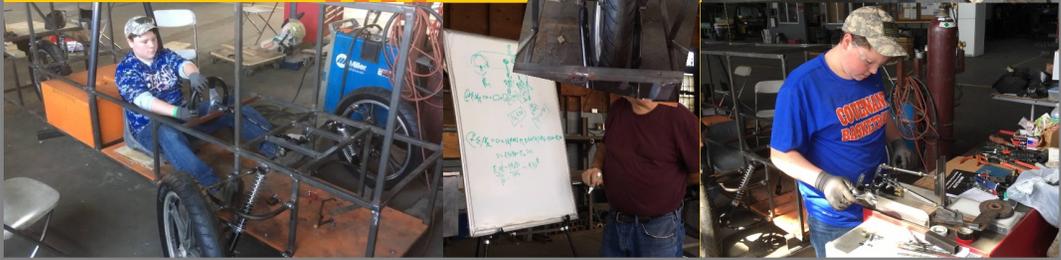
*May 7*





*Issac and Jake install the springs for the suspension. Of course Jake has to test it out!*

*May 13*

A yellow banner with decorative sunburst patterns and text. The text is in a cursive font and describes the work being done on the suspension system.







*Morgan finishing mounting the Solar Panels.*



*May 21*





*May 21*

*Morgan and Kaya team up to grind the welds smooth on the rear suspension mount.*

*Issac and Jake start adding the side panels to the frame... Now it is starting to look more like the car we envisioned!*



*May 27*



May 27-28

*The team is encouraged that it is starting to really look like a solar car; however, there is still a significant amount of electrical work still to be done.*



*Jake and Morgan gave Kaya the first ride in the car.*



*If their names were Solar, it would be "Solar Powered"!*



*Shannon and Jake spend Memorial Day, disassembling and painting the frame.*



*May 29*



*Jake is working on the motor mount.*

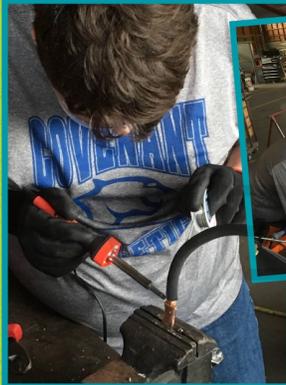


*Mark shows the team how to create a simple mold for a fiberglass nose cone.*

*June 3 and 4*



Morgan and Jake continue the process of making the 48 volt, 1/0 cables. The Solar Express contains approximately 40' of 48 volt main power cables and there are numerous individual cables due to all the required switching and protection devices.



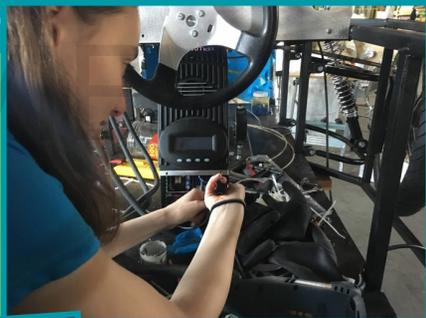
June 9



*Issac, Steven, and Kaya create and install the dashboard.*



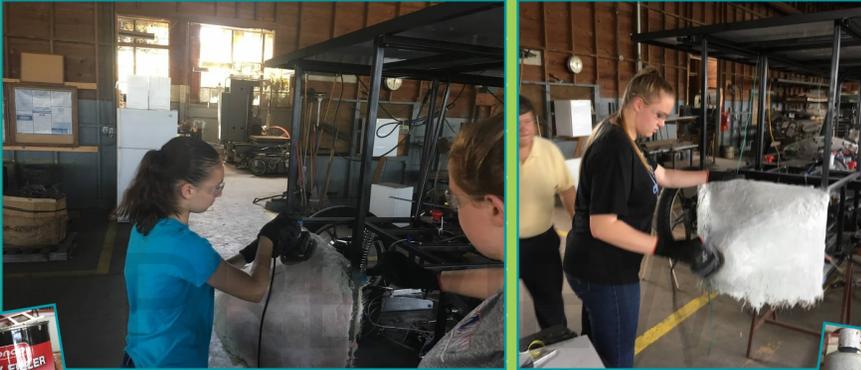
*June 10*



*Kaya installs the solar charge controller.*

*June 10*

*Morgan and Kaya apply fiberglass to the nose cone frame and sand it smooth.*

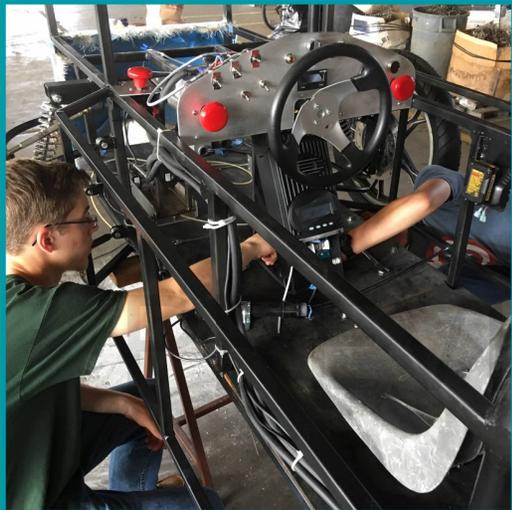


*Aesthetics and aerodynamics? Work with what you've got.*

*June 11 & 14*



June 17



*Issac, Jake, & Tyler finish up the electrical and install the drive system.*



*Jake attempts to  
take the car out for  
a spin, before half  
the team goes to  
Zambia on a 2 week  
mission trip.  
June 17*

*Jake and Mr. Caramay drill the revised mounting holes for the rear suspension.*



*July 8*



*Kaya hooks up the battery fan and charge controller.*



*Jake identifies buttons with labels and creates a water bottle holder.*



*July 9-10*

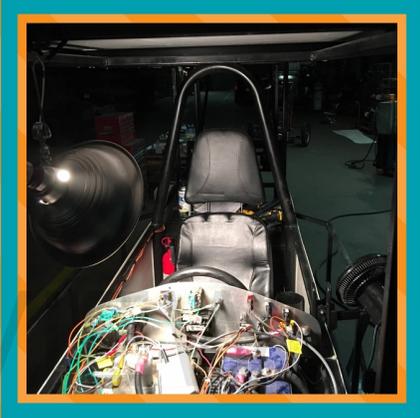
*Mr. Caramay & Mr. Rose cut our windshield design out of plexiglass. Then, we carefully installed the windshield.*



*The finished nose cone from our mold is looking quite nice!*

*July 11*

July 11



*Jake installed the new seat with headrest and seat belts & cup holder.*



*No, it's not time to apply the graphics yet!*

July 13 & 14



*Jake, Kaya, & Morgan test drive the finished car. Over the next few days, we only had time to accumulate about 15 miles of testing vs the 500 miles suggested by the Solar Car Challenge organization.*



*It's alive!*



*On Saturday, the team attended final registration, and meetings on Pre-race Orientation, Safety, Driving Etiquette / Rules, Spotting, Radio Operation, & Information Analysis, removal of disabled cars from the track, Scrutineering, judges, and other expectations.*

**Electrical and Mechanical Characteristics**  
VEHN245A11

**2017 Solar Car Challenge Official Registration Documents**

**Mechanical Interface**

**MCP Motor Hydraulic Drive Controller Board**

**Wheel and Tire**

**Performance Graphs**

July 15: Day 1

**Limiter Very Fast-Acting ANR**  
Copper Busbar

**Covenant Christian Academy**  
Mechanical Drawing

**Panasonic N240 HIT**  
Photovoltaic module HIT<sup>TM</sup>  
VEHN245A11

All drivers must have a valid driver's license. Oops! Our oldest had a birthday. Half the drivers just received their license within the last month.

**12 Volt Auxiliary**

**SEVCON**  
Electrification Partner  
Millipak

**48 Volt System**



July 16: Day 2

We arrive with the car, and a few tools, noticing that every other team has ice chests, chairs, tool boxes, & replacement parts. Team mom, Tanya, picks up necessary basics, while the team assesses the car to prepare for scrutineering. At least they look like they have it all together in those handsome team polo shirts and matching shorts and hats from Ivy School Uniforms.







*Every time the vehicle left the garage, safety flaggers waived flags and guided the driver.*



*July 16: Day 2*



*Station 1: General Scrutineering - Documentation, Vehicle Size, Roll Cage, Roll Bar, Crush Zones, Vehicle Points, Driver Conditions, & Student Involvement.*



*July 16: Day 2*

*Judges said the car was 18cm too long. This was a result of our aerodynamic nose cone being an "as built" modification that was not included in the original design measurements that complied with the dimension limits of the race rules. So we had to pivot to shorter, less aerodynamic nose cone.*

*Oral Presentations... worth an additional 4 laps in the final race. CCA prepared us well.  
Morgan wrote the presentation, but everyone was required to participate.*



Covenant Christian Academy  
Oral Presentation

Team Members: Isaac Fuller, Steven Rose,  
Morgan Caraway, Kayla Lane, Jake  
Caraway, Tyler Tarkington



Date: July 17, 2017

**Catching The Vision, But Delayed & False Starts**

- Our team sponsor learned about the Solar Car Challenge from another parent at Covenant Christian Academy (CCA) just August, who has a co-worker with a kid on the Liberty Christian team
- He wanted to see CCA start a similar offering as a way to enhance our college prep program with an applied engineering activity
- However, it took all of last fall semester for him to gain approval of CCA to start a Solar Car Club, which significantly delayed our start time for this project
- In order to have enough people to form a Solar Car team at CCA, where only four students signed up this year, we included students from two other local schools
- Finally, we were able to start with our first team meeting in late January, less than 7 months before the race!
- However, after getting some bad advice from a person in the audience at the January workshop, we started our project with a Chinese buggy that we bought & started converting to electric, before learning from John King, that this approach would not work

**False Start - Ignorance Was Initially Bliss**



- Late January start with our Chinese buggy
- Ignorance in design and general of the team work ahead
- It quickly became obvious that the Chinese buggy's wheel base is entirely too small to support this solar car
- Additionally, it doesn't comply with the rules for student-led design

**Getting Our Footing & Building On A Solid Foundation**

- Fortunately at the January SCC workshop our team sponsor met Mark Rose from Mineral Wells, who was trying to start a team there
- He realized by some of the questions that our team sponsor was asking in that meeting, that our team needed some help with the mechanical side of the car and the tools with which to build the car
- Mark strongly encouraged the CCA team to drive out to Mineral Wells and use his industrial quality machine shop as a place to build our car and learn the skills needed to construct it
- By late February, the CCA team realized that Mark's offer was extremely generous and more than worth the 2 1/2 hour round trip drive each day that we worked on the car (averaged 2 1/2 days/week)
- Mark immediately started teaching our kids to TIG & MIG weld, operate the metal band saw, and learning AutoCAD.
- Mark was the turning point that allowed our team to meet the critical March 1st filing deadline

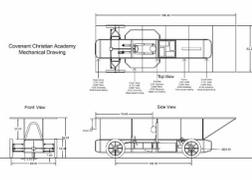
**Skills Learned by Team Members**



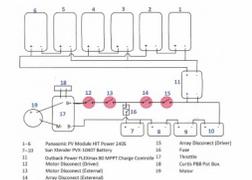
**Skills Learned by Team Members**



**Mechanical Drawings**

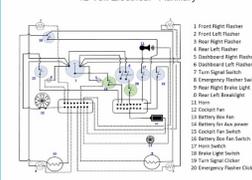


**48 Volt Electrical - Propulsion**



- 1-6 Panasonic NiMH AA Power 1400
- 7-10 Sun Wonder Pro 10000 Recharge
- 11 Dakota Power 12V 100AH GEL Charge Controller
- 12 Motor (Shimano 200W)
- 13 Motor (Shimano 200W)
- 14 Motor (Shimano 200W)
- 15 Any Document (Driver)
- 16 Fuse
- 17 Switch
- 18 Single 100A Full Box
- 19 Motor
- 20 Motor

**12 Volt Electrical - Auxillary**



**Next Steps**

- Finish fixing a nagging problem that we are having with a drive chain that keeps jumping off the sprocket
- Implement all of the adjustments that we learned about in the Electrical and Mechanical soldering stations on Sunday
- Complete all the remaining screwing stations
- Run a respectable race and invite our friends and family to watch
- Stay safe and well hydrated!
- Go back to school this fall and share with our classmates what a wonderful program that the Solar Car Challenge is and get them to join our 2018 Solar Car club
- Modify the Solar Express based on the lessons learned during this race
- Get ready for the 2018 Texas Motor Speedway to Palo Alto, California cross country race!

**Oral Presentations**

Team	Laps
Oregon High School Solar Car Team	4
Solar Saints	4
Palmdale High School Solar Falcons	4
Clear Creek Wildcats	4
Walnut Solar Car (Advanced)	4
Stallions Solar	3
Walnut Solar Car	4
Staten Island Solar Car	3
Iron Lions (Electric Solar)	4
Stony Point Solar Car	4
Wylie East High School Solar Car Team	3
Iron Lions (Classic)	4
Southwest Engineering Team	3
North Broward Eagles	4
Winston Solar	4
Covenant Christian Academy Solar Car Team	4
Presidio High Aficionados of Solar Car	4
Shine Runners	3
St. John's College Green Giants	4
Liberty Christian School Solar Car Team	2

*July 14: Day 2*

*Thanks to FedEx for adding a special touch to our presentation.*

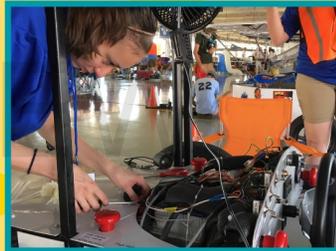
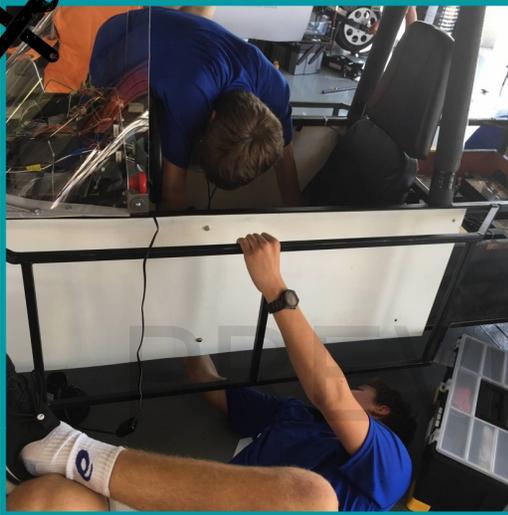
*At the end of the 1st day of scrutineering, we realized we had a lot left to work on.*

*July 16 : Day 2*



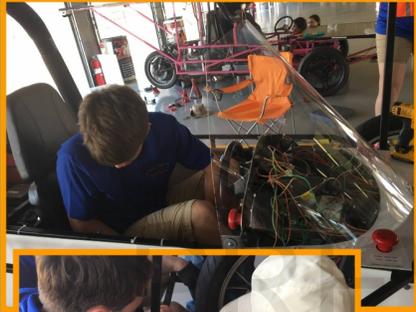
*Mark worked nearly all night long, completely re-engineering and rebuilding the motor mount assembly to be able to handle the high torque loads associated with the electric motor. This was finally the silver bullet that solved most of our nagging chain problems, which had plagued us all through the first several days of scrutineering!*

*July 17: Day 3*



*Before Day 3 scrutineering, all hands are on deck installing the required Grade 8 bolts & nuts for the seat, seatbelts, and suspension mounts.*

*Next, we focus on installing the completely re-engineered rear suspension with the revised motor mount structure that Mark had labor nearly all night making. This was the silver bullet that solved the chain issues we had been struggling with.*



*July 17: Day 3*

**THE POWER OF  
TEAMWORK**





July 17: Day 3



*Scrutineering Station 2: Electrical and Battery Requirements - Documentation, Propulsion Battery System, Motor and Controller Info, Assistance Devices, Supplemental Battery System, Electrical System Check, Disconnects, Main Battery Pack Fuse, Solar Array...*

*Minimal corrections: Adhere larger & more "High Voltage" warning stickers for solar panels, cover battery box outlet plugs, install insulation over battery cables ends.*



*Scrutineering Station 5: Braking Tests - Competency & Safety  
Passed 1st time.*



*July 17: Day 3*

*The students are responsible for  
submitting the car for  
scrutineering. No adults allowed.  
Enjoy the 20 minutes of peace and  
calm before a new storm!*



*Scrutineering Station 6: Endurance Test - Solar Car Inspection, lead vehicle inspection, full-speed panic stop, trailer loading / unloading.*

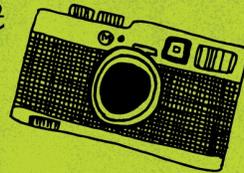


*The car was brought to the inside track to prove safe travel at an extended distance, adequate communication, and simulation of a mechanical failure to demonstrate procedures for safely loading and unloading the solar car.*



Media Day! Several teams, who were finished with scrutineering, were interviewed by CBS, NBS, and the Fort Worth Star Telegram. Everyone was included in the group Solar Car Challenge photo at Texas Motor Speedway.

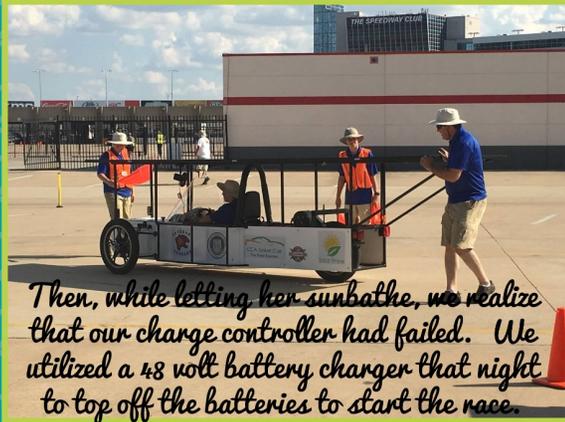
July 18 - Day 4



*Finally, The Solar Express has earned her graphics. The team adheres the school mascot, CCA crest, team logo, and sponsor acknowledgements.*



*July 18: Day 4*



*Then, while letting her sunbathe, we realize that our charge controller had failed. We utilized a 48 volt battery charger that night to top off the batteries to start the race.*

*The first thing in the morning on race day #1, we have to quickly install our backup solar charge controller. This is when we learned the value of having multiple spares of every component!*



*First day of racing... We meet our judge.*

*July 19: Day 5*



*Not only did we finish a lap, The Solar Express was passing other cars.*



SHINED BRIGHT



*July 19: Day 5*





*The spotter has a birds eye view of the track. He gives warnings to the driver of competitors location and accidents via radio. Binoculars!*

*Although we lost track time twice, we still finished the day's race in 5th place! If we had not incurred 3 penalty laps, we would have actually been tied for 3rd!*

Day 1						
Day Rank	Overall Rank	Team	Laps Run	Penalty Laps	Day Laps	Total Laps
<b>CLASSIC DIVISION</b>						
1	1	Iron Lions	98	0	98	102
2	2	North Starward Eagles	85	0	85	89
3	3	Wylie East High School Solar Car Team	74	1	73	76
4	4	Palmdale High School Solar Falcons	71	0	71	75
5	5	Governor Christian Academy Solar Car Team	71	3	68	72
6	6	Stony Point Solar Car	61	1	60	64
7	7	Presidio High Afficionados of Solar Car	49	3	46	50
8	8	St. John's College Green Giants	43	0	43	47
9	9	Clear Creek Wildcats	34	3	31	35
10	10	Winnham Solar	15	0	15	19
11	11	Shine Runners	9	0	9	12
<b>ADVANCED DIVISION</b>						
1	1	Walnut Solar Car	97	4	93	97
2	2	Liberty Christian School Solar Car Team	93	2	91	94
3	3	Texas Island Solar Car	84	3	81	84
4	4	Oregon High School Solar Car Team	53	1	52	56
5	5	Shadows Solar	15	5	10	13
<b>ELECTRIC-SOLAR POWERED DIVISION</b>						
1	1	Iron Lions	93	1	92	96
2	2	Walnut Solar Car	80	0	80	84
3	3	Southwest Engineering Team	60	6	54	57
4	4	Solar Saints	53	2	51	55
<b>Day 2</b>						Total
Day Rank	Overall Rank	Team	Laps Run	Penalty Laps	Day Laps	Total Laps







Day of Challenges:

July 20: Day 6



1) Immediately, race day 2, we had a severe alignment issue, that caused Morgan to struggle just to complete the first lap, but was quickly corrected.

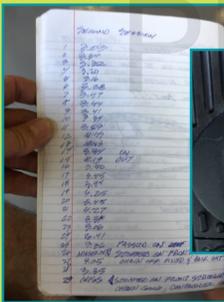
2) Later that morning, we were plagued with complaints that our horn was not loud enough, while passing other cars. To quickly resolve the issue, we removed the nose cone to deal with it, and later during lunch break installed a slightly louder horn. 3) Lastly, during the afternoon driving session, after Kaya had passed a car, and was going into turn 1, she turned a little too sharply to return to her lane, and momentarily set the car on two wheels. Later, we replaced the shocks with solid struts for the rest of the race to give the car greater roll stability. Now we see why SCC suggests 500 miles of pre-race drive time.







*Even with the morning technical issues that cost us 50 to 60 minutes, we managed to pull into 3rd place for the 2nd race day!*



July 20: Day 6

Day 2						
Day Rank	Overall Rank	Team	Laps Run	Penalty Laps	Day Laps	Total Laps
<b>CLASSIC DIVISION</b>						
1	1	Iron Lions	101	0	101	203
2	2	North Broward Eagles	92	0	92	181
3	3	Covenant Christian Academy Solar Car Team	85	2	83	155
4	4	Wylie East High School Solar Car Team	76	0	76	152
5	5	Palmdale High School Solar Falcons	73	0	73	148
6	6	Stony Point Solar Car	59	0	59	123
7	7	Presidio High Aficionados of Solar Car	47	0	47	97
8	9	Winston Solar	39	2	37	56
9	8	St. John's College Green Giants	36	0	36	83
10	11	Shine Runners	34	2	32	44
11	10	Clear Creek Wildcats	20	0	20	55
<b>ADVANCED DIVISION</b>						
1	1	Walnut Solar Car	117	3	114	211
2	2	Liberty Christian School Solar Car Team	96	2	94	188
2	3	Staten Island Solar Car	76	0	76	160
4	4	Oregon High School Solar Car Team	16	0	16	72
5	5	Stallions Solar	6	0	6	19
<b>ELECTRIC-SOLAR POWERED DIVISION</b>						
1	1	Iron Lions	107	0	107	203
2	2	Walnut Solar Car	79	0	79	163
3	3	Southwest Engineering Team	79	0	79	136
4	4	Solar Saints	59	0	59	114



*Driving made the time fly. Learning how to make the car more efficient as a team was exciting. The more engaged we were, the less we noticed the heat.*



*July 21: Day 7*

*The team times each lap of our solar car, as well as our competition. We adjust our time to be just better than our competition, not maximum speed, which can overheat the car or deplete energy faster than we are receiving energy from the solar array.*





*Texas Motor Speedway Garage, Bay 3: Each team has one length of the garage, one side for working on the car, the other side for storing everything else.*

*July 21: Day 7*



*Radios and 12 volt batteries (fan & horn) were charged daily. Radios are the life-line to our drivers, spotters, safety, and leaders. Every driver brought a radio, 2 radio batteries, a fresh 12 volt battery, and their personal 32oz water bottle.*





On the 3rd day of racing, we tied for 2nd place with Wylie East, bringing us up to 3rd place overall.

**Day 3**

Day Rank	Overall Rank	Team	Laps Run	Penalty Laps	Day Laps	Total Laps
<b>CLASSIC DIVISION</b>						
1	1	Iron Lions	85	0	85	288
2	3	Covenant Christian Academy Solar Car Team	71	0	71	226
2	4	Wylie East High School Solar Car Team	71	0	71	223
4	9	Shine Burners	67	0	67	111
5	2	North Broward Eagles	67	2	65	246
6	5	Palmdale High School Solar Falcons	64	0	64	212
7	6	Stony Point Solar Car	49	0	49	172
8	10	Winston Solar	51	2	49	105
9	11	Clear Creek Wildcats	47	0	47	102
10	7	Presidio High Aficionados of Solar Car	37	0	37	134
11	8	St. John's College Green Giants	30	0	30	113
<b>ADVANCED DIVISION</b>						
1	1	Walnut Solar Car	108	2	106	317
2	2	Liberty Christian School Solar Car Team	91	0	91	279
3	3	Staten Island Solar Car	78	7	71	231
4	4	Oregon High School Solar Car Team	36	0	36	108
5	5	Stallions Solar	14	0	14	33
<b>ELECTRIC-SOLAR POWERED DIVISION</b>						
1	1	Iron Lions	86	0	86	289
2	4	Solar Saints	66	2	64	178
3	2	Walnut Solar Car	65	3	62	225
4	3	Southwest Engineering Team	57	0	57	193



*By the end of the week, the team was exhausted, but at least we had worked most of the kinks out and were able to relax while waiting for dinner.*



*July 21: Day 7*

*The concrete floor was the coolest place in the garage!*



*Issac raced 4 hrs in a.m. & Steven 3 hrs in p.m. Minimizing driver changes allowed us to stay just ahead of Wylie East, who used this same tactic.*



Day 4						
Day	Driver	Team	Laps Run	Penalty Laps	Day Laps	Total Laps
<b>CLASSIC DIVISION</b>						
1	1	Team Isaac	86	4	82	378
2	3	Coconut Christian Academy Solar Car Team	80	0	80	306
3	4	Wylie East High School Solar Car Team	79	0	79	302
4	2	North Broward Boys	75	0	75	281
5	8	Palmview High School Solar Falcons	68	0	68	280
6	8	Stone Runners	66	2	63	234
7	9	Stacy Potts Solar Car	56	0	56	228
8	7	Wrenn Solar	51	0	51	156
9	7	Prostate Men Alliance of Solar Car	41	0	41	125
10	10	St. John's Catholic Girls Group	26	0	26	149
11	11	Cher. Creek W/Utah	17	0	17	118
<b>ADVANCED DIVISION</b>						
1	1	Wrenn Solar Car	117	0	117	434
2	2	Coconut Christian Academy Solar Car Team	100	0	100	382
3	3	Wrenn Solar Car	83	0	83	314
4	4	St. John's Catholic Girls Group	67	0	67	176
5	5	Stacy Potts Solar Car	21	0	21	54
<b>VR POWERED DIVISION</b>						



*July 22 - Day 8*



*We placed 2nd for the day, just 2 laps shy of 1st. Awesome race day!*



*We appreciate all the support from our encouraging friends and family!*



*Rob & Ruth Lane  
Steve & Jeanne Roe  
Mr. & Christie Fuller  
Tim, Regena, & Corey Tarkington  
Shannon & Tanya Caramay  
Heather, Carey, & Isabell Clayton  
Bill & Sharon Cole  
Bo & Pat Caramay  
Headmaster Keith Castello  
Aiden & Timmy Castello  
Natalie Lucas, Carlie Spain,  
& Mally McHenry  
Clay Butler, Max Pafford,  
& Ben Smith  
Carol & Emme Phillips  
The Mineral Wells Team:  
Katelynn, Tyler, & Paul*



*July 22 : Day 8*

*Final walk back to the garage bay.*

*July 22: Day 8*





Media coverage from The Fort Worth Star Telegram, ABC, & NBC honored the participants of the Solar Car Challenge.

July 23: Day 8



**2017 Race Results  
Texas Motor Speedway**

**Overall Standings**

Rank	Team	Total Laps	Distance (mi)
<b>CLASSIC DIVISION</b>			
1	<a href="#">Iron Lions</a>	370	555.0
2	<a href="#">North Broward Eagles</a>	321	481.5
3	<a href="#">Covenant Christian Academy Solar Car Team</a>	306	459.0
4	<a href="#">Wylie East High School Solar Car Team</a>	302	453.0
5	<a href="#">Palmdale High School Solar Falcons</a>	280	420.0
6	<a href="#">Stony Point Solar Car</a>	228	342.0
7	<a href="#">Presidio High Aficionados of Solar Car</a>	175	262.5
8	<a href="#">Shine Runners</a>	174	261.0
9	<a href="#">Winston Solar</a>	156	234.0
10	<a href="#">St. John's College Green Giants</a>	149	223.5
11	<a href="#">Clear Creek Wildcats</a>	119	178.5
<b>ADVANCED DIVISION</b>			
1	<a href="#">Walnut Solar Car</a>	434	651.0
2	<a href="#">Liberty Christian School Solar Car Team</a>	382	573.0
3	<a href="#">Staten Island Solar Car</a>	314	471.0
4	<a href="#">Oregon High School Solar Car Team</a>	175	262.5
5	<a href="#">Stallions Solar</a>	54	81.0
<b>ELECTRIC-SOLAR POWERED DIVISION</b>			
1	<a href="#">Iron Lions</a>	375	562.5
2	<a href="#">Walnut Solar Car</a>	291	436.5
3	<a href="#">Southwest Engineering Team</a>	262	393.0
4	<a href="#">Solar Saints</a>	240	360.0

**Special Awards**

Award	Recipient
<b>Jarrett Dunn Award &amp; Scholarship</b> Presented to the solar car team member writing the best essay on Information Systems used in the Solar Car Challenge Project	Jeremy Lim <a href="#">Walnut Solar Car</a>
<b>Lifetime Achievement Award</b>	Honorable Mention: <a href="#">Titan Solar Car Team</a>
<b>Lee Cabe Award</b> Presented to the judge best representing the true spirit of solar car racing.	Jonathan Hinds, William Shih
<b>Fred Varian Award</b> Presented to the race staff member who best represents the true spirit of solar car racing.	Bill Engel, Jim Duncan
<b>Guntis Terauds Award</b> Presented to the solar car team displaying the highest level of courage in the face of engineering obstacles.	John King
<b>Lockheed Martin Award</b> Presented to the solar car team displaying the highest level of Engineering Excellence.	<a href="#">Shine Runners</a>
<b>Chris Jones Award</b> Presented to the solar car team displaying the highest level of good sportsmanship.	<a href="#">Walnut Solar Car (Advanced)</a>
<b>The Sandt Award</b>	<a href="#">Iron Lions</a>



July 22: Day 8  
We are incredibly proud of our Covenant Christian Academy Solar Car Team. They designed the car, worked numerous hours building the "The Solar Express," passed the 3 full-days of rigorous "scrutineering," resolved a chain alignment issue, raced the 4-days in 100+ degree heat, and finished the race... in 3rd place of 13 teams in their Classic Division! Anything worth doing is worth doing well. This was no exception. "Seize the Day!" Issac

*Covenant Christian Academy Solar Car Team*



*Morgan Caramay -  
Covenant Christian  
Academy*



*Tyler Tarkington  
- Covenant Christian  
Academy*



*Steven Roe  
- Covenant Christian  
Academy*



*Jake Caramay  
- Covenant Christian  
Academy*



*Covenant Christian Academy Solar Car Team*



*Kaya Lane  
- Summit International  
Preparatory*



*Issac Fuller  
- Classical Conversations*

*July 22: Day 8*

*Mineral Wells addition to CCA Team*

*Although they didn't complete their car in time for the race, these students worked hard on the Mineral Wells Team car and deserved to experience the Solar Car Challenge. Covenant adopted Katelynn, Tyler & Paul and they helped as spotters, and Tyler helped repair the chain issue. Thanks Mineral Wells Team.*



*Katelynn Elliott  
- Mineral Wells HS*



*Tyler Doss  
- Mineral Wells HS*



*Paul Sutton  
- Mineral Wells HS*



July 22: Day 8

*Our CCA team wants to honor our team sponsor / advisors...*

*Shannon Caramay, who had the vision, Automotive and Engineering knowledge and experience, funding, enormous amount of time, motivation, and focus to see our team through to completion of the solar car and race.*

*Mark Rose, who generously offered his machine shop and equipment to both the Covenant Christian and Mineral Wells teams, as well as a wealth of Mechanical Engineering and racing knowledge.*

*Rob Lane, who shared his knowledge of Electrical Engineering and time.*

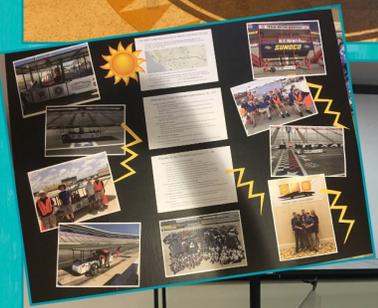
*We are so grateful for your generous investment into the next generation of engineers and leaders of tomorrow.*

*Sharing the Solar Car experience with the next generation of CCA Cougars at the New Family's Ice Cream Social.*



*July 27*

*The Rhetoric School will have a 1st day of school surprise at Covenant Christian.*



*Can't wait to race across the U.S. to California next year! Go Cougars!*

### What was your most memorable experiences in '16 - '17?

- Isaac Fuller (12<sup>th</sup> grade)
  - The experience of being able to build the framework of the car, to later on see it rolling and working, and then participating on a competitive level in the race.
- Morgan Caraway (10<sup>th</sup> grade)
  - I was exposed to new experience and activities that I would not normally have had the opportunity to do and I learned some managerial skills as well.
  - The Texas Motor Speedway scrutineering and the competition was the most memorable experience.
- Kaya Lane (10<sup>th</sup> grade)
  - Seeing the car get on two wheels and I survived!
- Steven Roe (10<sup>th</sup> grade)
  - In addition to the mechanical and electrical aspects of the car, I learned a lot of leadership skills, that I was not expecting
- Jake Eudaly (9<sup>th</sup> grade)
  - I enjoyed learning many things I want not have learned in school.
- Jake Caraway (8<sup>th</sup> grade)
  - Seeing the even more competitive cars, like Greenville's which had impressive aerodynamics and was #1 in their class, at the competition and thinking about how we can improve this coming year.
  - I want to build one of the sleek advanced cars like the Walnut, CA team, but better!
- Tyler Tarkington (8<sup>th</sup> grade)
  - The celebration at the awards banquet and Isaac's inspiring speech.

*August 6*

*A few weeks later,  
we had a review  
meeting summarizing  
the season and  
making plans for  
next year!*

### Priorities for the CCA Solar Car Club in '17 - '18

- Slight refinements to the current design:
  - Add a front suspension "anti roll bar" to improve handling
  - Downsize to 4 hp motor for increased energy efficiency of driveline
  - Develop and implement cruise control for increased energy efficiency of driveline
  - Convert to a belt drive for reduced frictional losses in the driveline
  - New more aerodynamic windshield made out of lexan to reduce aerodynamic drag
  - Shorten nose structure to accommodate more aerodynamic nose cone
  - Look for ways to modestly lighten the car for improved efficiency
  - Add "quick jack" location points for safe and easy lifting
- Focus on developing superior race strategy
  - Add full telemetry and instrumentation with remote wifi enabled data acquisition
  - Lots and lots of practice runs to learn the car and it's efficiency characteristics
  - Develop optimized energy management strategy using lessons from The Winning Solar Car book
- Operational Excellence
  - Trained operations for all team members during the event (e.g. alignment, chain, etc...).
  - Develop a well organized tool management and car transport trailer logistics
- Community
  - Develop a better team website to share our learning experiences with the CCA community
  - Develop a video documentary / iMovie to document our the beginning to end experience