Suzuka Dream Cup 2003

AURORA IN JAPAN, 2003 - TECHNICAL REPORT

The Aurora Vehicle Association Inc. was invited to be an entrant in the 2003 Suzuka 'Dream Cup' which took place on 26,27 July 2003. We thank the organisers of the event, the body of officials and the famous newspaper in Japan Yomiuri Shimbun for assisting the Aurora 101 entry to be part of the event.

Michiko Sato our organiser from Yomiuri Shimbun and interpreter Harry Imada.

The Aurora team has been a competitor at Suzuka on 3 occasions. We were the best foreign entry and took 8th place with 61 laps in the inaugural Suzuka 'Dream Cup' in 1992. We were an entrant in 2002 finishing 6th in the first 4 hour heat covering 42 laps. Unfortunately due to electrical and battery problems the Aurora RMIT 101 solar car was unable to take place in the second 4 hour heat and as a result finished in 25th place on aggregate of the two heats. Another Australian entrant in 2002, Lake Tuggeranong College, finished in 13th position with a total of 60 laps.

The organisers of the Suzuka 'Dream Cup' have encouraged foreign teams to compete in this event. The highest foreign placing has been fifth with the Californian entry 'Afterburner' achieving this in 1995 covering 66 laps and the MIT car 'Manta GT' doing the same in 1998 covering 70 laps.

The highest number of laps covered in the Suzuka 'Dream Cup' has been 96. This was accomplished in 1992 by the team from Honda R&D when the race was run over 3 heats allowing more time for solar recharge of the batteries. Since the race has been structured over 2 four hour heats it has been the Osaka based team TIGA, from Ashiya University that has the most laps. This was 90 laps recorded in winning the 2002 race. TIGA planned significant improvement to their solar power and adoption of a wheelmotor for 2003 to aim at covering an unbelievable 100 laps.

There has been a fierce rivalry between TIGA and the Osaka University entry OSU Model S for supremacy in this

event. TIGA has won three of the past six events whilst OSU has won the other three. Strong Japanese teams such as Tamagawa, KIT, Sunlake and Tokai have not succeeded in breaking this rivalry.

OSU and the top guns preparing for the race.

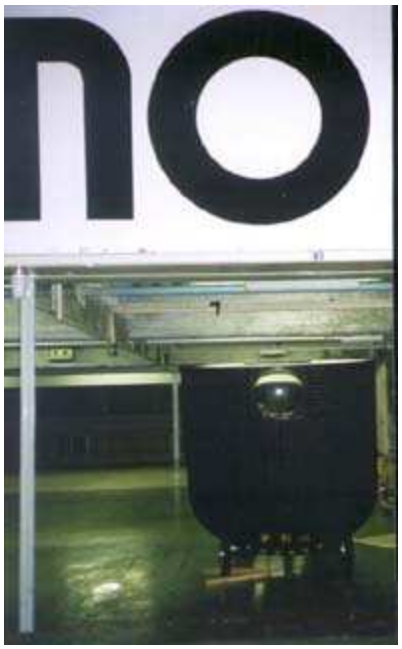
In the 2003 event the big news was the entry of a brand new OSU solar car. It was beautifully built, lightweight, and powerful. It was configured with four wheels to generate greater cornering power on the curves of Suzuka. This was the favourite for the race. The TIGA entry had not succeeded in completing a new solar panel but had cleverly arranged to borrow 10 solar panels from Aurora to supplement their solar power.

AURORA 101 ENTRY UNOFFICIAL

The Aurora Vehicle Association in considering the possibility of entering the 2003 Suzuka 'Dream Cup' noted that the rules of the event concerning the method by which the solar panel area was to be measured differed from both the World Solar Challenge and the American Solar Challenge, the world's two major solar car cross continent solar car events.

Both the WSC and ASC require that solar panel size does not exceed 8 square metres of area. When they measure the panel area they take width x breadth less the area of the driver's escape hatch. The Aurora 101 solar car is built to comply with this and has an actual solar panel area of 7.85 square metres.

The Suzuka 'Dream Cup' defines solar panel as length x breadth alone not allowing for the fact the escape hatch has no solar cells. On this basis the 'official' size of the Aurora 101 solar panel is closer to 8.3 square metres thus exceeding the stipulated 8 square metre maximum. Aurora brought this up for consideration by the officials long before accepting the invitation seeking that the rule be brought in line with WSC and ASC. The officials ruled that Aurora did not meet the rule and would be invited to compete as an unofficial entry. This was acceptable to the sponsor assisting Aurora, Yomiuri Shimbun and acceptable to Aurora.



Early pit visitors Thursday 24 July.

In contrast most of the competitive Japanese entries are built to a newer class called ISF 5000. In this class the overall size of the car is stipulated at a maximum of 5.0 metres x 1.8 metres with the size of the solar panel being free within this area. Actual size of solar panel typically reaches 8.2-8.3 square metres. The unofficial Aurora 101 had a disadvantage of up to 0.4 square metres in solar panel area versus the leading Japanese entries.

An interesting thing happened. One of the Japanese teams circulated a petition amongst most of the entrants in the main race to say that Aurora should be allowed to be an official entry. Some 22 of the 28 team managers with cars in the major race signed in agreement. The matter was not pursued.

THE AURORA TEAM AND ARRIVAL AT SUZUKA

Eight people formed the Aurora team for this event being; Peter Pudney, Brad Trewin, Paul Jolly, Kon Kotsonis, Tom Baker had never visited Japan whilst Jack McArthur, Damien McArthur and David Fewchuk were part of the 2002 team.

The container holding the solar car, the tools and pit equipment had left Australia on 27 June and was already awaiting Customs clearance and unpacking at the Suzuka track. Kiyoshi Yoshioka, who befriended Aurora in 2002 had made excellent shipping arrangements and we were ready to unpack at 1.30 PM on 22 July ticking off the precise contents list in our CARNET document for the Customs officials.

Customs clearance with the help of Kiyoshi Yoshioka from Nippon Express.

The track officials who manage a great variety of activities at Suzuka promised that we could have a 1 hour practice session on part of the track on 23 July if our car was ready to run. That required us to set up the pit and do a number of last minute adjustments that day, suffering from travel weariness and facing an instant adjustment to Japan. Michiko Sato from the Yomiuri Shimbun was on hand when we checked into our hotel and we became re-acquainted with Harry Imada, our assigned interpreter. Michiko had attended to all details and we had a smooth transition from landing at Nagoya airport to working on the solar car at Pit 1 at the Suzuka Formula 1 track.

An early priority was to visit the supermarket and stock up on casual food. The fruit is expensive, only bananas being in our price range. Drinks feature many large bottles of tea, coffee, fruit juices and pop. Milk is a tricky selection; how do you know what is plain stuff. The Japanese are extremely helpful and delight in helping us foreigners. So following the search through the fish, the pickle samples, the preparations of sushi and the tempting fresh buns we all came away with something good.

Another shopping expedition. Harry, Tom, Kon, Brad and Damien.

The weather was doubtful. Usually by this time of the year clear weather is expected in the Suzuka area although with lots of coastal influence. It was grey, cloudy and cool. We needed sleep and had an early start planned for track testing. Our two inexperienced drivers went to lessons to qualify themselves for a track licence issued by JAF and passed the required tests OK.

On Wednesday morning, no sun . We got to the track and it was already raining lightly. We could not forgo this chance to see the track so Kon Kotsonis was strapped in to have his first 'non-playstation' look at Suzuka. We were on the lower half circuit containing the main straight the sweeping bottom right hand corner and the worst climb. Kon negotiated all this very cautiously, the rain got heavier and finally after about 7 circuits we stopped. Just in time.

Kon had reported some water dripping on him from the hatch but that was nothing compared to the water that had entered the car from the wheel wells. It was sloshing about 3 centimetres deep around the crucial electric tray. It was sloshing around the batteries. We were lucky to stop in time before major electrical problems occurred.

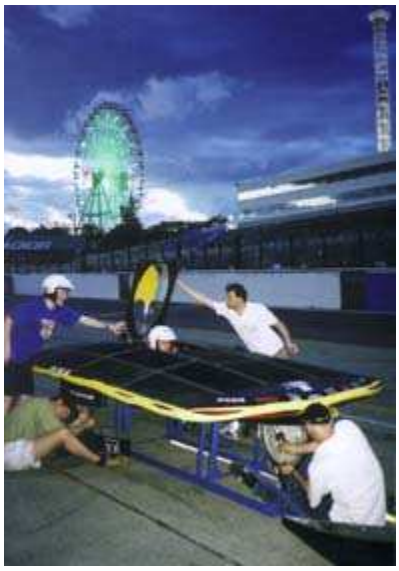
No solar power but a wet practice session for Kon Kotsonis on 22 July.

This required a drying session. The track officials produced a dozen towels which got the job done. Brad found two electrical problems which were fixed and we all put forward ideas as to why so much water had entered. Finally we concluded that some came from the join of top to bottom where we had left it un-taped and some from a mis-fitted wheel-cover at the rear. The front wheel-house also leaked its fair share. The solar panel and hatch seal had held up very well.

The rest of the day was wet. We had plenty of vehicle checks to do and we spent the rest of the day hard at work.

In the evening we cruised in our supplied rental van for a place to eat. Western style preferably. These restaurants were not going to get rich off this group. We all tried hard to keep below 1500yen (about $A20) but the beer costs were a threat to the budget. We would order by pointing to the pictures in menu or by taking the waitress outside to point to the food model in the window. Mostly we were not sure what we were eating unless it came from the do-nut shop.

Thursday 24 July saw Damien take his first drive session again on the lower half track. At least it was dry and in the short time we had we could measure the improving times as Damien became more familiar with the track. We practiced pit stops, wheel changes and modified the mount for our instrument cluster so it could assist our change times. Our team likes making and modifying parts but the realisation that on the following day we began the serious stuff was coming upon us. The transport trucks for other teams were beginning to arrive. They parked behind the pits and drivers took their sleep with the diesel motors running to produce air conditioned comfort. The Tamagawa team unloaded their well equipped truck and started to assemble their car. They were sworn to secrecy concerning their battery technology, this being one of the most important components for this Suzuka ' Dream Cup'. The tone at the track was lifting in anticipation as the pits started to fill. We finished the day in darkness still practicing wheel changes with the Suzuka ferris wheel reminding us that this could be a bit of fun.



Practicing pit stops on 24 July.

Drivers or magicians, Kon and Damien.

FRIDAY 25 JULY; SCRUTINEERING

We had an extra hour of sleep on this morning planning to arrive at the Suzuka track at 8.00 AM.
The pits had changed. They were all full of the 75 or more solar car teams that planned to race. Two thirds of these were in the junior class where the sense of solar car joy was very evident. Actually this group are officially called the 'Enjoy' class. Appropriate. They have names like Lake Wind, Fizzer, Sky High, Big Wave and so on. The shapes are extreme, the colours vibrant and the teams expectant.

The main event is for solar cars in the 'Dream' and 'Challenge' classes. There were 28 entries. The star attraction was definitely the new OSU car. TIGA looked odd with a glossy finish over the leading front half of their car with the non-reflective Aurora panels on the rear. This dull finish is created by a microscopic embossing of the surface designed so that the sun's rays late in the day would not just reflect off the surface but would be angled on to the solar cells. This is a wonderful development from Hans Gochermann in Germany who produced these panels.

Our friend and solar car expert Dr. Hideki Kimura from Tokai University.

We pushed the Aurora 101 solar car into the line of cars waiting for scrutineering to begin. Another line was for weighing of drivers; the minimum weight being 70 kg. We had both drivers gulping as much water as they could to ensure they weighed in heavy. If they could not reach the minimum weight then the minimum ballast would be added. Damien was over 70 kg but could not wait long enough to get his wrist-band before rushing to the mens'. Kon needed 2 kg of ballast.

There are many items checked in scrutineering and the officials in this phase do their utmost to get all cars certified to race. The scrutineering of all cars was completed by mid afternoon, a mighty effort and a compliment to the efficiency and knowledge of the officials.

Being in Pit 1, closest to the scrutineering area we had a chance to have a close look at all the teams and their cars. Many teams also took a close look at Aurora 101 noting its unique triangular chassis, its single front wheel drive and its powerful solar array. No other car was anything like it. The single front drive wheel causes a lot of discussion as observers initially think it to be an unstable arrangement. But after refining this layout since 1993, the Aurora team know it to be both stable and safe.

We passed all aspects of scrutineering and began our final race preparations. It was hard to believe that tomorrow was race day when all modifications had to stop, when it was going to be up to the drivers to manage the car alone, when what we built in the Clayton workshop over so many thousands of hours would be put to the test against Japan's best, on their toughest international race-track.

But just so we wouldn't become too serious we had to attend the track-side party for all entrants. Enjoy was again an appropriate word. An attractive announcer pushed the party along. We were organised into teams to see who could build the tallest tower of free-standing drink cans. Jack McArthur thought laterally and won. We ate, met other teams and became part of the biggest solar car event in existence. Enjoy!

SATURDAY 26 JULY; ITS ON

We still wished for more time to fiddle but this event is at high speed from early morning. A crucially short free practice session of only 25 minutes started exactly at 7.55 AM. Kon Kotsonis was cautious and saw the majority of the track for the first time. He managed just 4 laps with his best time at 6m 11 sec. Already the drivers familiar with the layout were below 4m 30 sec. This was a bit of a shock.

Qualifying practice was for 50 minutes commencing at 9.15 AM. This time it was Damien's turn to see the full circuit for the first time and with the longer period and more laps his times improved rapidly finally recording 4m 49.39 secs., not as fast as Adrian Marziano in 2002 who did 4m 37.08 sec but good enough for 11th grid position.

The sizzle was at the head of the field. We were joking when we predicted that a 4 minute lap could be achieved.

K Nomura in the red TIGA car did a fabulous 4m 02.72 sec lap to be on pole position. Second position was only 2 seconds behind. This was going to be a fast race and the serious teams were wondering how the cars and the tyres could hold up at these speeds.

HEAT 1, 1.00 AM SATURDAY 26 JULY, 4 HOURS

It's exciting rolling the solar car on to the starting grid. The whole team goes out slowly gliding past the eager ones already in place. Escorting the team from Australia, from the city of Melbourne in its black red and yellow colours to the marked grid position. Number 11. Ahead of us the car called Forest Walker, beside us the slimmest car in the race, Enax. Mr Takasaki lies prone in his Enax car because it is so slim. He admits that his co driver Mrs Takasaki is the faster driver but she will get her turn at the mandatory driver change midway through the 4 hour period.

At the head of our column of the grid slink TIGA and just behind, their arch rivals OSU. It is bright and not so hot. Great solar power weather . At five minutes before race start everyone cleared the grid leaving the drivers alone, buckled in, sweating in their overalls gloves and helmets, waiting for the green flag.

Damien McArthur on the grid for heat 1, 26 July.

Solar car 'head bubble' --- Really!

There is no roar, no wheel-spin, no nervous dash for position. Just 28 weirdly shaped solar cars silently gathering speed, their drivers knowing that the race is won by energy conservation.

Damien is off to a slow start and drops down five positions. The occasion is big. Sixteen years of age, without a valid Australian driver's licence and departing from the same starting line that will see a Formula 1 field in several months time. Nothing like this in Hamilton.

But the position improves and Damien gets the measure of the track. The solar power of the Aurora 101 car is evident and soon Damien is passing car after car. By lap 4 he betters his qualifying time and is about to climb into third place. Now its becoming fun and the rest of the Aurora crew beam with pride as they scan the TV monitors in the pits. Radio contact is possible only over one third of the track, as is direct telemetry but that is enough. The car is running well, the energy allocation is not being fully expended and Damien is feeling OK.

Until lap 5. At corner 8, a right angle right hand bend leading up an uphill straight to the hairpin Damien loses control. The Aurora101 spins through 180 degrees, the rear wheels jar on the ripple strips at the side of the track and Damien can stare directly at several oncoming cars. He quickly rejoins the race but has done some chassis damage in the abrupt change in speed caused by the spin. By lap 9 the car is difficult to steer, the rear tyres are rubbing on the wheel spats and its time to return to the pits.

It is evident that the chassis is moving from side to side and the reason is also evident. The Panhard rod bracket has broken. Jack McArthur, Paul Jolly and others jump into making a new bracket and securing it in place. Twenty six minutes later Damien is back in the race having slumped to 19th position. The car is still fast and lap times settle in the 4m 50 sec range. Bit by bit Aurora 101 earns back position after position.

All hands fixing the chassis damage during heat 1, 26 July.

On lap 25 its Kon Kotsonis' turn to master the Suzuka track. By his tenth lap he is below 5 minutes, the telemetry showing how smoothly he is driving. The temperatures in the motor controller, the batteries and the power trackers all ease back. On lap 42 Kon does 4 m 40.61 sec, the fastest Aurora lap in Heat 1. We have made it back to seventh position, covered 43 laps and shown the speed potential which we believed we had. The leaders are 6 laps ahead and are spelt TIGA.

Kon Kotsonis after a great drive in heat 1.

Heat 1 Results are as follows:

1.	TIGA	49 laps	4h 07 m 04.71 sec	average speed 69.1 km/h
2.	OSU	48 laps	4h 02 m 37.88 sec	
3.	KIT	48 laps	4h 06 m 17.17 sec	
4.	SUNLAKE	46 laps	4h 04 m 57.59 sec	
5.	Tamagawa	45 laps	4h 06m 33.01 sec	
6.	FALCON	44 laps	4h 01m 38.00 sec	
7.	AURORA 101	43 laps	4h 03m 02.55 sec	

Fastest lap: TIGA 4m 31.59 sec

Fastest Aurora lap: 4m 40.61 sec

That evening there is a special fireworks display. We are at the pits until midnight. We bring in pizza for dinner. This was a costly mistake. Pizza in Japan is 5 times the price in Australia even from a home delivery hole in the wall facility.

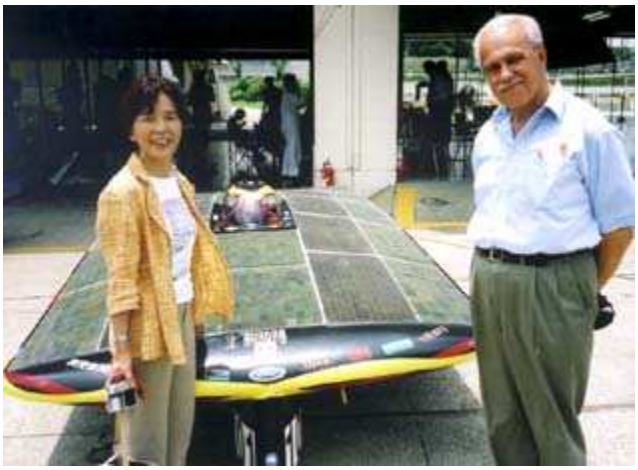
We worked to make a more elegant and permanent repair to the chassis and also added more cooling to the motor controller and the two power trackers controlling the new solar panels. New tyres and other checks of the car are done and we head to the Sunroute hotel. Our battery pack had been impounded at the end of Heat 1 and after the short and weak charging session before sunset.

SUNDAY, 27 July

The second 4 hour heat would take place in the afternoon. The morning saw the Enjoy class have their 4 hour race. Their top qualifier Kihoku Solar had recorded a qualifying speed of 8m 38.62 sec, faster than Aurora 101.

At 10.00 AM our first real race for the day took place. This was the time that the battery packs were released. A big rush called the battery race took place as the batteries were joined to their respective solar cars and the precious 2 hour charging session could begin. Harry our interpreter had borrowed a trolley for us so we could be part of the battery race.

The charging session is crucial to the success of the second race heat. The sky was not so clear, the humidity had increased and we wondered if the charge would be sufficient. Our solar array contained 10 new panels with high efficiency triple junction galium arsenide solar cells from Emcore. They were powerful and during the session we witnessed over 1900 watts from the solar array and pretty good performance in cloudy conditions. Members of other teams were pretty surprised as they saw our telemetry readings for solar panel performance. Galium arsenide panels of this power have not yet made their way on to Japanese solar cars. By time the session ended and including the time on the grid formation we nearly filled the batteries.



Unofficial team member Ronnie Okuda from Tokyo with Chief Steward Dennis Negkas.

The procedure onto the grid was the same as the day before and the excitement quite as high.
We were closer to the front this time in 7th position. TIGA was the last team onto the grid and we took the opportunity to photograph the Aurora101 and TIGA teams together. Melbourne and Osaka, sister cities for 25 years were pitting their best solar cars against each other.

Osaka and Melbourne, sister city solar cars TIGA and Aurora101 line up for heat 2.

Aurora 101 and team on the grid for heat 2, 27 July.

Kon was driving the first half of Heat 2 and was feeling the heat as we left him on the 5 minute warning signal. After a slow start Kon got going. Smooth but fast. On lap 3 he recorded his fastest, 4m 35.24 sec. In the pits we were amazed. On the driver change at lap 31 Kon had averaged 4m 51 sec per lap over his 30 lap assignment.

Damien had been mentally warming up for his turn. The temperatures went up noticeably as he worked the car around the track. Finally on lap 46 he recorded 4m 29.67 sec, the fastest lap time of the race.

What nobody really noticed was that Aurora 101 was in the lead for Heat 2 and by the chequered flag had recorded a total of 50 laps. This is the first time in the 12 year history of the race that any solar car had covered 50 laps in a 4 hour heat.

The finishing positions for Heat 2 were as follows:

1.	AURORA 101	50 laps	4h 03 min 53.08 sec	ave speed 71.43 km/h
2.	TIGA	49 laps	4h 02 min 56.14 sec	
3.	Tamagawa	49 laps	4h 02 min 56.63 sec	
4.	KIT	49 laps	4h 03 min 00.68 sec	
5.	OSU	49 laps	4h 03 min 07.33 sec	
6.	FOREST WALKER	47 laps	4h 01 min 09.08 sec	
7.	FALCON	43 laps	4h 01 min 01.59 sec	

The overall winner was TIGA with 98 laps then OSU with 97 laps, KIT with 97 laps, Tamagawa with 94 laps and Aurora101 with 93 laps.

K Nomura TIGA's winning driver.

Top three at the presentation, OSU, TIGA and Kanazawa.

K Nomura receiving the winning trophy from Hanae Iida of Honda.

The deservedly happy TIGA team.

The famous Doraemon Solar Car built by Mr Yasui at Simon.