This issue of *The Sundial* is dedicated to the core group of people who have committed the summer of 2012 to finishing Hyperion, Team PrISUm’s 11th car since 1989. It should be acknowledged that many team members are away at internships or summer jobs, or have returned home away from Ames and are unable to commit the long hours required to bring the project to completion. Team PrISUm would not be where it is today without the hard work of every team member, and everyone’s contribution is important, large or small.

The group of team members highlighted in this issue have been working day and night over the last month during final assembly and deserve recognition. They have foregone vacations, employment opportunities, classes, and most still have not had adequate time to spend with their families. Others are working full-time, and their free time goes to PrISUm. They do so because they know the value of dedication, and aside from the satisfaction of a job well done, they know that their work will not go unnoticed. Everyone is eagerly anticipating the race in July where Hyperion will have its first chance to shine!

Team PrISUm once again demonstrates the spirit of racing, self-direction, and the courage to make a difference. The team’s success throughout this project would not be possible without donated money, materials, and thousands of volunteer hours.


Things are changing so fast around here that portions of this issue of *The Sundial* will undoubtedly be out of date by the time you read it. For the most recent information and pictures, be sure to check our website and Flickr gallery.

Follow the team’s progress during this year’s race including GPS tracking through our web site at:


We will post daily updates throughout the competition.
It has been the best experience of my life to see this team grow and develop over the past two years. Since the Fall of 2011 I've had the great privilege of serving the team as Project Director. It is so exhilarating working with this diverse body of team members who have such dedication that they will do whatever it takes to ensure Hyperion's success as our 11th solar car project at ISU. It hasn't been easy by any means, but a combination of persistent hard work, careful design, and plenty of good luck, leaves us feeling confident and optimistic ahead of our competition in July. We've met a number of critical, yet seemingly impossible deadlines, increased sponsorship by over 30%, and had a strong finish at the FSGP competition last summer. For the first time since I've been at Iowa State, we are on track to put over 200 miles of testing on our vehicle before the cross country competition.

One of my key contributions to this vehicle is designing and analyzing the suspension system. One of the biggest concerns for handling stability and safety on this 3-wheeled car is getting the center of gravity (CG) correct. In order to achieve this, we have to balance the weight of everything that goes into the car so that the CG lies at the centroid of the triangle formed by the three tires. Since the driver sits far back in the vehicle for improved aerodynamics and safety, we have to counteract that weight by positioning the battery box cantilevered out front. As a result, the frame needs to be strong enough to support a heavy load up front. Our last car, Anthelion, actually did a great job of balancing the CG and was very stable around the race track compared to many other cars. However, we had problems with the durability of the frame, which cracked in several high stress locations. For Hyperion, extra time was spent to ensure that the frame will be plenty strong.

We've come a long way. We have a lot of the wiring harnesses finished, the battery box is almost finished, and now what's in front of us is driving the car. We need to drive it hard, make sure everything is secure, and make sure it's ready for the race in July.

Since I've graduated with my master's degree I won't be a student in the fall. I started working at Ames Lab here on campus a few weeks ago, so I can stick around and assume an advisory role for the electrical team. I've been working closely with other E-team members to help ensure a smooth transition as I'm leaving. One of my focuses has been documenting all of the work we've done for Hyperion's Battery Protection System (BPS) so if there's an issue then someone else can work backwards from my thought process. I'll definitely stay in contact.

Ames Lab is a stepping stone. My tentative plan is to cut away at my Ph.D. through Ames Lab's tuition reimbursement program. It's possible, after several semesters, that I could start research full-time at the university in the context of a Ph.D. track. At that point I could continue studying embedded systems and hardware security which is what my master's degree was focused on. I really enjoy working with embedded systems, like Hyperion's BPS, and any vehicle with batteries needs such a system. My job at Ames Lab relates to the computing infrastructure at the lab itself. It's not directly related to embedded systems, but I am writing software which is something that I enjoy. Ames Lab has such a wide variety of scientific work, so it's fun being exposed to different kinds of projects. Having this kind of exposure is definitely an advantage.

I came to Iowa State through Scientists Without Boarders which is a program for engineers that allows for Brazilians to study all across the United States. I was matched with Iowa State through their placement program. I have friends that attended school here before, so I was already familiar with Iowa State.

I was thinking about joining the team after hearing about PrISU m in Mechanical Engineering 641, but then after I saw Anthelion on display I thought it was really, cool and I joined the team. I worked with Evan Stumpges on the Vehicle Dynamics Telemetry System. VDTS is a system built into the car to track and optimize dynamic performance. Modern production cars use similar systems. This is a new system we've introduced with Hyperion. We still need to fine-tune the programming and integration with Hyperion, and soon we will be able to test our work.

Right now I'm working on installing the solar cells. I'm working with Logan and a few other people, and we're almost finished. I really enjoy working with other PrISU m team members. The variety of engineering and non-engineering disciplines has given me an opportunity to learn in ways that I wouldn't be exposed to simply through my classes. I'm one of only a few women on the team, and I strongly encourage more women to join. Women naturally see things differently than men, and can help the team grow as professionals. I want to remain in renewables, specifically wind energy. I'm also studying German right now and would like to do my Master's degree in Germany. At some point I will return to my home university, and possibly get a solar car team started. I've made some great contacts here and I'm sure we can get additional consulting if we need it.
It’s all about the students. I can ask questions, they provide the answers. They figure out the solution in-process. I can’t tell the students what to do or it becomes my car. I stop by as often as I can to see what they are doing. In my engineering classes I give the instructions and lead the way. At PrISUm the students are in charge. The students decide if we have a team or not. Sometimes my questions inspire new ideas or ways to solve problems, but a student project requires student solutions.

We’ve begun accepting projects for independent study to recognize their hard work. Not only does it show that they are learning, but it also shows motivation. If I were hiring and someone shows me a high GPA that is important, but I also want to see what they have done. Someone with proof of motivation is more likely to succeed. By including approved projects toward college credit we can reward individuals for their dedication. The key point here is “Science with Practice.”

Team PrISUm has 3 advisors; Dr. James Hill, David Ringholz, and myself. We are faculty in Engineering and Design. The solar car team needs students from all disciplines, but also needs support from a variety of faculty, such as from the College of Business. The team does not simply design and engineer a car. They also run a non-profit business, interface with student government, and conduct educational outreach and community activities. It’s hard to get other people interested in PrISUm when there are only a few disciplines represented. In this last year I have gone out and actively engaged faculty from different departments to promote the team spirit of inclusivity from my position as an advisor. This will allow for more independent study projects, and better school representation.

Right now I’m working on the new circuit boards that just came in. We designed them on the computer using Altium electronics design software, but all of the holes for the dashboard LED’s were missing when they came back from printing. I went through them all with a tiny drill bit, and now I’m manually soldering the LEDs onto the board. I made a mistake when changing the Altium file, and the company that printed the circuit boards for us does not do elongated holes. I didn’t look into it far enough to make sure it was ok, and in the manufacturer’s order form they say they can’t do this. It has taught me to be a little more careful. I learned my lesson, now I have to fix my mistake.

I’m studying computer engineering, which fills the gap between electrical and software engineering. It gets down into the digital logic components, memory, and microcontrollers. It’s usually the computer engineers that design the microcontrollers and program what they do on a very basic level. When I entered PrISUm I just started programming the dashboard. I didn’t have much part in designing the physical board since I had just joined the team at the beginning of last semester, but I programmed nearly all of the embedded C computer code required for the dashboard to operate.

I got into computer engineering by fixing and putting together computers. I taught myself how to debug a computer through trial and error using information off the internet. For me, video games were a pull toward this technology due to the stimulating reward in the end. I now have a greater appreciation for blinking lights because I understand how it works from a technical perspective.

Right now I’m testing circuit boards, making sure they can talk to the motor controller. This way they can relay information like speed to the dashboard over Controller Area Network (CAN), which is our communication protocol that allows our embedded systems to communicate. The motor controller board is a component that I designed, assembled, and then programmed the firmware. I took the computer code from our previous car, Anthelion, and re-wrote it to improve reliability. The motor controller board communicates directly with the Battery Protection System to help keep the car safe.

I’m also working on fabricating an air duct for the fan that keeps the driver cool. This duct is an odd shape and made from carbon fiber, but it’s small enough that we can fabricate in our kiln. This is the kind of work I hope to contribute to the next project, but for now I just try to do whatever needs to get done and contribute where I can. I also helped with a grant from WebFilings.

I started off in science with First Lego League while in middle school. Then in high school I did Science Olympiad where I started experimenting with circuit boards. Now I’m studying for my bachelors degree in mechanical engineering, then my plan is to get a master’s in electrical engineering, and ultimately work in robotics. PriSUm is a great mix of disciplines; electrical, computer, mechanical engineering, and even business and design majors working under the same roof as a team. I also like the student focus: the car student designed and the project is student run. The faculty advisors do check in once in a while, which I really appreciate, but no faculty is telling us what to do.
The car is almost done, we have a few components coming back from fabrication including the wheels which are beyond our ability to machine. There are only a few remaining components that we will fabricate ourselves. Other than that it’s just a matter of bolting everything together, and we haven’t had any issues yet. The entire front suspension is together minus the wheels. The frame was fabricated by Sinmed Customs, and we’ll have final assembly done very soon so we can pass it to the electrical team so they can complete their jobs. As soon as we have a rolling chassis, the full system testing will begin. After that we can focus on the body integration, making it aerodynamic with the streamlined canopy and active fairings. This is a pivotal moment, and every day the car is looking a little different.

I’m very glad I came to college for engineering. I’ve met people that came to college for computer integrated machining and end up not liking it for lack of formal engineering education. In contrast, I’ve made machining a part of my engineering studies. I’m not a professional-grade machinist, but I do enjoy it, and it’s a good skill to have. I can use the experience when designing parts and can more effectively work with professional machinists. There is a happy medium between designing parts for performance and designing for manufacturing.

It’s interesting coming to college and talking to all of the people who come from different worlds. I’ve lived in Mankato all my life; same house, same kids, same school. Now we’ve come to college where we can explore our personal interests and do what we want without anyone telling us what to do. We have the drive to figure it out ourselves and the foundation of ISU to make it happen.

Aerodynamics is the biggest aspect of a solar car that is immediately obvious. The outer shell of the car, the fairings, and canopy all work together to flow the air over, reducing the drag force. Without the shell you’d have a bunch of flat plates, including the driver, and wheels spinning that make all kinds of drag. If you put an aerodynamic shape over it you decrease the amount of force that the motor must overcome, making the car go faster using the same amount of power. Anything that flows, like gas or liquid, is a fluid. We use a cluster of surplus computers running Ansys Fluent for computational fluid dynamics (CFD), which is modeling flow over objects. First we make a negative model of our car within a solid block using Autodesk Inventor. We then tell Ansys that this solid is now a fluid, and we can specify the velocity and viscosity of the fluid and the computer will tell us how much drag our shape has, how it will act in crosswinds, lift, down-force, and which way the car wants to roll due to aerodynamics. We can determine how strong of a crosswind the car can withstand without flipping over, and use this data when designing the suspension. CFD is actually graduate-level Aerospace Engineering work, and I spent most of my freshman year learning how these programs work. As I move along in my undergraduate classes I’ll know a lot more about aerodynamics than I would through academics alone.

There is a certain mentality at PrISUm. We give each other a hard time, and we help each other. We aren’t the types that only work during the week and party on the weekends. We sometimes spend all weekend at PrISUm. The basic requirement is that you be a self-starter, and work.

I’m nearly finished constructing the dashboard out of carbon fiber. I’m cutting and finishing all of the holes for the toggle switches and LEDs. Next the E-team will be able to install their components. We just received a donation of tools from Snap-On, so I organized them in our new Snap-On tool chest. This will make it easier for team members not to lose or misplace tools. I work with a lot of the materials and fine detail work. I’m also PrISUm’s shop manager. We have what we call “the 3M room” from a grant of materials we received a few years ago. There aren’t really any parts of the car from 3M, but their materials hold everything together. We also rely on them heavily for consumables used in producing the body of the car, like sand paper, glue, tape, and I’m frequently covered in 3M products.

You can’t learn if you don’t get dirty. I like to work with my hands, and I tend to focus on one-person projects. Constructing a suspension can easily take several people, and I enjoy it, but I find most satisfaction in focusing on my own projects.

Were I to make a wish list for PrISUm, one of my major requests would be an HVAC system for our shop. We do a lot of cutting and sanding of composites and molds, so we create a lot of dust. I’m very strict about team members using protective gear, but this way our shop can stay clean. We need a facility with a ventilation system, as will come with the Student Innovation Center.

PrISUm has helped me to define my interests. I started out in mechanical engineering, but my grades started to suffer due in part to long hours at PrISUm. For a time, I wasn’t sure if I wanted to stay in mechanical engineering, but I’ve reorganized and I will keep moving forward.
I’m getting the team ready to go on the race. We need to make sure we have enough people certified to drive large vehicles per university regulations. I’m also securing our hotels and campsites, processing Risk Management and insurance forms, and securing funds for expenses associated with a 3-week long road trip for 22 people. I’m also coordinating members to secure enough non-perishable food items to take with us. We’ll likely embark on a camping trip before the race as a test. We are carrying the name of Iowa State University with us, and we need to make sure all logistics are being handled appropriately, including funding.

I also focus on outreach events, and we have several this summer even before the race. We emphasize the need for Science, Technology, Engineering, and Mathematics (STEM) education regardless of a young person’s plans in life. Currently the US ranks 17th in the world, and we’re slipping. We also work to address gender imbalances in our colleges and on our team. We are working with other national groups to get more large events such as the Science Olympiad hosted at the ISU campus, as well as opportunities for team members to participate in community events. These are all part of Team PrISUm’s mission as a non-profit organization. I’m treasurer of an amateur racing team, supported a great deal by the Government of the Student Body (GSB), individual and corporate sponsorships, and ultimately the taxpayers. We have a responsibility to make good on our mission regardless of the outcome of the race. Likewise PrISUm is a recruiting tool for the university, and the better we look, the better the university looks. So we have to be thorough on the drawing board, on the books, and on the road.

I’m finishing up the T-shirt designs. The team looked at them and had some good ideas, so I’m fixing them up and giving them a vote on the final two. I just started with the team about a week ago. I really like designing for them, and everyone seems pretty awesome. I just graduated in May with a degree in Journalism and Women’s Studies, so I’m just spending the summer helping the team, and it’s been fun! I feel like I’m really productive later in the night when everyone is working in the garage. I can get a couple of designs done before they come back. When I need a break I can go to the garage and help them. I took a design theory class through the Journalism department, then did a one-semester internship at Youth and Shelter Services working on brochures and postcards along side another person who did T-shirts, so we were able to bounce ideas off each other. The Women’s Center produces an online ‘zine every year, so I produced design and content as an independent study for my major, only this time we had a grant so it got published.

I knew about PrISUm, but I didn’t realize the scale until I decided to just stop by. Then I saw the frame of the car and the solar cells and I was amazed that this a project put on by college students. I like seeing how the different teams work together. I knew a little about electrical and computer engineering, and seeing all those little components come together to make a car is amazing. I wish I could do more. They’re a cute little nerdy family, and they joke around a lot, but they’re all committed to it. I have some experience cooking for large groups of people on a budget, so I’ll be going on the race this summer to help feed the team and keep them together.

I’m working on the Sundial with Abby and Evan, and producing some short videos of the team. I don’t do a lot when it comes to actually designing and building a car, though I do pitch in here and there. I focus on tech support, outreach events, fundraising, cooking, and otherwise lend support so team members can develop their individual roles. I’ve had a career in academic technology while moonlighting as a cabby, and I’ve worked with non-profits and migrant laborers. I work with my extended family’s detasseling business in July, so I wont be on the race crew. I push team members to perform or encourage them to take a break, I ask questions or make observations on their work, or just listen. I’ll ask questions where I know the answer, but I want to hear it in plain English so when it comes time to present their work to non-engineers they can relay these ideas without overwhelming the audience with complex engineering concepts and acronyms. Communication with people outside your discipline is vital for success, and I encourage all team members to engage in fundraising and be cost-conscious. In my career I’ve witnessed firsthand the need to build diversity. PrISUm’s roots are in engineering, but the team is incomplete without a variety of disciplines involved. I recruit new members and focus on building a team in support of our overall mission while looking for ways to expand and improve. PrISUm has helped me identify my purpose at the university, and where I want to direct my career. I encourage anyone who isn’t quite certain of their future to volunteer or join a student group. I’ve chosen to enter the Human-Computer Interaction graduate program, thanks in part to PrISUm.
Corporate sponsorship and individual donations are what make PrISUm go. Your support has advanced the cause of Iowa State University, promoted solar technology, and supported PrISUm's educational outreach mission.

Team PrISUm is a 501(C)(3) non-profit organization, and all donations are tax-deductible. Please consider your donation as an investment by visiting our secure donation page on our website, or make checks payable to:

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Many Team PrISUm members also contributed money, food, and materials along with their time to make Hyperion come to life. This generosity unites PrISUm as a team.

To all of the Ames area business and ISU departments who fed us, gave us discounts or the odd part, or helped make our vehicles safe, our many thanks. - Team PrISUm