jmp™
Statistical Discovery.™ From SAS.

AIM Autosport's Ian Willis with Daniel Herrington in the winner's circle in Houston.

CHALLENGE

Get a competitive advantage by cutting lap time and track-testing costs for open-wheel race cars in the Star Mazda Championship Series.

SOLUTION

Using JMP to design experiments with race-car data to predict possible outcomes and optimize the way the car is set up.

RESULTS

Together, AIM Autosport and DMH Racing have shaved seconds off lap times and saved hundreds of thousands of dollars in testing.

MORE INFORMATION

www.aimautosport.com

www.danielherrington.com

www.starmazda.com

His goal is speed; his software is JMP®

Talk about driving designed experiments. That's exactly how Daniel Herrington gets his competitive advantage in open-wheel racing for the Star Mazda Championship Series.

The world's fastest-growing sport just got faster. That's because AIM Autosport and DMH Racing are now using JMP statistical discovery software from SAS to fine-tune open-wheel race cars.

The ability to visually interact with racing data has enabled engineers to understand more clearly, and even quantify, the effect of various parameters on the car's performance. That information is empowering these engineers to prepare a car for specific track conditions. The result is optimized performance, which translates to quicker lap times.

With JMP on the team, rookie driver Daniel Herrington staked his claim to fame in just a couple of months in the Star Mazda Championship Series: a first place in Houston, a second place at Sebring and Milwaukee, and, at Mid-Ohio, the fastest single lap time in the May 2006 race. At the time of this printing, Daniel Herrington leads in points—and in optimism. "You have to know that you're the fastest guy out there, that you have the best team and that you have the best equipment," says the 19-year-old driver. "We do. And we have JMP software."

A golden opportunity

The idea to use statistical software came to Dr. David Herrington, owner of DMH Racing and Daniel's father, when he was looking for a way to help his son gain a performance advantage in such a competitive field. In addition to being a racing enthusiast, Dr. Herrington is a medical doctor with about 20 years of experience using SAS software for research.

"I recognized that this was a golden opportunity to do some statistical data analysis that's not typically done in racing," says Dr. Herrington. "A lot of factors influence a race car's performance. And many of these factors are interrelated and influence one another to produce the aggregate of the lap time. However, it's not always easy to discern the magnitude of the effect of each individual parameter or how each might interact one with another."

STATISTICAL DISCOVERY.™ FROM SAS.

"Instead of acting on instincts, we can act on instincts backed up by real facts."

Ian Willis
Partner
Aim Autosport

That's where JMP comes in. Dr. Herrington starts with exploratory data analysis to get a sense of what factors will be best modeled using simple linear models—and what factors may have more complex relationships that should be explored using the response surface features of JMP.

"We attempted initially to model tire pressure as a function of lap time with a simple linear model, but we realized that it might be more appropriate to model it with a surface response model," says Dr. Herrington. "The analysis indicated that there was an optimal pressure that yielded the best lap time under certain conditions, and higher pressures or lower pressures were suboptimal. We learned that even half a pound of pressure can have a big impact on the tire performance—knowing what the right tire pressure is very important."

"We look at quadratic relationships, and we also do a fair amount of looking for plausible interactions," says Dr. Herrington. "For example, it's plausible to expect that the front wing setting and rear wing setting could influence each other. In those instances, we will routinely build an interaction term into our models to see if there is sufficient data to confirm our suspicions."

Adds Dr. Herrington, "Using JMP, we can understand the data and the relationships among different factors in an efficient and intuitive way. The graphical nature of JMP is extremely helpful because it allows us to quickly interpret the results of the models and incorporate what we've learned into how we set up the car."

Ian Willis, Formula Mazda Team Manager and partner of AIM Autosport, the team for which Daniel drives, explains that all drivers in this type of racing have the same kind of car and are limited in how they can set up the chassis. "When you're working with spec-car racing, which is so restrictive, the performance advantage comes in the details," says Willis. "So when we use JMP for design of experiments, we're able to optimize those settings beyond any other race team."

When the car was set to the optimal settings predicted by JMP, Willis says, Daniel started cutting time off laps. "Cutting a 121-second lap time to 119 seconds is huge. We go crazy looking for a tenth of a second."

Even in the preliminary laps of a race weekend, it's important for the car to

be set up as perfectly as possible, says Daniel Herrington. “On the first session out, we can be quick right away instead of having to chase our tails trying to find the right setup. The predictive nature of the software allows us to be prepared right off the bat. And when you start the weekend off up front, everyone else is trying to catch you.”

The team’s use of JMP saves money, too. “Every piece of information about the performance of the race car costs money to obtain,” says Dr. Herrington. He estimates the preparation and operation of the car costs about $60 per minute of track time. “That translates into enormous amounts of money for testing and development of the car. So it’s very important for us to be able to collect data in the most efficient way possible,” he says. “And if we can be even 20 percent more efficient, that translates to hundreds of thousands of dollars of savings.”

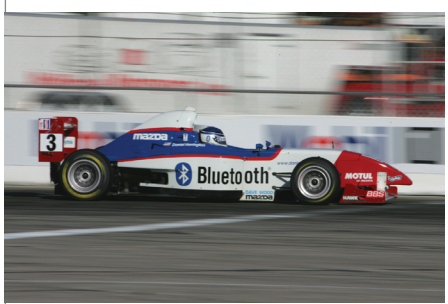
So many influential factors

As the team gets better at predicting the best setups for its open-wheel racers, it is working to incorporate as much data into the process as possible, which includes information on the tracks themselves. In Milwaukee, for example, the track is oval, which requires a completely different setup than the road courses on which the team usually races. It makes sense to consider even differences between road courses, says Willis, because the car could be configured differently for different track characteristics, such as the number and length of straightaways or the amount of low-, medium- and high-speed corners.

Even weather needs to be factored in, Dr. Herrington says. “We are collecting and making use of other co-variants outside of our control—but that still have an impact on our performance. Being able to add air and track temperature, wind direction and speed, and humidity to our models is very important. The fuel load and the number of miles that the tires have on them—these, too, are treated as co-variants in all of our models.”

In the long term, the team will continue gathering data to create a massive database that spans racing seasons and tracks across North America. “I see that data gathering is critical,” says Willis. “You know, garbage in, garbage out. People grossly underestimate how important good record-keeping is. Every little factor counts. And nobody has really maximized how to make the best use of that data.”

Of course, Willis’ more than 20 years of racing experience, gut instinct and anecdotal information will continue to be a part of the decision-making process at AIM Autosport. “This will not only verify what I think; it will quantify it,” says Willis. “Instead of acting on instincts, we can act on instincts backed up by real facts.”



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