THE SOLAR FLARE

by Kali McKee & Lisa Lewis



Hey SC enthusiasts! This summer is an exciting time for the solar car team. While most students have returned home for the summer, the team is on campus working diligently with the Ra8 design. The team is also preparing for Ra7s for two trips down to Texas. The car will first go to the Siemens PLM World Conference in Dallas and then to the 2013 Formula Sun Grand Prix track race in Austin.

In early June, Siemens, one of our major sponsors will be hosting a conference where Ra7s will be displayed. A few team members and leaders will attend this conference to represent the Prinicipia Solar Car Team, and have the opportunity to learn more from NX aficionados. While they are learning and creating in Dallas for a week, continue prepping for the track race.

The 2013 FSGP track race will take place at the Circuit of Americas track in Austin. We will spend six

2013 Principia Solar Car Team

days in Austin, with three days of scruntineering and three days of racing from June 27-29th. The winning team will be determined by the number of complete laps driven over the 3-day event.

This summer's race team is comprised of 6 experienced team members, 4 new members, and our faculty advisors. It will be a great opportunity for new members to gain experience for next years 2014 American Solar Challenge. They will learn about team dynamics on the race, take on new roles, and experience a real race.

While this newsletter gives you a small glance into what is happening with the team, be sure to visit our website, like us on Facebook, or follow us on Twitter to read frequent updates about the race and progess on Ra8.

Designing a Fresh Start

by Garrett Fielding

Once again, the team finds themselves at the beginning of another build cycle. Due to substantial regulation changes, our final race with the Ra7 design will take place this summer in Austin, Texas. A new car must not only be constructed, but completely redesigned. Looking forward to the 2014 American Solar Challenge, we are employing the assistance of two recent graduates, Andy Berner and Justin Sinichko. Andy was the project lead on the aerodynamic design of the Ra7/7s body style, and Justin was a driver for three cross-continental distance races in both the United States and Australia.

The design process is one filled with trial and error, ingenuity, and a lot of learning. Kenneth Stack and I (Garrett Fielding) have busied ourselves with learning the ins and outs of NX, the 3D design software used by Boeing, GM, Ford, and others, that we have used to design our cars since Ra4. Donated by Siemens, this powerful software tool allows us to create shapes and models that can then be built and tested using our 3D printer. Starting with smaller components of the car, we have learned how to most efficiently model a part in this software. The four of us continue to correspond, sharing ideas, reviewing shapes used by other teams around the world, and critiquing each other's designs.

Beginning with the new regulations, our first task is to decide the space the driver will occupy inside the car. In compliance with new regulations, we have allowed more forward head room and positioned the feet to be the lowest part of the body. Once this space has been determined, we can begin placing shapes and curves around the driver in order to most efficiently flow through the air. Many elements of the car must be taken into consideration beside aerodynamics. In contrast with our most recent design, the team has decided to build a "bubble" style canopy, rather than the sleek manta that we have recently become known for. Although less aerodynamic, this change will allow us to homogenize sunlight striking the array surface by reducing the overall curves of the upper body.

The most apparent difference will be the addition of another wheel to the car. Since Ra 5, all of Principia's cars have had three wheels in order to reduce rolling resistance. Due to regulation changes, we must add a fourth wheel into our design. This addition promises to provide a challenge for the aerodynamic aspect of the car as it eliminates several convenient characteristics of three wheeled cars. We can no longer package the driver as part of the rear wheel to reduce drag. This creates challenges in terms of protrusions from the main body of the car, which will reduce aerodynamic efficiency.

Ready to wrestle with these problems, the design team works to develope our new four-wheeled design for Ra8 and look forward to having our digital creation realized in a working solar car.

A Place to Sit

by Matt Herman

 ${f T}$ his semester marks the beginning of the next generation for the solar car team. The first step to designing and building a new solar car is the creation of the seat. Lead designers Garrett Fielding and John Broere wanted the seat to be made first so that the roll cage and rest of the car could be designed around the driver "package," a name for the area where the driver would sit in the car. The team took on the task of constructing the frame out of plywood and two-by-fours.

The Ra7 seat mold was used as inspiration to create a seat, which also must hold its shape for the process of making a new carbon fiber seat. We dug out the table saw and cut pieces to shape the seat into the proper angle to fit new regulations. With the aid of screws and many hands, we assembled the new chair together. But that was only the first part in the endeavor.

getting the seat as smooth as it needed to be for the carbon fiber layups. This was accomplished with bondo, a popular car body filler, which covered every inch of the seat surface to smooth out the bumps. Our initial mistake was putting on too much bondo to begin with, which left the surface quite uneven. We continued adding more and more layers and patches of filler and sanded the surface as we went.

Eventually we spray-painted the seat and sanded it down to see where the low spots were. This was a major improvement, because we could apply bondo in the right places, as it was all the same color. A few layers of spray paint and bondo patching proved effective and gave us a final seat that looked much better and felt smoother. This process was finished after a few weeks of work and is now ready for summer, when we have carbon and other materials necessary to build the Ra8 seat.



The real learning process on the seat mold was

Telemetry

by Adam Rolph

Did you ever wonder how the rebels on Yavin IV in the first Star Wars knew so much about the battle at the Death Star, even though it wasn't happening anywhere near them? Luke Skywalker was tens of thousands of miles away, and every time he pushed a button or pulled a lever a different voice would crackle over the radio and say something like: "Luke, you've shut off your targeting computer. What's wrong?". This is an example of telemetry. Telemetry is the constant and remote monitoring of statistical information, and the Principia solar car team has an entire group of people devoted to it.

Why track data about the solar car? Data is tracked for many reasons, the most prevalent of which is the ability to help the driver diagnose problems with the car. Some examples of useful information unavailable to the driver are things like battery usage and average power drain. If there is no immediate problem for the driver to focus on, telemetry data is used to make long-term tactical decisions stant stream of numbers. In order to utilize those raw numbers, the team uses an original computer program written in C# on a laptop in the chase vehicle. That program interprets the stream of raw numbers coming from the car into a more humanfriendly and recognizable state.

As a result of the custom C# program, gauges such as a speedometer dial and battery table display on the laptop in order to make telemetry easier to read and use. The raw data is still displayed on the side of the screen, in case the feed goes out, or the accuracy and continuous nature of the data stream changes for some reason.

Overall, telemetry is one of the most exciting tasks to have as a member of the solar car team. Since telemetry information is direct and real-time, the decisions and communication skills of the telemetry team make a significant impact on the entire team's ability to succeed.

by other members on the solar car team. Those decisions are then relayed to the driver. Since solar car races are usually endurance based and span over multiple days, decisions about what speed to maintain and when to make accelerations can yield energy and time saving results.

The telemetry system is all original and built by students. Embedded electrical systems within the car send raw numerical information over a radio to a team in the chase vehicle. That raw data is difficult for a human to read or benefit from, since it is mostly a con-



Gateway Motorsports Parkway

by Pete Telschow

Over the past Spring Break, our team had the privilege of utilizing the Gateway Motorsports Parkway in Madison, IL to test our car. The facility is used primarily for NASCAR races and drag racing events, but we were able to use the road race track for general testing. The track has plenty of straightaways to test the speed as well as the proper turns to test the handling. Overall, it is a perfect venue for training our drivers as well as making sure that the car is fully functional and race ready.

We talked as a team about finding another place to test our car other than on the River Road where we have tested in the past. Gateway was mentioned, but we did not expect to be able to afford their fees. I contacted them, along with John Broere, one of our advisors, to see if using the track would be an option.

Mike, an enthusaistic employee of Gateway, contacted me, and we started working out dates and times that we could test our car. It was exciting to know that this opportunity was actually going to be possible. When Mike and I started to talk about how much it would cost us to use the track, we quickly discovered that the track was out of the team's budget. Mike was able to lower the price when we explained that we have our own insurance coverage and would not need fire or medical teams on the track, but the price was still out of our range.

Shortly thereafter, Mike, John, and I had another conversation, which led to Gateway agreeing to consider being one of our sponsors. We offered to attend events at the track, showing our car to their patrons, in exchange for time on the track. We also agreed to advertise for them by putting their name on our car. We used the track once during spring break, and we will be testing again on the 18th of June.

This is such an exciting opportunity for the team to be able to test at a professional facility. We had a wonderful time there for our first test and we cannot wait to go again!



Spring Break

by Kali McKee & Lisa Lewis

After a cold winter, spring break was packed with (mostly) beautiful weather and productive days. Spring break is valuable time for the team because it allows us to focus specifically on solar car without other distractions. During school weeks, students' schedules become busy and the time spent working on solar car is limited. Breaks are the perfect opportunity for the team to make significant progress on the car.

During this break, we accomplished many tasks. But most importantly, we spent two whole days testing Ra7s. It is important to test the car months before a race in order to make sure everything is working properly.

These two testing days allowed new team members to learn how to play certain roles, practice safety around the car, and allowed new drivers to test the car. On the first day, the team tested on campus, due to the overcast weather and slight snow flurries. The team drove to the other side of campus to Principia College's Crafton Athletic



Center, and proceeded to do general testing and short laps around the building. Other than struggling to keep warm with hot chocolate and bundling up together under blankets, since the temperature was never about 35 degrees (23 degrees wind chill), the day of testing went flawlessly and everyone had a blast.

The following morning, the team headed down to Gateway Motorsports Parkway in St. Louis. GMP has a 1.25 mile NASCAR oval and a 1.6 mile road track. Because solar car racing is done mostly on public roads, we used the road track for testing. Testing on a track is very different than testing around Crafton. It simulates races such as Formula Sun Grand Prix, and gives the team an opportunity to practice racing procedure and testing the car at higher speeds since we are in a controlled environment. This was also a great opportunity for new team members to get to know the car.

Brian Ritter drove the track first and logged 50 laps. We then practiced changing all three tires

while out on the track, which simulates any flat tire changes we may experience during a race. Kali McKee hopped into the car after the tire changes and drove another 40 laps. As the day came to a close faculty advisor, Rachel Holser, drove 12 laps and our beloved advisor, Joseph Ritter (who hasn't driven the solar car for 11 years), drove 4 victory laps. The team then headed back to the Ritter house for a fun night with delicious food and stories about solar car.

Over all, the week was filled with team bonding, productive testing days, learning experiences, and midnight runs to Steak n' Shake.

Cardboard Canoe Regatta

by Tamara Thomas

For the past five years, Principia College has hosted a Cardboard Canoe Regatta, which involves building boats using only cardboard, duct tape, and then decorating them with paint. These boats are then raced in the water for the fastest time. This year, solar car members Garrett Fielding, Pete Telschow, Ian Straus, Tamara Thomas, and Kenneth Stack participated in the race.

Principia College students had three days to build their boats. A lot of work goes into building a "sea worthy" cardboard boat that will support the weight of up to three people. One of the challenges of this competition is the rule that only 10% of the boat can be covered in duct tape, which prevents students from covering their entire boat in tape.

In years past, the race has been held during the fall term, but this year the race was moved to the spring semester during parents' weekend so parents would be able to support their students. Due to the abnormally long winter season, the race was relocated to our pool, Crafton Athletic Center, instead of on the Mississippi River, where the temperature of the river was still in the 30's. On the Saturday morning of the race, students brought their creations down to the pool where many spectators were ready to cheer on their friends. The object of the race was to be the fastest team to paddle the boat from one end of the pool to the other and back again, without tipping over or sinking. This posed a challenge for many who ended up swimming the majority of the distance while pulling their soggy cardboard behind them. Only a few boats actually made the entire distance with dry competitors, one of which was our very own solar car team member! New team member Tamara Thomas and her racing partner Madeline Grendel completed the race with the fastest time and finished with her boat still completely in tact.

Unfortunately, other solar car teammates did not have quite as successful of an outcome. Team members Garrett and Pete were only able to successfully get Garrett in the boat before tipping, so Pete swam behind for a little extra power. Ian raced the boat he built with Kenneth and another student, Gaby Meja, but his race consisted of him dragging the boat behind him to the finish line. Although their boat sank, their team won the most creative boat design. The team shaped their boat like a toilet!

Everyone had a great time at the Cardboard Canoe Regatta this year and the audience had some great laughs while watching many of the boats flip or slowly sink until the competitors found themselves in the water. This competition is a great opportunity to practice skills such as teamwork, creativity, and engineering principles.



Parents' Weekend

by Sean Neel

Towards the beginning of April, Principia College hosted Parents' Weekend, which allowed the students to bring their parents to class and observe different activities across the campus. The weather was beautiful, and the solar car team was ecstatic to spend time with all of the member's parents. In preparation, the team split into two groups: one group gave a presentation in Wanamaker Hall, while other group drove the car up from the shop to display after the presentation. We had a great turnout of about 40-50 parents who were interested in the work we had been doing.

During the presentation we talked about our preparation for the upcoming race this summer in Austin, Texas, as well as the 2014 American Solar Challenge and 2015 World Solar Challenge. This allowed us to give the parents an accurate timeline of everything we have to prepare for. Parents were able to ask the students any questions about their experiences, what they have learned, or just simple questions about the car. After the presentation, we directed parents to the pub patio where they could see Ra7s on display. This gave them a reallife perspective of the car.

Both the presentation and display of Ra7s were a huge success. The parents all had positive things to say about the work the team had done, and we had a wonderful time sharing our experiences with our supporters.

Student Bio: Adam Eckert

Hi, my name is Adam Eckert and I am majoring in Biology and Natural Resources, with minors in Computer Science, Sustainability, and Physics. I am interested in technology and science; I enjoy computer-based technologies and hope for a career applying these technologies to solve important challenges of the 21st century.

I love the outdoors and particularly value the National Outdoor Leadership School (NOLS) courses I've taken, including technical rock climbing, splitboarding (back country snowboarding), and avalanche assessment. I have a Black Belt (First Degree) in Tae Kwon Do, and enjoy ultimate Frisbee, soccer, wakeboarding, kayaking, and slack-lining. I've always loved to travel and in recent years I've crewed on a marine research vessel for KAI Marine Expeditions (Spain), been a Research Assistant for the Wider Caribbean Sea Turtle Conservation Network (Trinidad), and volunteered at the Paradero Wildlife Rescue Center and Sanctuary (Costa Rica). I'm really excited to be a part of the Principia Solar Car Team and to learn more about solar technology, how the car is engineered, and what goes into planning and creating a whole new car under



new regulations. I love taking things apart and putting them back together, so maintaining Ra7s is a blast and I can not wait to start building Ra8! As this is my first semester on the team, everything is new and I can only keep learning.

Thank you to everyone who has been so supportive of our team and who make these experiences possible!

Student Bio: Gabe Korinek

I am a sophomore studying engineering sciences with a physics focus. I will be transferring to University of Minnesota after next year as part of Principia's 3/2 year program. I joined the solar car team because I wanted to be involved in a technical and hands on project and get some engineering experience while at Principia. My main focus on the team is working with mechanical systems such as suspension, brakes, and steering. Though I will not be with the team when we race this summer, I will be staying after graduation for a week to help prepare the car.

What I love most about solar car is the number and variety of projects that I can get involved with, from taking pictures to working on mechanical systems to logistics. Another great aspect of solar car is the people I get to work with. Everyone has a different way of doing things and are always offering suggestions on how to go about new concepts for designs or what improvements we should make to the car. It is great to work with this diverse input. When I am not with the team I enjoy a variety of activities which involve the outdoors, such as mounbiking, tain running, backpacking, and camping. In addition to this, I love physics and engineer-



ing projects. Basically I am interested in anything with mechanical workings.

Right now, I am trying to teach myself basic programming with an Arduino and running track. This summer I will be working with the Minnesota Conservation Corps helping restore natural resources and build trails.

Student Bio: Karlin Krishnaswami

Hey, Solar Car fans! I am Karlin Krishnaswami, a recent grad from Principia with a major in Sociology and minors in Religion and Educational Studies. During the first week of spring semester, I spontaneously decided to join the team, and I am really glad I did. I have enjoyed learning about Ra7s, mechanics, aerodynamics, and what goes into designing and building a car.

Over the past few weeks, I have been working with Pete Telschow, our team manager, on one big project—inventory. So far we have inventoried most of the supplies in the shop and we are currently updating the Material Safety Data Sheets for all of the chemicals in our flame cabinet. This is important to making sure our shop is up-to-date with safety practices.

One of the highlights of my semester was the opportunity to drive a few laps around Crafton Center during one of the test days. I am sad that I did not join the team earlier, but I am glad for the experiences I have had and look forward to participating in the 2013 Formula Sun Grand Prix this summer!

Student Bio: Ian Straus

Hey everyone, my name is Ian Straus and this is my first semester on the Principia Solar Car Team. I am from West Hartford, Connecticut, originally Los Angeles, California, and like Karlin, I am part of the class of 2013. As a recent grad in Business Administration, I consider myself to be an innovation enthusiast. So far, I have really enjoyed working with the different components and aspects of Ra7s and figuring out how it all works together. I also enjoy problem solving and thinking about how to overcome challenges that may arise while building and maintaining a solar car.

I was very excited to join the team and I hope to gain valuable knowledge about product development, mechanics, and engineering. I plan on using the skills I learn through Solar Car as a foundation for my learning when working for my future employer(s).

I am also a car enthusiast, which makes Solar Car

even more exciting. Through the design and building process of Ra8, I have learned a lot about car design, racing strategies, and general mechanical maintenance.

Projects I have been directly working with include the Ra7s braking system, the body



design for Ra8, mechanical components, and general car maintenance. Some other projects I have assisted with are contacting suppliers and community relations. I am happy that I have been able to support the Principia Solar Car Team and look forward to seeing how the team's next car will perform.



Word Search

by Lisa Lewis

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Words Austin Biography Design Formula Grand Mold Motorsports

Prix Race Regatta Seat Summer Sun Telemetry Track







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Solar Car Timeline



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To receive updates on what we are doing each week, join us at: *http://www.principia.edu/solar*

Please address contributions to:

Fundraising Chairman Principia Solar Car Project Elsah, IL 62028 Checks payable to: Principia Solar Car Team All contributions to our 501(c)(3) educational organization are gratefully accepted and are tax deductible. Please include a corporate matching form if your employer has such a program.