

# THE SOLAR FLARE



Fall 2002

## Racing the Dragon: The Solar Car in China

After a tense wait for the shipping crate, October 16<sup>th</sup> marked the return of Ra IV from its extraordinary exhibition this summer in the People's Republic of China.

Our participation in the first ever China Solar Challenge and Road Show was unique among opportunities explored by the team thus far. Staged by EDS – a major corporate sponsor of the team – and the Chinese Society of Automotive Engineers, and hosted by four Chinese universities along the exhibition route, the event proved to be an exciting success. EDS had decided to send a pair of solar car teams to the country with the intent to showcase the utility of their automotive software technology. After some discussion, the company selected the University of Missouri- Rolla and Principia to represent the dozen or so US solar cars designed with their Unigraphics software package.




On July 31<sup>st</sup> four team members – John Broere, Chris Churchill, Matt F, and Alison Wiegand – faculty advisor Steve Shedd, and Resident Counselor Cindy Shedd departed with members of the Missouri-Rolla team for Shanghai, China. The event started in Shanghai, stopped in Nanjing, moved on through to Tianjin, and ended in Beijing. The opening ceremony was on August

3<sup>rd</sup>, and the closing ceremony on August 13<sup>th</sup>. After touring Beijing with Prof. John Williams, who generously donated his time, the crew returned on August 17<sup>th</sup>.

Unlike previous solar car races, most of our time was spent with the cars on display at universities or science museums. Our other activities primarily consisted of contributing to technical forums, attending official banquets, and driving demonstration laps for the media. The China Solar Challenge was entirely an exhibition and demonstration; the few short racing events included in the road show were largely choreographed, and were set up entirely for the media.

The people who approached the displayed cars were very inquisitive, asking not only the “typical” questions that we have come to expect from onlookers, but also more incisive questions about the workings and practicality of the cars. There is a great deal of air pollution in Beijing and other parts of the country, so there is great interest among the people in finding an environmentally clean transportation solution. A good number of inquirers spoke English, and for those who did not our host universities provided students who acted as interpreters.

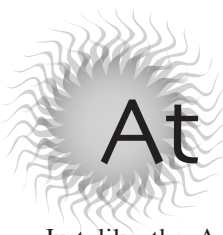
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# At the China Tracks

Just like the American audiences we've met in our travels across the United States, Chinese crowds loved to see the solar car in action. In each of the four cities we visited during the Chinese Solar Challenge and Roadshow we were pleased to drive the car for non-competitive exhibition.

August third was the first of two days spent at the Shanghai Science and Technology Museum. We opened the shipping crate that had carried our car across the ocean and found everything to be a little salty, but in good shape. On this first day we answered questions about our team and our car, and the next day all three teams drove a few laps together around the road circling the museum. This demonstration, like the others in the China Solar Challenge, was not intended to push the cars hard or fast. It was simply to allow visitors and the media to see that these seemingly impractical science projects really do roll.

In the second city, Nanjing, the teams were asked to put some real kilometers on the cars as we participated in a trip around the city. The race directors wanted to see some faster speeds than city streets would allow so they arranged to have a 7 kilometer (4.3 mile) stretch of highway closed to regular traffic. The University of Missouri, Rolla finished the distance first, closely followed by Principia College. Tsinghua did not have the necessary torque to climb the incline and had to load their car into a truck. Once all the teams were together again, we made our way into the city, and into rush hour traffic on narrow streets. Chris Churchill, the Principia driver that day, says he will never forget the experience. "It was the most harrowing driving experience ever!" he recalls. Lane lines and traffic lights were merely suggestions for the vehicles that jammed the streets, inches from our delicate car. Fortunately all cars and team members emerged in one piece and traveled to the next stop of the trip, Tianjin. The cars made few demonstration laps around the campus of He Bei University. Also included was a loop around the school on city streets. In dramatic contrast with their previous excursion, this time the cars were given full police escort, cleared streets, right



of way at intersections, and protection at all corners. What a great run!

On our way to Beijing we stopped for half a day at an automotive proving ground outside the city. Using a straight stretch of smooth track, all

three cars did a "parade lap" together. Each car then completed several demonstration laps individually. Once in Beijing we spent two days at the Chinese Museum of Science and Technology where our cars were on stationary display. The final day of the event was in the central plaza of Tsinghua University. After a day of display, the cars got one last run. Following a lap around the central green, the event directors who had worked endlessly throughout the solar challenge got an opportunity to drive. Mr. Mike Zhao and Mr. Jimmy Wong of EDS piloted the Rolla and Principia cars, respectively. We were thrilled to let them see what driving a solar car is really like.

Our team enjoyed the opportunity to drive around on Chinese ground and demonstrate the potential of solar energy to audiences in many cities. Now that it has returned from the trip, Ra IV will still be used for publicity and education while we are building Ra V. For the next several months it will be on display at the shop that gave it its paint job, Doug Jenkins' Custom Hot Rods in St. Louis.

*Alison Wiegand*



*China* from p. 1

Following our arrival in Shanghai we met up with the solar car team from Tsinghua University. Tsinghua built and raced a solar car six years ago. It has since been modified, but remains the sole solar electric vehicle produced in the country. The team exhibited their car on the route alongside Ra IV and Solar Miner III from Rolla. We took the opportunity to get to know members from the Tsinghua team, and find out what life was like for them in China.

By the end of the event, we had had a great deal of fun with our hosts, enjoyed the many different events and banquets we had attended, befriended our counterparts from Rolla, and were very grateful for all of our supporters back home. We hope the team will again have such an unique opportunity to share our car and ourselves overseas.

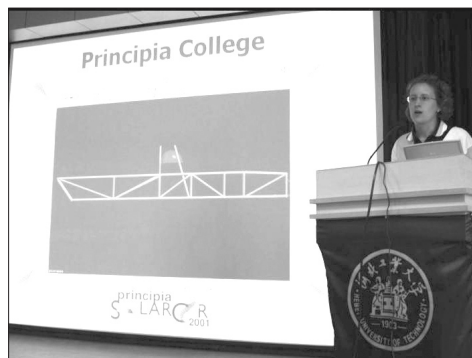
*Matt F*

# Teaching Design Theory

At each Chinese university we visited, the teams participated in a technical forum with Chinese graduate students. Each forum was designed to educate the engineers about the process of designing and building a prototype solar vehicle. Half hour technical presentations were given by EDS, Tsinghua, UMR, and Principia at each of the four forums. Though our teams began relatively unprepared – we did not know the content of the forums until shortly before giving them – by the final forum Beijing we were veterans at the task.

The main obstacle to having the presentation understood was the language barrier between the American teams and the graduate students. Though the Chinese students had all had at least 6 years of English, it was necessary to use simple language to be understood, and still get across important technical points. Throughout the presentations, the students seemed to be most impressed by several of the construction strategies employed by Principia and UMR.

One of these was the use of innovative solutions to achieve the same end result that both cut costs and save labor. An example of this was our foam composite bodies. Instead of using the traditional carbon-fiber mold process used by most teams, using



**Alison Wiegand discusses the finer points of chassis design**

housing insulation as a composite resulted in a body that was lighter, cheaper, and easier to build. Insulation was particularly appealing to the Chinese because the material could be obtained easily by them, and would save them a considerable amount of money.

Another idea that impressed the engineers at the forums was the use of off-the-shelf parts for certain components that are very difficult to build to save time and increase reliability. The students and the Tsinghua team were most impressed with our use of a manufactured magnetic

motor. By using the New Generations motor, the US teams save the daunting task of designing and building a motor, and are able to use a proven, acceptable design that is affordable and has excellent performance.

The final strategy they seemed impressed with was simplification: everything that is not needed in the car should not be in the car. Focusing on the primary goals of the car (e.g. safety and energy efficiency), we make sure that our design and construction cycles do not get bogged down in extraneous details.

In giving these presentations, we not only showed the Chinese students how we design and build our cars, but we also learned through the effort. By examining our own design process, we were able to think of several ways in which to develop our upcoming car more smoothly.

*Chris Churchill*

## Ra V on Wheels

After dodging several potholes, I made a hard left and rounded the corner. The six of us assembled there were all grinning from ear to ear – I was giving Ra V its first rolling test. On October 14th we finished our first major construction goal for the car: we had a rolling chassis. (The chassis consists of the frame, the suspension, and all other mechanical components that are needed to support the car and make it move.)

This is doubly good news, not only because we have the chassis rolling, but also because we are four to five months ahead of where we were in the last build cycle allowing for months of valuable testing time during which we can work out all of the car's idiosyncrasies.

In the week preceding this milestone, the

team members finished the kingpins, axles, and the steering system; all that remained was to assemble the various suspension components. The Friday night before the 14<sup>th</sup> Andy Berner, Aaron Pratt, and I spent the whole night in the shop, attaching a-arms, kingpins, axles, hubs, and wheels to the frame. With just a little bit of final adjustment on Monday afternoon, we were able to take the car around the parking lot for a few laps.

We don't have the brake disks attached to the car, but we will be acquiring those before the end of the quarter. Currently we drive something like the old Model-A Ford. We don't stop.

We have worked on an agreement with our friends on the University of Missouri-Rolla team, and they are going to cut our brake rotors using their



**Kevin Pratt pushes Chris Churchill in the new rolling chassis**

water-jet machine. The machine uses a focused, very high pressure (~50,000 psi) stream of water mixed with an abrasive to cut metals and other strong materials.

The next step for the chassis team, led by Chris Churchill, is to help the electrical and body teams with any attachments to the chassis, and to optimize all of the parts on the chassis.

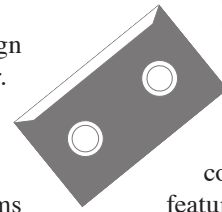
*Kevin Pratt*



After some thought, we decided to redesign our newsletter and team logo this quarter. After critically reviewing our old issues of Ra News, we realized that we could make improvements in its readability and visual appeal. We decided to switch design platforms from Microsoft Publisher to Adobe Indesign, a more powerful design tool which gives us more flexibility in publication layout. To improve the readability of the text we switched to a sarif font. Feeling the title Ra News did not accurately reflect the vitality of the team, we changed the name to **The Solar Flare**.

The team also voted to change the team logo this quarter, deciding upon the one you see preceding the title of the newsletter. We hope you like the changes. Please write us and tell us what you think.

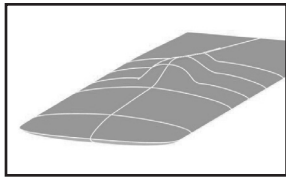
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## Ra IV Video

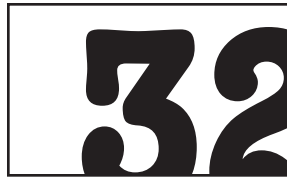
Would you like to relive the excitement of Ra IV's career whenever you desire? A compilation tape of four videos featuring Ra IV is now available.

You can own the official ASC 2001 music video, team member Nick Johnson's full-length documentary of the building and racing project, a fast-paced compilation of news coverage put together by George Cooke, and a brief advertisement for the Chinese Solar Challenge by Brett Darken of North Star Productions. The cost is \$8 to cover materials and shipping.



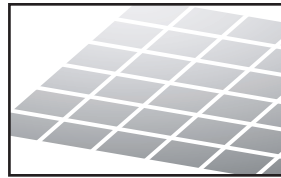
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... and More!



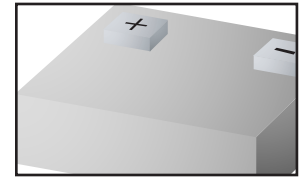
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