In July 2005 the North American Solar Challenge (NASC) featured university built solar powered cars ran across the United States into Canada. The competition began in Austin, Texas with stops in Weatherford, Texas; Broken Arrow, Oklahoma; Topeka, Kansas; Omaha, Nebraska; Sioux Falls, South Dakota, Fargo, North Dakota; Winnipeg, Manitoba; Brandon, Manitoba; Regina, Saskatchewan; Medicine Hat, Alberta; mainly following U.S. Highway 75 and Canadian Highway 1 to the finish line in Calgary, Alberta, Canada, for a total distance of 2,500 miles.

The preliminary team list includes a mixture of veteran and rookie teams from across the United States and Canada

The North American Solar Challenge 2005

Organization	Car Name	Car #	Class
Auburn University	Sol of Auburn	7	Stock
CalSol	Beam Machine	254	Stock
Illinois State University	Mercury I	88	Stock
Iowa State University	Fusion	9	Stock
Kansas State University	Paragon	28	Open
Massachusetts Institute of Technology	Tesseract	6	Open
McMaster University	Phoenix	116	Stock
Northwestern University	nu'Nergy	11	Stock
Principia College	RA 6	32	Open
Queen's University	Ultraviolet	100	Open
Red River College	Red River Raycer	95	Stock
Southern Illinois University - Edwardsville	Cougar Cruiser	57	Stock
Stanford University	Solstice	16	Stock
University of Calgary	Soleon	65	Open
University of Michigan	Momentum	2	Open
University of Minnesota	Borealis III	35	Open
University of Missouri - Columbia	Suntiger VI	43	Open
University of Missouri - Rolla	Solar Miner V	42	Open
University of Waterloo	Midnight Sun VIII	24	Open
Western Michigan University	Sunseeker 05	786	Open

Demonstration Vehicle Class		
University of North Dakota	SubZero IV H2	273

NASC major sponsors include the U.S. Department of Energy (DOE), Natural Resources Canada and DOE's National Renewable Energy Laboratory. The event is designed to inspire young people to pursue careers in science and engineering. NASC's predecessors, the American Solar Challenge and Sunrayce, generally have been held every two years since 1990. With each race, the solar cars travel faster and further with greater reliability.

The NASC promotes:

- Renewable energy technologies (specifically photovoltaic or "solar cells")
- Educational excellence in science, engineering and mathematics
- Creative integration of technical and scientific expertise across a wide-range of disciplines

•"Hands-on" experience for students and engineers to develop and demonstrate their technical and creative abilities.

Safety is the first priority for the NASC. Each team put its car through grueling qualifying and technical inspections. Teams that failed to meet the requirements were not allowed participate. During the race, each team was escorted by lead and chase vehicles sporting rooftop hazard flashers. An official observer accompanied each solar car team to keep it alert to any safety issues.

One of the best accounts of the day to day happenings of the event comes from excerpts from the Daily Rayce Log of Richard King, the US Department of Energy representative that accompanied the event (follows in italics).

They say that to do something great in life it has to have significance. The significance comes from making a difference, either in your life or the lives of others. The solar challenge I am blessed to be out here witnessing has both. This event is turning students into leaders, and disbelievers into believers.

Two years ago when most of these students joined their respective solar car teams, little did they know how hard the task ahead of them was going to be. From the long hours designing and building a car from the ground up, to the demanding requirements necessary to race across two continents in 10 days, solar car racing is hard. For those with the right stuff, it has built character and leadership - qualities that will change their lives for the better. That's significant.

To power a car at highway speeds all day, day after day, on sunlight is a technological accomplishment that many find hard to believe. What these teams are proving out here is that solar electricity really works and energy efficiency pays off. Considering the consequences of billions of people around the world burning fossil fuels at an ever-growing rate, demonstrating technologies that can make a difference is significant.

Day One: The Start!

What a great start. Despite some low hanging clouds, the starting ceremonies and rayce start were spectacular. Thousands cheered as the solar raycers departed on the longest cross-country race in history. The goal now: to reach the finish line in Calgary, Alberta, Canada faster than anyone else — just using sunlight for fuel!

The University of Minnesota was in pole position and was first to leave at 9:00 a.m. central time Sunday, July 17. They were also the first to arrive at the stage stop in Weatherford, Texas, just outside Ft. Worth. They reached Weatherford College at 1:05 p.m., taking just four hours to travel the approximately 200-mile leg. However, the University of Michigan was right on their tail, arriving just two minutes behind them! That means that Michigan is currently in first place because they started the rayce in Austin five minutes behind Minnesota.

MIT was third to reach Weatherford College. Their car, named Tesseract, had no problem keeping up to the leaders and is just nine minutes behind. I heard the University of Missouri-Rolla, the defending champions, got lost briefly, but otherwise flew at highway speeds all day. They finished 20 minutes behind the leaders. The University of Waterloo played it safe and conserved their batteries early but soon changed their

strategy when they learned the cloudy weather was improving as they went north. Waterloo finished the leg 10 minutes behind Rolla, and 30 minutes behind the leaders.

About 2:00 p.m. dark clouds rolled in from the southwest and it rained very hard for about half an hour. Western Michigan University (6th), Iowa State (7th), Auburn (8th) and CalSol Berkeley (9th) made it to the college just ahead of the rain. All the others were caught on the road. The rain was so hard it forced several teams to the side of the road to wait. The University of Calgary had an electrical short from the water that splashed up into the car. The repair took about a half-hour to fix. Northwestern University had a short in their battery that has resulted in a catastrophic failure. Unless someone has a spare battery pack for them to use, they will not be able to continue.

I also heard Queens University had a failure of some kind and had to trailer their car in. However, I was unable to find them to ask why. Other than that the first leg was very successful for most of the teams. The skies cleared and we had sunny weather from about 3:30 p.m. on. The town of Weatherford and Weatherford College have been extremely hospitable, providing free food and entertainment for the teams. There were hundreds of people stopping by all afternoon to see the cars and talk to the teams. All-in-all, it was a really great day.

Tomorrow we start the longest leg to Winnipeg, Manitoba, Canada. There are several checkpoints along the way, but the teams will not gather as a group again until they all reach Winnipeg. The leaders should reach the Topeka checkpoint by the end of the day tomorrow.

Day Two: The Longest Leg.

The real raycing begins when each team can drive as far as they can for several days in a row. Sunday's short first leg (212 miles; or 339 kilometers) was easy. Teams drove that distance in four to six hours, and many had plenty of energy to go further. Neither the car's efficiency nor aerodynamic design was fully tested.

Monday saw the beginning of the second and longest leg, over a thousand miles (1,600 kilometers) to Winnipeg, Canada. Teams will drive as far as they can in 10 hours each day, from 8:00 a.m. to 6:00 p.m. Having an open-ended route really tests the car's capability to collect and convert sunlight, and use that electricity the most efficiently. The solar race cars get spread out along the route, with the fastest and most efficient in the lead. The design intricacies of the cars and the strategies of the teams take over and make the rayce much more interesting. For the next couple days we will begin to see who has designed and built the best solar powered car.

Monday's start was fun. Joe Tison, the Mayor of Weatherford and President of Weatherford College (he is one in the same person!), was on hand to wave the starting flag. All the teams started without a problem except for Illinois State University, who stayed to recharge their batteries for a while.

Although this is the longest leg, teams still have to stop in several checkpoints along the route for one-half hour. This gives the public a chance to see the cars, and it allows teams a chance to have a driver change and pit-stop. The first checkpoint was at the high school in the Broken Arrow, Okla., just outside Tulsa. The distance from Weatherford, Texas, to Broken Arrow was 306 miles (490 kilometers). The first car there

was the University of Michigan, which took five hours and 56 minutes to get there. Minnesota was 10 minutes behind them, and Rolla another 14 minutes behind Minnesota. All three solar cars made incredible time.

MIT and Western Michigan University (WMU) came into Broken Arrow three minutes apart. They were about an hour behind Michigan. Waterloo came in another 30 minutes later. All these teams had a flawless morning of raycing. I left the checkpoint after Waterloo came in so I'm not sure who was next in. I did hear that Calgary and Stanford were having battery problems and at times were working on their cars at the side of the road.

By the time I reached the leaders they had stopped for the day at 6:00 p.m. I found Minnesota and Rolla next to each other in adjacent parking lots in Independence, Kan. Each had traveled an incredible 402 miles in one day! However, the Michigan team had pulled into a road-side rest stop about 17 miles further up the road, making their total for the day 421 miles (674 kilometers). In driving time that gives Michigan about a 20-minute lead. All three had to drive through a thunderstorm about an hour earlier. Both Minnesota and Rolla said they had to pull over because it was raining so hard they couldn't see.

I talked to Dan Eberle tonight who was back at the Broken Arrow checkpoint. Three teams were there and were going to stay the night at the high school: Iowa State, Stanford and Principia. Dan said he traveled most of the day with the middle of the pack and said they all had a good day with minimal down time. So, everyone had a great day of raycing! With the leaders so close, only minutes apart, the excitement continues to build. I can't wait to see what happens tomorrow.

Day Three: What a difference a night makes.

What a difference a night makes. When we went to sleep, Michigan was in the lead and Rolla and Minnesota were right behind them. The rest of the pack was nowhere to be seen. When we all awoke, it was cloudy and raining. The leaders tried to speed ahead to get out from under the clouds, but they couldn't. All three had to stop to recharge their dead batteries. However, in the rain that is very hard to do.

As the leaders parked charging by the side of the road, along came Waterloo, MIT, Principia, Missouri-Columbia, and Stanford, passing them! It was the classic story of the tortoise and the hare. The teams who conserved and had some energy to spare in their batteries were able to dive through the morning rain. The teams who gambled thinking there would be sunny skies in the morning, lost. What great drama.

MIT had good strategy, and luck on their side. They were able to maneuver between two large rain clouds to maintain about 20% power from the solar cells. That was just enough to keep moving at 20-25 mph. Waterloo said they played a more conservative strategy the day before, plus they were able to get some charge last night so they had just enough to creep along in the morning too.

Of the three front runners, Minnesota had the best luck. They ran out of energy going up a long hill. They decided to stop and charge just enough to get to the top and no more because they calculated they could coast down the next couple miles using their motor to regenerate electricity (which puts electricity back into the battery from the

motor using the momentum of the car). Together with a little break in the clouds, they too were able to limp along at 20 mph.

Michigan and Rolla were not so lucky. Both had depleted their batteries and could go no further until the rain stopped and the skies cleared.

Between 12 p.m. and 1 p.m. the sky finally cleared to bright sun and everyone could pick up the pace. However, the lead had changed hands. At the Topeka checkpoint, MIT was first to arrive at 1:01 p.m. Waterloo was second 46 minutes behind. Minnesota crept in at 2:14 p.m. About a half hour later a group of five teams came in together. Principia at 2:53 p.m., Missouri-Columbia 30 seconds behind them. Michigan arrived eight minutes later, Rolla eight minutes later than Michigan, and Stanford four minutes later than Rolla. All six were in the Topeka checkpoint at the same time. What an exciting morning.

I heard many of the other teams in the back were catching up to the leaders too.

From Topeka to Omaha there was nothing but blue sky and the cars maintained highway speeds of 55 to 65 mph. The leader at the end of the day was MIT. They were camping at the Omaha checkpoint for the night, arriving there at 6:25p.m. Minnesota was about five miles back, and Waterloo was about 39 miles back.

Day Four: Here we go again.

Here we go again. Another rainy morning, and another lead change. Wednesday morning, just when the teams were leaving the checkpoint in Omaha, it started to sprinkle. The route north took them right into a thunderstorm. MIT, the leader out of the checkpoint, drove right into the middle of a hail storm! To protect their solar cells, they had to stop and cover the car. About 20 minutes later, just as the storm stopped, guess who drove by? Minnesota! Because they were 20 minutes behind, Minnesota missed the hail storm and kept driving right by MIT to take the lead!

Once out of Omaha the skies cleared and for the rest of the day there was full sunlight to power the race cars. The order of the leading teams in the morning was (after Minnesota overtook MIT) Minnesota, MIT, Michigan, Waterloo, Principia, Rolla, Missouri-Columbia and Western Michigan.

By the time they all arrived in Sioux Fall, S.D., the Site of the next checkpoint, only Rolla had moved up a spot, passing Principia. That is because Principia had a spin-out in the rain which cost them about 20 minutes.

The checkpoint in Sioux Falls was really spectacular. There was such a warm out-pouring of interested people who swamped the checkpoint when the cars came in. All the solar cars had two motorcycle policemen escort the cars through town, so it was quite a scene when the whole entourage drove in with lights flashing and people cheering. We all had a great time in Sioux Falls.

At times it is hard to tell what state we are in! The day started in Nebraska, cut over into South Dakota, then back into Minnesota. By evening the leaders were still in Minnesota, about 100 miles from Fargo, North Dakota, the site of the next checkpoint.

By location, MIT was about 10 miles ahead of the University of Minnesota, and Michigan was 11 miles behind Minnesota.

We love the folks out here on the border of Minnesota and South Dakota. Both camp sites where Minnesota and Michigan were staying at day's end were attracting a crowd as word passed that a solar car was in town. What was so special was the generosity. Several families brought food for both the teams. I stopped by both their camps and everyone was feasting on fried chicken and pizza!

Tomorrow the leaders should cross into Canada! Then it is on to Winnipeg.

Day Five: on to Winnipeg.

After two days with morning clouds and rain, we had a day with clear skies and lots of sun. The sun makes the cars run faster and smoother, but there is less drama when the teams just drive the speed limit. For the most part, that is what happened today with the leaders. As Minnesota, MIT and Michigan raced through Fargo, N.D., on up across the Canadian Border to Winnipeg, the distance between the teams didn't change. Minnesota was 34 minutes ahead of MIT in Fargo, and 22 minutes ahead of them in Winnipeg. In Fargo, MIT was 2 minutes ahead of Michigan. At the border they were in the customs station at the same time, and when they reached Winnipeg, MIT was four minutes ahead. Virtually dead even after more than 1,500 miles! This is the closest rayce I can remember.

The one change that did occur within the top five was between Waterloo and Rolla. At Fargo, Waterloo was 20 minutes ahead of Rolla. But about 40 miles from the border Waterloo took a wrong turn and got lost. By the time they got turned around, Rolla had passed them. As Waterloo desperately tried to catch up, they wore down their batteries just short of Winnipeg. We expect to see them in to the Stage Stop on Friday before 8:30 a.m., putting them about an hour behind Rolla for fifth place.

The arrival times for the four teams who made it to Winnipeg before the end of the day are: Minnesota 4:11 p.m.; MIT 4:34 p.m.; Michigan 4:39 p.m.; and Rolla 5:37 p.m.

The highlight of the day was the border crossing. The Canadian customs officials were very helpful, and they were as excited to see the solar cars as we were. They had made a separate lane for the solar teams to make the process as easy as possible. Each team had prepared a list of their team member names, so it only took a couple minutes to get processed. We all took pictures, including a Winnipeg TV station.

The Stage Stop in Winnipeg is at Red River College. They have a beautiful green front lawn where the solar cars park as they come in. This is the end point for the second leg that started in Weatherford, Texas. No one will go any further until the rest of the teams catch up over the next two days. Once all the teams have arrived they will start together on Sunday, July 24 for the third leg from Winnipeg to Medicine Hat, Alberta.

I am looking forward to tomorrow and talking to the rest of the teams. After being with the leaders for the past several days I have missed all the drama that has gone on with the others. I have heard about gallant efforts by everyone, but have been unable to witness them. For example, Auburn has been performing better than they ever have in

the past in spite of some battery problems. And I hear Red River College has been doing very well for a rookie team. However, a couple teams are struggling. Queens and Kansas State have both had some major problems and are furthest back. On Friday I should have more news – so be sure to check back!

Day 6: Red River College

We are here on the campus of Red River College in Winnipeg, Manitoba, Canada. The college generously opened its doors to the teams, allowing them to park and relax on their front lawn and use their facilities. After five blistering hot days on the road, there is nothing more inviting than the opportunity to rest with your solar car on a cool green lawn. The students relaxed all day, telling stories, playing Frisbee, or catching some much needed sleep in the shade under their car.

What an exciting day of raycing, too. Waterloo woke up early and sped in at 8:51 a.m. to the cheering Canadian fans who were anxiously waiting for one of their country's own to arrive. They were glad to be in fifth place and are looking forward to racing across the prairies along the historic Canadian Highway 1. They have driven this route before so they know it well and believe they have a little advantage. They also think they know best how to navigate the strong winds that are commonplace in Saskatchewan.

One of the most exciting "races within the race" has been taking place between the 6th, 7th and 8th place teams. After racing five days from Austin, Texas, these three teams arrived less than ten minutes apart from each other!

Principia arrived first at 10:23 a.m. After their spin-out on Day 4 the team said the car has been running flawlessly. They only made one mistake since then when they took a wrong turn yesterday and got caught off course.

Missouri-Columbia arrived nine minutes later. The team runs a relatively conservative strategy which has paid off with a 7th place finish thus far. After some minor problems the first and second day the team said they are very happy with their car's performance.

Western Michigan University (WMU) arrived eight minutes later. They too have had no problems with their car the past several days and have been keeping up to posted speed limits.

All three of these teams said the lead between them has changed many times and neither wants to give up their position. They are all very experienced teams so it will be interesting to see who will win this "mini rayce"

The next set of five teams is two hours behind this group, and each of the five is about one hour apart. They all arrived between 12:27 p.m. and 4:31 p.m. In order of arrival they are: Stanford, CalSol Berkeley, Auburn, Iowa State and Calgary. Although this group is not so close to each other as the other group, with 1,000 miles still to go, anything can happen.

In talking to these teams the same general story repeated itself. They all struggled a bit here or there, but overall they have been happy with their performance. The Auburn team seemed the most proud, saying they have never built such a good car.

They especially liked the fact that they could enjoy a day of rest. In previous races they never made it to a rest stop in time to actually have any rest because their car was too slow!

The final team to arrive today was the University of Calgary. When word went out they were two blocks away, everyone lined the circle to cheer them in and welcome another Canadian team home. The team was tired and glad not to have to spend another day on the road. Back in Kansas the rain really hurt them. All the splashing water made the power go out. Upon looking things over they found three inches of water in their motor controller! But they never gave up and don't intend to. They believe to a team member that they can and will move up in the standings. The city of Calgary is their home and they intend to get there first!

Which just may be possible from here. This rest day gives the teams the opportunity to fix all the nagging problems and recharge the batteries. Sunday when they start as a group, it will be a mad dash across the Canadian Prairie. Many of the teams will try hard to be first to Medicine Hat, the end point of the third leg. And it wouldn'ta surprise me if someone new did. But, similar to the Tour de France, Minnesota could maintain the overall lead without being the first to finish the leg.

Tomorrow we enjoy another day on the beautiful campus of Red River College while we anxiously await the remaining four teams to arrive. (I say four because I heard Queens trailered in because they hit a pot hole and one of their front wheels is damaged.) There will be a press conference in the morning with the Manitoba Minister of Transportation and other dignitaries to officially welcome the teams to Canada. The solar cars will be on display all Saturday afternoon, culminating with a BBQ provided by the Red River College. Then on Sunday morning the third leg will start in front of the legislative building in downtown Winnipeg.

I love these cool Canadian nights. So nice not to sleep with the air conditioner on!

Day 7: Red River College 2

You just knew as soon as we got to Canada a hockey game would break out. Saturday afternoon at Red River College, after all the teams had arrived at the campus, the Calgary team started playing street hockey in the parking lot. Soon other teams joined in, so they just had to start a tournament. Someone made a trophy out of duct tape that looked just like the Stanley Cup. They called it the "Stanley Duct". The competition was intense - but all in good fun. By late afternoon it was down to two teams, Minnesota versus North Dakota State University. The playoff was exciting, with Minnesota winning 4-3. I must add that the NDSU team members played gallantly even though they were out numbered 15 to 4!

The Manitoba Minister of Transportation and Government Services Ron Lemieux surprised everyone earlier in the day when he showed up for a visit. He gathered all the teams together and gave each a special Manitoba license plate with "NASC 05" printed on them. That was a nice gesture greatly appreciated by the teams. The license plate will be a valued memento of their time spent in Winnipeg.

Another "race within the rayce" is the competition for the best in the "Stock" class. There are two classes of vehicles, Open and Stock. The Open class is for cars with space cells on them that are a factor of ten more expensive than commercial cells. The Stock class is for teams who choose not to purchase the space cells and power their cars with commercial cells. The difference is 20+% efficient solar cells versus 14-17% efficient solar cells. With eight square meters on a car, the difference is 1,100 watts of total array power versus 1,500 watts. This class places more emphasis on vehicle design, efficiency and strategy. CalSol currently leads this category, with Stanford, Auburn and Iowa State not far behind.

CalSol is currently winning the Stock class, which is commendable for this student run team from Berkeley. They are extremely focused and one of the most well trained teams in the race. Each team member knows exactly what to do and does his or her job without direction. They are amazing to watch in a checkpoint or when they have a flat. The entire team fans out and starts working in unison to accomplish what is necessary. Before they are done someone with a checklist calls out each item to insure nothing is forgotten. A whistle blows which means "it's a go" and they all run back into the chase van and they are racing again!

Since I brought up the subject of solar cells, I'd like to explain in a little more detail.

The key requirement for any winning car race is power. The more horsepower under the hood, the faster the car will go. In a solar powered car, the most critical component is on top of the hood - the solar cells. Photovoltaic solar cells convert sunlight directly into electricity. The more efficient the solar cells are at converting the sun's radiant energy into electricity, the faster the solar car will go. So teams purchase the best cells they can find.

Because the earth is 93 million miles from the sun's nuclear fusion reaction, the strength of the radiation is relatively weak (thank goodness). The energy density of sunlight at the earth's surface is about 1,000 watts per square meter. The dimensions of a solar car are two meters by four meters, which means their surface area is eight square meters. Therefore, the amount of energy that strikes the surface of the car is 8,000 watts, or eight kilowatts. Solar cells that are 20 percent efficient will convert the sunlight into 1,600 watts of electricity, or 1.6 kilowatts of power. One horsepower equals 744 watts; so the amount of power these solar racecars have to work with is about two horsepower. To me that is the most amazing aspect of a solar powered car, the fact that they can travel cross-country at highway speeds with just two horsepower of electricity generated from sunlight!

I caught up with Queens this morning and they told me they had to trailer in Friday night because the car hit a pothole, which damaged their steering and suspension. They worked all day here at the college and claim they are ready to rayce again tomorrow morning. McMaster also had to trailer in because they have been having electrical problems with their array and batteries.

Kansas State arrived this afternoon under their own power, as well as Red River College. Both teams were glad to finally get some rest, especially the students who attend Red River College. Because they live in town, most of the team members went

home to get some sleep! The last team still out there is Illinois State. Word has it they were held up around the border and were expected to arrive later tonight.

Day 8 - Crossing Canada

What a difference a day of rest makes. Sunday, July 24th, was the fastest, most exciting day of raycing I have ever witnessed. The day of rest gave everyone a chance to tune their cars so the whole field was running at peak performance. One after another they left downtown Winnipeg headed for the open road. As soon as they were on the highway every car accelerated to 100 kph (62 mph) and just held it to Brandon, the first checkpoint, about 200 kilometers away.

The top five leaders arrived on each other's bumpers. Michigan arrived at 11:31 a.m., with Minnesota three minutes behind them. MIT arrived two minutes behind Minnesota at 11:36 a.m., and Waterloo arrived five minutes behind MIT. Finally, Rolla arrived six minutes behind Waterloo even though Rolla stopped for 15 minutes to fix an electrical short!

And if you think that group was close, you should have been in Brandon to see the 7th - 12th cars come in. The largest spread was three minutes! There were seven cars in the checkpoint at once, probably a record. Principia arrived at 12:12 p.m., the sixth to arrive. But starting at 12:31 p.m., Stanford, WMU, Columbia, Calgary, Iowa State and CalSol arrived in that order — all within ten minutes. It was awesome!

What a difference a border makes. The size and enthusiasm of the Canadian crowds has been overwhelming. People were out on the highway along the route with signs and cameras hoping to get a glimpse of the solar cars as the rayced by. And we had the largest crowd so far at the Brandon checkpoint. Those who arrived to see the cars were interested people who asked a lot of questions. The teams were energized as they worked on their cars with so many crowded around. The warm hospitality we have experienced everywhere also continued as the Brandon community donated lunches to the teams and had the local radio station broadcasting from the checkpoint. When the second group came in, the crowd had grown to twice the size!

Today was a day that tested aerodynamics. There was a strong head wind blowing across the prairie. All of us saw our gas mileage go down. I have been getting over 45 mpg in the Toyota hybrid Prius I have been driving — up until today. My mileage dropped to 37 mpg today because of the wind. MIT said they saw a 50% decrease in their van's mileage versus about a 20% drop in my car. The difference is aerodynamic drag. The van is a box that butts the air. A sedan has a smoother profile that slips through the air more efficiently.

The university and college teams have spent the last two years designing their cars to have the least amount of drag. That is why so many look like airplane wings. Well, these designs were put to test today. With a strong head wind, the cars with the least aerodynamic drag used the least amount of energy as they tried to maintain a constant speed of 100 kph.

Michigan gained 19 minutes on Minnesota by the time they reached the Regina College checkpoint late Sunday afternoon. I would say the University of Michigan students did their homework well the past two semesters.

Waterloo has a clever design. They are experimenting with moveable air foils, or flaps, on their fairings to try to take advantage of the wind, much like the sail of a boat. If it is blowing in the right direction the wind can help them save energy. They may be right because they stayed even with Minnesota and MIT all afternoon.

The arrival times at the Regina College checkpoint this afternoon were: Michigan 4:07 p.m.; Minnesota 4:27 p.m.; MIT 4:32 p.m.; and Waterloo 4:40 p.m. Rolla came in soon after them, but I didn't catch the time. Stanford arrived at 6:30 p.m., and I heard Principia stopped for the night a few kilometers away because they took a wrong turn….

After all this the rayce is still too close to call. I can't wait until tomorrow.

Day 9 - Leaders reach Medicine Hat

That was fast. Winnipeg, Manitoba to Medicine Hat, Alberta. 653 miles (1,045 kilometers) in 11 hours 45 minutes. Average speed: 55 mph (90 kph). Who? Essentially the top five teams. How? A little sunlight. Reaction by the students as they congratulated each other this morning when they arrived at the Alberta College campus: sweeeet!

Yesterday depended on good aerodynamics because of the strong head wind. The key today was to have a light weight car because we started climbing in altitude as we approached the Canadian Rockies. Heavier cars need more energy to go uphill. Light weight cars need less.

Rolla has one of the lightest cars, if not the lightest, in the rayce. Michigan also has a very light car. I don't have the numbers on me, but I will try to get them. Both of these cars gained on the car in front of them today. Rolla was behind Waterloo last night, but arrived first to Medicine Hat. Michigan was behind Minnesota in the standings last night but squeaked ahead to take the lead for the first time since way back on the second day. Michigan and Minnesota are extremely equally matched, so just a few pounds can make a difference of a few minutes.

That goes for all five of the top teams — they are all equally matched. And they are all faster than the winning car in the 2003 rayce from Chicago to L.A. along Route 66. Yes, even the fifth place car in this year's rayce would have won the last one we held.

The first place smile was not on the Minnesota team members this afternoon as it has been for the past several days. Understandable. They have some serious work to do to retake the lead from Michigan. With 188 miles (291 kilometers) to the finish line in Calgary, there is plenty of opportunity to make up the 11 minutes they are currently behind. Minnesota clearly has one of the best cars in the rayce, so Wednesday's final leg will come down to determination, focus, strategy and team work. This team has already proven they have what it takes; they just need to prove it one last time.

The "rayce within the rayce" for the stock class tightened up today. In Winnipeg at the start of this third leg, CalSol was leading the top four teams in the stock class by about an hour. Stanford was second. Auburn and Iowa State were about an hour behind Stanford. The standings as of tonight have CalSol still in the lead but with Stanford just six minutes behind! That is closer than Michigan and Minnesota.

Iowa State fell three hours behind. I'm not sure what happened to the Auburn team, they are still out on the route. I will try to catch up with them tomorrow.

Everyone already here will have a day to rest tomorrow to get ready for the final leg to Calgary on Wednesday. Those yet to arrive should be here in the morning, and then they can rest and get ready too. The end is in sight

Day 10 – Teams Prepare for Final Leg

Mixed emotions ran through the teams as each prepared for the final rayce day. The culmination of two years of hard work and 11 days of hard raycing is near. "Bittersweet" is how one team member described it. The NASC has been so rewarding and exciting that no one wants it to end.

The campus of the Medicine Hat College provided the perfect place to display the cars and make those final preparations. (My apologies for inadvertently calling it the Alberta College yesterday.) There was a constant flow of people all day Tuesday coming to see the cars and talk to the teams. It helps to have the raycers on the front page, and on page two, and on the entire back page of the newspaper here in Medicine Hat. The newspaper did a great job of writing about the NASC and capturing the drama of the rayce. The whole town will be watching the start tomorrow morning at 8:00 a.m. mountain time.

Yes, please note the start time has been moved up one hour, from 9:00 a.m. to 8:00 a.m., so all the teams can cross the finish line in Calgary by mid-afternoon. The leaders should cross the finish line around 11:00 a.m.

You couldn't see it, but there was a lot of strategic planning going on. Those in charge of strategy were studying weather maps or calculating energy requirements. Others were out scouting the entire route into Calgary. Teams such as Michigan and Minnesota need to know the route perfectly so they don't loose any time. The few minutes separating first and second place is so close that one wrong turn or catching one stop light too many could change the outcome.

Stanford and CalSol were busy doing the same because they are in an equally close race for the best in Stock Class – separated by 12 minutes. Stanford spent most of the day repairing the rear portion of the car's solar cells. Out on the route Monday their chase van hit the solar car! They were coming up to an intersection when the light turned yellow. The team called over the radio to go through it, but the solar car driver decided to stop. That miscommunication resulted in a minor bump, which damaged about 25 of the cells along the tail end of the car. The team said they would have waited to fix it later, but with just a 12-minute lead they wanted every watt of power the car could generate.

On Tuesday I talked about the weights of the solar cars. Back in Austin before the start rayce officials weighed each solar car. I was able to look up the data this morning and I was right, the University of Missouri – Rolla has the lightest car. 246 kilograms (542 pounds). Missouri – Columbia's car weighs 262 kilograms (578 pounds), and Minnesota has the third lightest car at 264 kilograms (582 pounds). Michigan, which I assumed had a lighter car than Minnesota, weighs 292 kilograms (643 pounds) and is 61 pounds heavier. Michigan's car is also 40 pounds heavier than MIT's and eight pounds heavier than Waterloo's, yet Michigan leads all of them. Interesting. Although

weight is an important factor in energy consumption, this data indicates that it is not the dominant factor to successful performance.

The finish line Wednesday at the University of Calgary will be an exciting place. Besides an expected huge crowd, the finish line is located at the Olympic oval where the 1988 winter Olympics were held. The University of Calgary and the city officials are planning a huge celebration, which includes lighting the Olympic flame in honor of the teams!

The closest rayce in history, a huge crowd, a symbolic setting; one can't ask for more.

Day 11: The Finish – Everyone Wins, but Michigan's First!

The greatest solar car rayce in history came to a dramatic photo finish today at the University of Calgary. Michigan and Minnesota were separated by a mere twelve minutes after 10 days and 2,500 miles of racing. They left Medicine Hat College this morning on each other's bumpers and they stayed that way all morning. For a while they were next to each other running side by side, neither wanting to give an inch. After what seemed an eternity, Minnesota gave way and pulled in behind Michigan. But the drama wasn't over. Further down the road the Michigan car lost a fairing and they had to stop to pick it up. But they managed to stay in the lead and cross the finish line just 11 minutes ahead of Minnesota to take the checkered flag!

Congratulations to a gallant team that fought back and made up over half an hour the last few days of the rayce. They never gave up and their car was virtually flawless. Go Blue!

The University of Minnesota team came in second – something to be very proud of. They were in the lead for most of the rayce and finished second by the slightest of margins. Their solar car is very fast and deserves credit for an outstanding performance.

Massachusetts Institute of Technology came in third and proved why they nearly won the last World Solar Challenge in Australia. MIT built a very fast and reliable rayce car. They persistently chased the two leaders.

Stanford won the Stock Class by 25 minutes over CalSol. Talk about coming from behind. Stanford was over three hours behind everyone at the end of the first day! They never gave up and slowly but surely made up time. Yesterday they passed CalSol to take a ten minute lead into Medicine Hat despite hitting the solar car with their chase van. Congratulations Stanford University!

What a finish line celebration! A huge crowd, estimated to be 14,000, turned out to cheer the raycers on. And there were hundreds more watching from the road side all along the route coming into Calgary. Street corners were full of people with cameras taking pictures and cheering the teams. The Olympic Oval was lined with people three and four deep. And it seemed every news station in Canada had a camera crew there to capture the celebration. Unequivocally the best finish in the event's history. We extend a special thanks to the City of Calgary and the University of Calgary for such a wonderful finish.

Tomorrow is an awards banquet for the teams at noon. Trophies will be handed out to some very deserving teams. Other awards include teamwork, sportsmanship, innovation, and best rookie team. But the biggest reward is how each participant feels this very moment. The sense of accomplishment is exhilarating. Congratulations to ALL the teams – you are all winners.

I have asked the teams to write down what this rayce has meant to them, in there own words. Tomorrow I will let them "report from the road" instead of me for a change. So be sure to check in one last time.

As adults we always worry about the future. Will today's youth rise to the occasion and be capable of carrying the torch? Well, rest easy. With this group of aspiring leaders our future is in good hands.

Being out here has been a fountain of youth to me. These young men and women are an inspiration. I count my blessings every day, but today I am counting them ten times ten.

2005 North American Solar Challenge

Final Results

Rank	Organization	Car#	Class	Rayce Elapsed Time	Rayce Total Distance
1	University of Michigan	2	Open	53:59:43	2494.90
2	University of Minnesota	35	Open	54:11:35	2494.90
3	Massachusetts Institute of Technology	6	Open	56:34:43	2494.90
4	University of Missouri - Rolla	42	Open	57:20:11	2494.90
5	University of Waterloo	24	Open	57:44:59	2494.90
6	Western Michigan University	786	Open	63:04:47	2494.90
7	Principia College	32	Open	65:26:00	2494.90
8	University of Missouri - Columbia	43	Open	66:09:07	2494.90
9	Stanford University	16	Stock	68:00:04	2494.90
10	CalSol	254	Stock	68:25:17	2494.90
11	Iowa State University	9	Stock	71:30:50	2494.90
12	Auburn University	7	Stock	73:15:36	2494.90
13	University of Calgary	65	Open	73:55:13	2494.90
14	Kansas State University	28	Open	87:33:24	2494.90
15	Queen's University	100	Open	112:22:59	1727.35
16	Red River College	95	Stock	116:52:33	1570.40
17	McMaster University	116	Stock	134:23:50	798.85
18	Illinois State University	88	Stock	138:02:54	662.75
	Northwestern University	11	Stock	Withdrawn	--
	Southern Illinois University - Edwardsville	57	Stock	Disqualified	--

Thanks to all that have made this remarkable educational program a success.