Team PrISUUm’s online naming contest for our ninth solar car resulted in over 50 total submissions, and early this semester, team members gathered to decide the name once and for all. The race was close, but Sol Invictus eventually emerged the clear winner. We still have not determined the identity of the namer, however, so it has been impossible to assign any awards!

Sol Invictus literally means ‘the Unconquered Sun,’ originating from Deus Sol Invictus, ‘the Unconquered Sun God.’ With the multitude of obstacles this team has endured, the name could be one of the most appropriate ever for the PrISUUm Team.

The team is currently seeking supplemental funding for transportation and entry costs associated with the race this summer. Ironically enough, the team will be spending a lot of cash just to cover the increased costs of fuel.

If you can help the team or know of anyone who might be financially willing and able, please do what you can to lend a hand!

We have to thank you, our supporters, once again for your incredible support during this project, but we are once again asking for one final push of support to get us from Dallas all the way to Calgary! Help us make it to the finish line!

Sol Invictus’ paint design, created by Wade Johanns, an aerospace engineering student on the mechanical team. The car has been painted and is waiting for a frame to house!

**Status Bar:** Teams ‘Officially’ Entered to compete in NASC

- Iowa State University
- FH Bochum
- Red River College
- Illinois State University
- Missouri University of Science and Technology
- Principia College
- Durham University
- Michigan State University
- Oregon State University
- University of Michigan
- University of Waterloo
- University of Minnesota
- University of Texas Austin
- University of Calgary
- Istanbul Technical University
- Georgia Institute of Technology (demonstration)
- CalSol (UC Berkeley)
- ETS-Ecole de technologie suerieure
- Northwestern University
- Queen’s University
- University of Arizona
- University of Kentucky
- Western Michigan University
- Auburn University
- Kansas State University

**INSIDE THIS ISSUE**

- Director’s Note
- Mechanical Update
- Electrical Update
- Outreach Update
- Solar Car Safety
- Fundraising Update
- Sponsors
Director's Note  
Is it over yet?!

The team has been stretched thin over the past few months, making trips to Remmele Engineering, the Northwest Airlines Composite Shop, and Don Ness Racecraft every weekend to complete the frame and body of *Sol Invictus*.

Regardless of stress levels, the team is still going strong! A zombie-like Solar Car member walking to class is not an unlikely sight on Monday mornings, but no need to worry, we’re getting this car built, one way or another.*

Designs have been finalized and machining has begun on the mechanical side. Our solar array recently arrived, and we’re researching ways to reflect light off the canopy to get the most out of those little cells! Business hours are precious, and reserved for relentlessly seeking out sponsorships.

With such little time remaining (you can check out a countdown timer on our website, www.prisum.org) team members can’t afford to put off anything. We’re pushing forward to finish the car with as much time to spare as possible. This will allow us to make the proper modifications, should we notice a problem with our design. All of this means we really have to push ourselves to get it all done.

I’d like to personally thank all of our supporters and to encourage all of you to continue to follow the team’s progress throughout the race in July. We won’t let you down!  

Sarah Kelly,  
Project Director

*Donations of caffeinated beverages are appreciated!*

---

Mechanical Update

Hello all! A lot has happened since our last update. The team was able to finish building the molds back in November. We would like to give a special thanks to Coastal Enterprises for donating all the foam for the molds and their timely response to our request for more foam when we ran out!

Team members bag the top shell at Northwest Airlines before pulling a vacuum that allows the shell to cure.

The finished molds were then sent out to be machined. Remmele Engineering out of Big Lake, MN machined the bottom mold and Advanced Pattern Works out of St. Louis, MO machined the top mold. Both companies did a great job and were extremely helpful. After the molds were machined the team laid them up with fiberglass and spayed them with Duratec. Fiberglass and Duratec for the bottom mold took place at Northwest Airlines in Minneapolis, a huge thanks to the composite shop personnel for taking care of us during the many weekend visits!

Northwest is also where we laid-up carbon fiber and cured the new shells using their autoclave. By the beginning of March we had both carbon fiber shells in our garage ready for the further work.

The team has since then glued the top and bottom shell together and cut out holes for canopy, brake lights, and turn signals. We then cut the shells apart again and added structural members to support the solar cells. The new bottom shell will be secured to the frame while the top shell with the solar cells will be removable. We like to take the top shell off to make work on the mechanical systems easier and to angle the solar cells in direct sunlight during the race.

Our welder Don Ness is working on the frame. It should be done soon and ready for heat treat. North East Machine is current machining some parts for the car; they have been extremely helpful donating their time and material to our cause.

The car is coming along, as you can see from all the work we have accomplished over the last couple of months, but there is still a lot of work to be done in order to race. Our goal is to have the car mechanically complete by early June in order to get plenty of test runs in before the big race! With your support we will make this goal and race for the win in July!

Hildegard Garma & Michael Bridwell  
Co-Mechanical Directors

Parts for the frame and a brake disc from American Waterjet
It's been an exciting semester for the electrical team! All of our planning and designing over the past year are starting to come to fruition as we begin building and integrating key components of the car. Everyone is very excited to see their designs come to life and watch all of the pieces come together, and with all this energy we're sure to end up with a well-built and reliable electrical system--one of the key components to a successful solar car.

The car’s solar array is here! We've been working closely with Alain Chuzel of SunCat Solar to design the cell layout of the new car. SunCat Solar also provided the services to cut, assemble, and encapsulate the cells. Sol Invictus will be using the same cells as the team's 2005 car, Fusion: The SunPower A-300. These are the best silicon solar cells available on the market, and will ensure that our car is one of the best. Sol Invictus will also benefit by having over 20% more cells than Fusion, meaning it will have one of our most powerful solar arrays ever.

The other major component of the car, the battery pack, has also been ordered and received! The team is using 2600 mAh lithium-ion batteries purchased from BatterySpace.com. These batteries are so new and produced in such low quantities that BatterySpace did not have enough available for our car immediately. We had to wait a while for shipping, but it was worth the wait. The electrical team is currently waiting on approval of the cells from NASC officials to start constructing the modules. In addition to the lithium-ion cells, the battery pack will house a lot of student-designed electronics. Most of the circuits for the car have been built and tested, and are performing better than expected. Once all designs are finalized, we'll order several copies of each board, so that we can simply swap parts rather than spend valuable time repairing broken electronics on the race.

Putting all of these parts together into a working car is going to be a big task, but fortunately we are receiving lots of help from our sponsors. Advanced Circuits is sponsoring the team with free PCBs, and Littelfuse has donated fuses and other circuit protection devices. E. Jordan Brookes has also been a major sponsor by donating the copper foil used to build and wire the solar array, and Cableco Technologies is generously supplying the large cables we use to run power from the batteries to the motor. I would like to extend a sincere thanks to all of our sponsors for making this project possible. As always, you can check out the sponsorship section of our website for a complete list of the team’s sponsors.

A lot will be happening this summer, so be sure to visit our website regularly for updates on our project. You can also find information on how you can help out the team through adoption of a solar cell or battery to help us cover the cost of these components. We’ve recently launched an online donation site also to make it even easier for you to support the team. We appreciate your continued enthusiasm for this project, and we look forward to a first-place finish in the race this summer!

Scott Elliott
Director of Electrical Systems
Outreach Update

Despite the huge amount of time currently dedicated to Sol Invictus, Team PrISUm has kept the calendar open for outreach events. Most recently team members helped out with the middle school Science Bowl on campus, and we’ve been so busy this year, members should have no trouble getting their 2 required outreach events this semester!

We apologize if you have had a request for an outreach event that hasn’t been accommodated. We’ve tried to keep up with our usual amount of outreach, but our weekends have been very full!

During our trip to weld the frame, team members were also attending Learnapalooza in West Des Moines. This meant that we were short a truck! The Formula SAE team here at ISU generously let us use the team’s 7th car, Spectrum, was recently taken from storage at the Iowa Science Center and transferred to the Science Station in Cedar Rapids for display.

Outreach events—Spring Semester 2008:

- March 13th (10 am to 4 pm): Engineering Day at the Mall (Ames, IA)
- March 18th: Central Iowa Chapter Iowa Engineering Society (Ankeny, IA)
- March 22nd (10 am to 2 pm): Iowa Energy Fair, City Hall gym (Ames, IA)
- March 28-29th: State Science & Technology Fair of Iowa Workshops scheduled for the 29th from 1:30 to 2:15 and 2:15 to 3:00 Hilton Coliseum
- VEISHEA Week: Display day on central campus, participation in VEISHEA parade!
- April 18-19th: Science Bowl
- May 3rd (9 am to 12 pm): Learnapalooza (West Des Moines)
- May 31st: Science Day (Charles City, IA)
- June 24th (2:30 to 4 pm) & June 26th (9:15 to 10:45 am): Iowa 4-H Youth Conference

Notice Some New Names?

We’re switching it up around the garage for the next project! As usual, elections were held this Spring to find a new Project Director and Assistant Project Director. And the winners were….

Project Director
Michael Steffen, freshman in Electrical Engineering
mas@iastate.edu

Assistant Project Director
Erin Kelly, sophomore in Chemical Engineering
erkelly@iastate.edu
Building a Safer Solar Car

by Tim Morgan, Asst. Project Director

Following a pair of accidents at the World Solar Challenge last October, and at least one article by a national magazine on the subject, the safety of solar is once again at the forefront of peoples’ minds. While Team PrISUm works constantly to ensure the safety of our drivers and others on the road, in light of recent events Team PrISUm felt it important to let our sponsors know about our work to keep everyone safe.

The process of making a solar car starts long before building any components. Every team member must consider safety first and foremost when designing parts for the car. Any major mechanical part, from the frame down to the axles is modeled in 3D using either Inventor or SolidWorks and then has finite element analysis (FEA) run on it using Algor. Finite element analysis is a computer simulation of the expected forces, stresses, and deflections on a part. This software allows Team PrISUm to determine with relative certainty if a part will fail under normal loads, or in the case of the frame, a vehicle impact scenario. By considering safety from the very beginning of design and running computer simulations on the parts, Team PrISUm is able to ensure a safe car without the costly prototyping and crash testing that is required for production vehicles. We then use this information to prove to the Iowa Department of Transportation that the vehicle is safe so it can be registered as a street legal “experimental vehicle.”

The focus of most discussions of solar vehicle safety is on mechanical components; however, the safety of the electrical components is equally important. For the past few vehicles, Team PrISUm has been using lithium ion batteries to provide extra power during acceleration and to store solar energy when the car is using less than the solar array is producing. The downside to lithium ion batteries is they can be extremely flammable if not used properly. Laptop battery recalls are a perfect example of the dangers of lithium ion batteries, and a solar car uses approximately 100 times as many battery cells as a laptop. To mitigate the danger of the batteries, all solar vehicles, as well as all devices using lithium ion batteries, are required to have battery protection circuits onboard. On Sol Invictus, the battery protection actively monitors every battery module in the battery pack to ensure it is operating safely, and if a battery module isn’t, the protection circuitry will shut down the entire battery pack immediately.

A final layer of protection is the race crew. Every time one of Team PrISUm’s vehicles goes on the road, a crew of people goes with it. Team PrISUm always operates with a vehicle in front and a vehicle behind of the solar vehicle. These vehicles alert other drivers of the presence of a solar car and give team members a mobile mission control from which to monitor the performance of the car. If there should be a problem with the car, we can pull over and have the people who actually designed and built the parts find and fix the problem. Finally, should a worst-case scenario occur and there is a collision involving the solar car occurs, team members trained in emergency first aid travel in the vehicles with the solar car.

Team PrISUm does everything possible to ensure the safety of our solar vehicles, both for our team members and others on the road. While we hope nothing ever goes wrong, Team PrISUm is confident Sol Invictus is a safe car should the unthinkable happen.
Fundraising Update

As always, this semester has been busy for the fundraising team. We are more focused on material donations this semester, as we have begun the build phase of our project.

First of all, we have had many donations of company time. While Remmele Engineering and Advanced Pattern Works donated machining time, Pearl City Wood Products in Muscatine, IA allowed us to use shop space to coat the molds in a high-build primer. The team worked day and night and even got some instruction on spraying techniques.

How do you get a 7,000 pound mold to the twin cities, you might ask! Our trailer won’t handle that load, so we got some help from our friends at Allsteel once again. They provided a semi trailer for our bottom mold on three different occasions to help us get our work done. Northwest Airlines helped the team again (and tolerated us) for countless weekends as we finished the molds and finally created our carbon fiber shell. We even slept on their floor! Not only was the equipment valuable to us, but the staff at NWA gave us pointers and assisted us to make sure our shell was the best it could be.

Other companies are getting in on the action by donating work on smaller components that will go on the chassis. Northeast Machine Company has agreed to machine our posts, hubs, and a-arms at no cost to us. This even includes material! This is a huge relief off our shoulders.

American Waterjet continues to help out from Winfield, IA. They have completed the washers that keep our wheels secure, and have made several mounting brackets for the frame already. They will soon be helping us with our titanium brake discs, and busbar for the battery pack made with conductive aluminum.

On the parts side, we have received many large discounts from providers of suspension, steering, and braking system parts. Koni North America has provided a huge discount to us on custom-valved shocks, while Eibach springs in Corona, CA has generously provided 6 springs to the team at no cost! Two of the springs will come with stiffer rates so that the team can try different setups to see which works best with the car.

Electrically, Rearview systems provided us with two new rearview cameras for the car so we don’t have the extra drag of mirrors. The cameras are mounted inside of the canopy behind a small window.

On the cash side, we continue to stress about funds, but we can’t claim lack of support! Our big cash sponsors, including BP, Iowa Energy Center, and the College of Engineering came through for us with $10,000 each again this year. Alliant Energy awarded us a $2,000 grant as well! In addition, the colleges of Mechanical, Chemical & Biological, Electrical & Computer, and Aerospace Engineering have each contributed $500 to the car’s progress.

And of course, all of this wouldn’t be possible without you, our faithful fans! Your adopt-a-cells, tires, and batteries are what keeps this team going on a day-to-day basis. On that note, we’ve given you another option for helping us out. Hate dealing with checks and snail mail? We’ve got a solution for you. Check out our new online donation site. You can pay by credit card, and you still get your subscription to the sundial, certificate, and t-shirts by mail. It’s just less work for you!

If you have any questions about the team, please contact us at (515) 294-0899. You can also e-mail solar-car@iastate.edu. And please feel free to check for updates on our progress on our website at www.prisum.org
The Sundial

Sponsors

Team PrISUm would like to thank all of the sponsors of PrISUm Sol Invictus

Platinum Supporter
The Boeing Company
Iowa Energy Center
BP Amoco
College of Engineering
Coastal Enterprises
3M
Autodesk

Gold Supporter
Allsteel
Altium

Silver Supporter
Musco Lighting

Cardinal Supporter
Danner Corporation
Advanced Systems, Inc
Advanced Pattern Works

Solar Saint
Garmin
Pacific Power Management
Alliant Energy

Solar Benefactor
Stanley Consultants
Pearl City Wood Products
Iowa Engineering Society
Cushion Seats, Inc
Advanced Solutions Corp.

Solar Sustainer
City of Ames Electric
Lee County Extension
PhysiciansCare
Northeast Machine Co
American Waterjet Cutting
Littlefuse
Cabelco
E. Jordan Brookes Co.

Team Sponsor
Premier Event
Bald Eagle Days

Adopt A Battery (cont’d)
Eagle Window and Door
Allen and Marie Ihlefeld
Thomas W. Thatcher
Ned and Ann Allen
Larry and Judy Rollstin
Paula Vallone
James and Carolyn Cornette
Marta Burkgren

Adopt A Tire
Debbie and Keith Felderman
Paul and Bernice Exstrom
Tom and Denise Kelly
Robert and Janice Anderson
Donald and Debby Helgeson
Bruce and Amy Crouse
Carl and Elaine Nelson
Margaret Weatherspoon
Walt and Jill Ortmann
Marshall and Louise England
John and Elizabeth Kelly
Gary and Joyce Krasche
Shirley King
Richard and Lynn Clegg
Gary Kent
W.E. Campbell
Eugene and Julieta Garma
David and Marian Andersen
Marc and Nancy Elliott
Randy and Susan Schirm
David and Teresa Hawver
Marla R. Shafer
Bandag Incorporated
Mary C. Grilli
Dr. & Mrs. Thomas Dittmer
Marilyn & Rolan Jensen
Brian and Melinda Drees
Richard and Barbara Johanss
David and Laura Martin
Nicholas M. Mohr
A. Beth Helgeson
Ron Nelson

Adopt A Cell (cont’d)
Paula Bridwell-Vallone and Joseph Vallone
Brody Construction
Elisabeth and John Thene
Howard and Ann Raffety - Grinnell
Middle School 6th Grade
Karl and Melba Gschneidner
Norma Buss
Sharon Babcock
Paul and Jill Murphy
Robert and Beverly Bole
Richard and Judy Jones
Roger and Joan Anderson
Michael and Karen Margitan
Martha Anderson
Susan Barron
Mary Helen Stewart
Charles and Bonita Glatz
Nick and Katie Mohr
Pam Reing
Bailey Wall
David and Teresa Hawver
Danielle Pane
Jay Hinkhouse
Joshua and Christine Engelbrecht
Scott and Joyce Hornstein
William R. Jordan
Jeffrey and Nancy Sorensen
Judy Tucker
Randall Hacker
Jim and Barb Bennett
Terrence Diaferio
Gary Moody
Kris Reicks
Deloris Heim
Steven and Elaine Weirather
David and Cathy M Carlyle
Marjorie Burkgren
Lea Johannsen
Gloria Hill
John Root
Justin Steinlage
Dee A. Dreeszen
Carolyn Jameson
Diane L. Spore
Barbara L. Johanns
Marta Burkgren & Ron Morgan
Metalcraft Inc
Ron and Dawn Billings
Leon D. Carson
Scott Elliott

Adopt A Battery
Ted and Rae Okiishi
Forth Dodge Machine and Supply Company
Lowell L. Lauver
Glasnapp Transfer
A. Beth Helgeson
Keith and Debby Felderman
James and Carolyn Cornette

Adopt A Tire
Debbie and Keith Felderman
Paul and Bernice Exstrom
Tom and Denise Kelly
Robert and Janice Anderson
Donald and Debby Helgeson
Bruce and Amy Crouse
Carl and Elaine Nelson
Margaret Weatherspoon
Walt and Jill Ortmann
Marshall and Louise England
John and Elizabeth Kelly
Gary and Joyce Krasche
Shirley King
Richard and Lynn Clegg
Gary Kent
W.E. Campbell
Eugene and Julieta Garma
David and Marian Andersen
Marc and Nancy Elliott
Randy and Susan Schirm
David and Teresa Hawver
Marla R. Shafer
Bandag Incorporated
Mary C. Grilli
Dr. & Mrs. Thomas Dittmer
Marilyn & Rolan Jensen
Brian and Melinda Drees
Richard and Barbara Johanss
David and Laura Martin
Nicholas M. Mohr
A. Beth Helgeson
Ron Nelson

Adopt A Cell
Carlton & Sally Peterson
Dave Blum
Bryan Mock
Guy and Kathy Venz
Fred Steffen
Robert Anderson
Cassandra O’Flaherty
Dan & Jane Billings

Adopt A Tire
Debbie and Keith Felderman
Paul and Bernice Exstrom
Tom and Denise Kelly
Robert and Janice Anderson
Donald and Debby Helgeson
Bruce and Amy Crouse
Carl and Elaine Nelson
Margaret Weatherspoon
Walt and Jill Ortmann
Marshall and Louise England
John and Elizabeth Kelly
Gary and Joyce Krasche
Shirley King
Richard and Lynn Clegg
Gary Kent
W.E. Campbell
Eugene and Julieta Garma
David and Marian Andersen
Marc and Nancy Elliott
Randy and Susan Schirm
David and Teresa Hawver
Marla R. Shafer
Bandag Incorporated
Mary C. Grilli
Dr. & Mrs. Thomas Dittmer
Marilyn & Rolan Jensen
Brian and Melinda Drees
Richard and Barbara Johanss
David and Laura Martin
Nicholas M. Mohr
A. Beth Helgeson
Ron Nelson

Adopt A Cell
Carlton & Sally Peterson
Dave Blum
Bryan Mock
Guy and Kathy Venz
Fred Steffen
Robert Anderson
Cassandra O’Flaherty
Dan & Jane Billings

www.prism.org
Special thanks to Sycamore Printing

110 Marston Hall
Iowa State University
Ames, IA 50011-2151