Mercedes-AMG Petronas Motorsport Handles Constant Change

Data and insights that fuel championships

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>
> —James Vowles, Chief Strategist Mercedes-AMG Petronas Motorsport

CHALLENGE

When you're the one of the most successful Formula One™ teams in recent history—or you lead your industry or your sector—how do you ensure that you keep your edge and stay ahead, no matter what happens? If you're Mercedes-AMG Petronas Motorsport, you keep pushing, keep using your data to extract insights and build a superior understanding that leads to operational excellence and competitive advantage.

Although the mission—to maximize points yield, leading to FIA Formula One™ World Constructors' and Drivers' Championships—is different than other organizations, the analytics approach turns out to be not so different, such as businesses wanting to detect fraud, cut costs, improve performance or product quality, or create a superior customer experience.

DETAIL

NEARLY 300

sensors on an F1 car

SOLUTION

Based on data visualizations, predictive analytics and AI, Mercedes-AMG Petronas Motorsport delivers on its objectives to become continuously aware, think systematically, and leverage experience. This story describes what that process looks like from the perspective of two team members, Chief Strategist James Vowles and Head of IT Matt Harris.

"We have a number of internal data sources, and our TIBCO® System of Insight links them all to make sure we consume and visualize data in a strong way," says Vowles. "With TIBCO's help, we've developed systems to visualize data and run simulations to make sure we can see the outcome and dig down into the depth of the data. You have to get to the root cause and move forward at the fastest pace possible."

BENEFITS

BECOMING CONTINUOUSLY AWARE

To become continuously aware, the team uses thousands of data sources that inform of any change in context, allowing early identification of issues and opportunities that other teams have not yet found. A very important step is finding the right variables to measure and watch.

"Fourteen weeks in advance of a race, we've already started work," continues Vowles. "We've gathered multiple channels of car data, sometimes 10,000 data points per second. It could be something simple, like how hot the water is running through the engine, or more complex, like how warm the tires are in 32 locations across that tire.

"For competitors, we gather everything we can—engine audio, video, GPS—close to 15 sources of information from every car in the race, and we try and use it all to build a picture of how we're doing, and how they're doing."
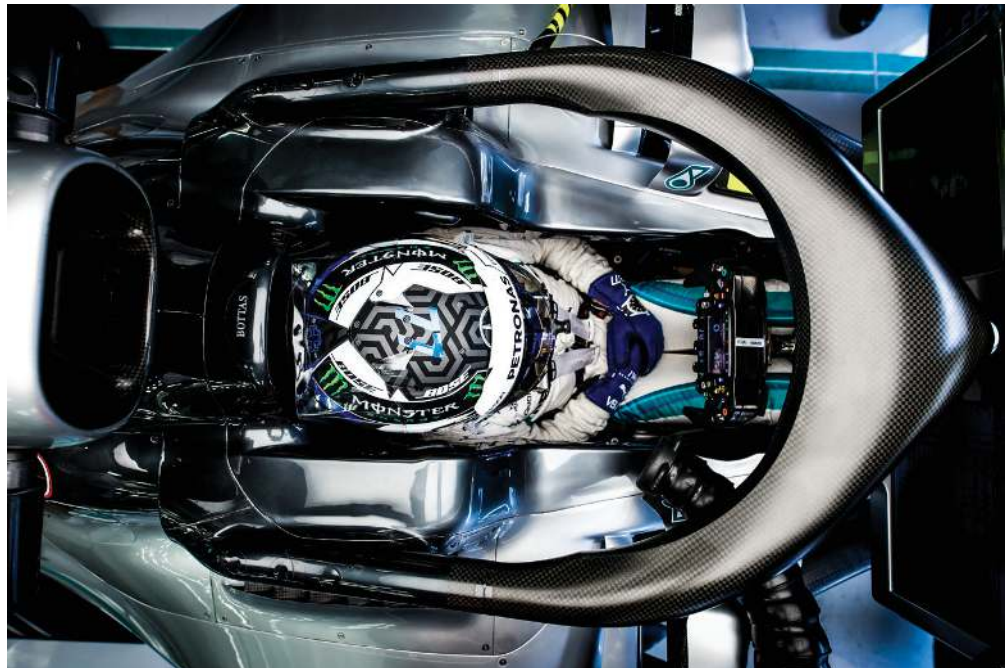
Detail and Changes In Detail

Matt Harris explains how data has been used to find and solve a problem and to improve performance: "We're always looking for the very small details. In Singapore, the driver, Valtteri Bottas, kept saying that every time he went over the bridge, he felt a cut in the engine. He said it happened in both practice sessions. This wasn't obvious to the engineers watching the live data traces, but with markers put down by the driver they were able to hone in on the specific part of the track this occurred.

DETAIL

DATA

- 21 race tracks
- 50 laps of data per race
- 1.5 hour practice sessions

They matched up the data and found a 13/1,000th of a second cut in the throttle caused by an electromagnetic field around the bridge. Bottas could feel that. So the engineers shielded the sensor preventing further interference. We're working with TIBCO on not looking at all the data, but at what's changed."

Another example of the team's detailed analysis has to do with improving gear changes. Harris says: "The driver changes gears about 100 times a lap. Every time there's a gear change, we collect around 1,000 data points. Those gear changes can be categorized into how fast they were, and how much stress they put on the gears. When you visualize that data, you can actually make the gear box last longer, or more importantly, make harsher gear changes. You can then find that if you put the gear box into one particular mode, it's roughly 50 milliseconds faster per lap. Cars can be separated by thousandths of a second in Qualifying, so 50 milliseconds matters. So for us to be able to make those harsher gear changes is important. We spent six years creating our own visualizations. TIBCO turned up, and in a matter of two months, did better work."

Digital Performance Drives Physical Performance
The team has used its TIBCO System of Insight to create over two million simulations of various race scenarios—weather changes, a safety car coming out, an accident occurring, and many others—and from those created a dataset for analysis. They use this digital performance to inform real world reality, using simulated events to provide actionable information. One example: where the driver should focus based on overtaking simulations.
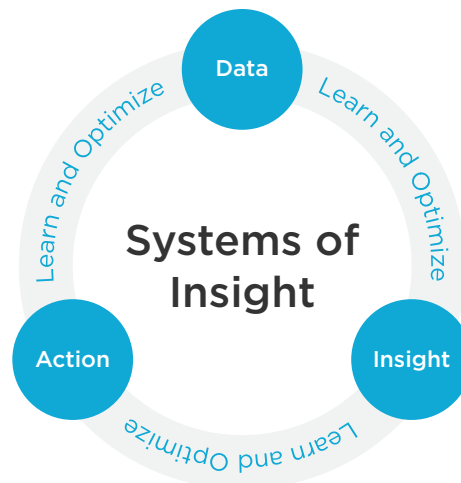
"The type of metrics used in race strategy are the inputs to the models," explains Vowles. "As an example, the driver, a human, is very unpredictable. You need to understand how good they are at overtaking, at defending, what happens in a pit stop, is the pit crew good, bad, variable? How does the car perform on a warm track, on a cold track, if there's wind, if there's not? You need models to consume all this information to try and produce the most accurate simulations and understand what could happen and how you should react at each point.

"With very small amounts of data and an unpredictable outcome, the next steps are building systems and models to improve our understanding. You need a tool like Spotfire to get to that level to extract the key information. When you do that multiple times across the season, you start to understand a lot more. That's the key."

—James Vowles

DATA CONSUMERS

ENGINEERS

26 engineers at the track, 20 at the factory—each one specializing in tires, strategy, car optimization, or driving

"The whole week prior to the race weekend is spent analyzing everything we have from historical data and races that year to make sure as we go into Friday with the drivers prepped, the team prepped, and we understand exactly what we need to do test-wise to generate the maximum amount of data that is going to provide insight. We're simulating the complex interaction of the car setup, the roads, the ambient conditions before we get into the actual weekend and to the track itself."

THINKING SYSTEMATICALLY
The team thinks systematically about the impact of the current situation or action, rather than about the situation itself. Thinking a few steps ahead helps them envision a scenario and work toward making it a reality.

The Best Data, the Best Insights
The 2018 FIA Formula One World Championship is hosted in 21 countries at different tracks around the world, so just because data from one track is useful, it doesn't mean that even one-tenth of it can be applied to the next track. As in business and life, so it is in Grand Prix racing —everything is changing: tracks, tires, weather, people, and of course, it all affects decision-making.

Vowles: "To win you need to understand what's important, and what's not. We need to make sure we're adapting to the situation. On a Formula One™ weekend, we have two 1.5 hour practice sessions on Friday when we run tests. Everything is changing—the temperature, the car, the driver. He's just trying to adapt to the track. One day out, we're looking at macro elements. How everything is globally performing, how the driver is settling in, how we are relative to competitors. We try to maximize insight and minimize variability, understand the core parameters, and if we are unsure, we run further tests on Saturday morning. We get into minute detail to reinforce our understanding. We're trying for small incremental improvements to fight for a winning position.

"There are, from each car, 50 laps worth of data and during the race there may be just five or six overtakes. You try to break down what caused the overtake to happen. There might be one or two samples that are very, very interesting. With very small amounts of data and an unpredictable outcome, the next steps are building systems and models to improve our understanding. You need a tool like TIBCO Spotfire® to get to that level to extract the key information. When you do that multiple times across the season, you start to understand a lot more. That's the key."

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LEVERAGING EXPERIENCE TO EVOLVE
Knowledge of men and machines has been accumulated and analytics has been used to identify patterns that lead to success or failure. The sooner the team can sort through these patterns, the faster they can move into innovating.

ACCURATE MODELING FEEDS DECISION-MAKING
Analytical modeling—statistical and machine learning algorithms that tease patterns and relationships from data—involves selecting the right data sets, algorithms, and variables, and using the right visualizations—all selections that are dependent on the team's experience. The visualizations then enable good communication about what the data is saying.

"By the time we get to Qualifying, we have understood everything from the data, and how we should use it in the best possible way to allow the driver to extract peak performance from the car," says Vowles. "There are a number of outcomes we're looking for. The easy one is just go out and win, but sometimes it's not that simple. You're trying to win the Championship—and to do that, you sometimes have to sacrifice elements in a race. There's a scale of risk versus reward. Every decision, every lap, every bit of data has a probability attached to it, so you can understand whether or not you should be stopping during this lap, who you're fighting, what you should be telling the driver to do.

"The speed of response for applying insight from the data is absolutely the first priority. If the car we had at the last race was the same as race number one, we wouldn't be on pole or win the race; we would be fighting for sixth or seventh position. It's an evolution game. It's a fight to see who can develop at the fastest rate possible during the course of the Championship. We have just a few hours to consume gigabytes of data and understand and dissect it to make the difference. You need the right tools and systems that allow you that insight."

DATA EMPOWERS EVERYBODY

Experience in processing data, interpreting it for the problem you're trying to solve, and bringing everyone along as you improve that process, also makes a huge and winning difference.

"When we get data, the consumers of interesting pockets of information are more than 26 engineers at the track and 20 back at the factory, each one a specialist in a number of areas—tires, strategy, car optimization, and of course, the drivers. They understand completely how that data relates to their feeling in the car. When you combine it all, it allows us to move forward," says Vowles.

After the race, the team holds a debrief to review all the data and analyze the race with an eye on how they performed, what they could have done better, and how they will incorporate those learnings to do better in the future.

FUTURE

From one season to another, Mercedes AMG Petronas Motorsport may also need to handle changes in car design imposed by the FIA, changes made by its competitors, and other variables. But as the team knows, no matter how much data is available, it won't make any difference if it's not understood and put to good use.