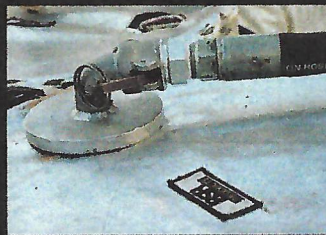
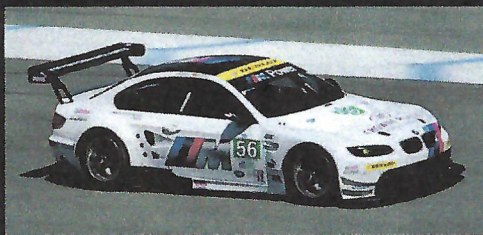


THE STRATEGIST

Winning races in the American Le Mans Series takes more than just a fast car and capable drivers. It also requires a sound pit strategy, as BMW Team RLL's Jay O'Connell explains.

By Jackie Jouret Photography by Helmut Werb



DRIVERS MAY GET MOST of the credit for race wins, but they wouldn't collect many trophies without the help of equally talented personnel working behind pit wall to make sure their cars are well set up and running on the right strategy.

Last year, BMW Team Rahal Letterman Lanigan won the GT team and manufacturer titles in the American Le Mans Series, and not just because the M3 was the fastest car in the field for 2011. The team also had the smartest strategists, who kept the BMWs going full speed all the way to the checkers while other cars were running short of fuel and dropping back.

To find out how they do it, we spoke with Team RLL's technical director, Jay O'Connell. O'Connell formulates the team's strategy for each ALMS race, then directs the action for one car from the pits while team owner Bobby Rahal directs the other.

O'Connell earned a degree in mechanical engineering from Cornell University, then joined Ford Motor Company. He eventually went to Ford Racing, where he worked with the IndyCar teams using Ford engines—one of which was Rahal's. He eventually went to work for Rahal, and today he serves Team RLL as its vice-president of technology while also overseeing strategy for the team's cars in ALMS and IndyCar racing. We caught up with O'Connell at Laguna Seca just before the M3s went on track for their ALMS qualifying session.

Bimmer: How do you begin to formulate the strategy for any given race?

Jay O'Connell: We start with the presumption of an all-green [flag] race and do the simple calculation of how many times we'd have to stop if it's green. Then we look at how many yellow [caution period, during which drivers are required to reduce speed—Ed.] laps we had the last year and the year before, etc., to try to get a feel for how much yellow we might expect, which could reduce the number of stops in a race.

You start looking at it from two different directions and then you can do some different scenario planning before the race. Depending on when the yellows fall, would you change your strategy?

With a long race, you end up keeping all that in the back of your mind, then you start into the race and if you get a yellow early on with less than half a tank of fuel, you're inclined to take it [pit to refuel] just because pitting under yellow is so much more efficient. You're losing less time—and most of the competitors will do the same.

As the race plays on, some cars may get out of sequence, some pitting under green and some under yellow. You've really got to keep an open mind about all the potential

strategies and all the results of those strategies. Then you have to start covering yourself for the end of the race: Which strategy do you need to defend against? Which has the highest probability?

All these different factors are going on in the pre-race preparation and then during the race to try and project what's going to happen.

Bimmer: How close do you cut it? In Formula One, they want to end the race with just enough fuel to make the cool-down lap, and Ferrari appeared to do the same thing on a couple of occasions in ALMS last year.

O'Connell: F1 is a little different because they're not refueling during the race any more. They can pretty much put fuel in for the whole race and they don't really have any yellows, so they just need to manage their green-flag fuel economy to make sure they hit the target.

In our situation, because of the yellows helping us, we can look at our fuel economy when it's green, and then it comes down to: If you want to cut it close, how much do you want to gamble? Obviously, when there's an hour to go before the finish, everyone's anxious to pit, because if there is a yellow they'll be at the front of the line. If you wait 'til the



yellow when people have pitted, you're going to be behind them.

The end of the race is a bit tense. You're always trying to play that game: Who can pit first and still make it?

Last year, the Ferrari guys pitted five laps sooner than any of us could make it, and we thought, "Wow, they're really gambling that they're going to get a lot of yellow." They got some yellow and they just about made it, but they were running out of fuel on the last lap and they lost a few positions. That's probably pushing it too far.

It just depends on where you are in the line, where you are in the championship, what time of year it is, how much risk you're willing to take on.

Bimmer: What are the IMSA regulations regarding refueling? Does IMSA require you to refuel during the race?

O'Connell: They limit the tank volume to 110 liters if you're using E85 [which BMW is—Ed.]. You couldn't make the whole race on one tankful, so you're forced to refuel, but you can use as much fuel as you want. They limit the height and the size of the pit tank, and they limit the size of the hose and the size of the restrictor that the fuel has to pass

through—all of that in order to make sure the fueling time is of a certain length.

There's still some work you can do to try to make that more efficient, which we do. A lot of it comes down to the design of the car, how the car accepts the fuel. Some cars take the fuel on faster than others.

Bimmer: Speaking of the car itself, can you take advantage of any EfficientDynamics features on the race car? Does the M3 use less fuel than the competition?

O'Connell: One of the best features we have is the VANOS or variable intake and exhaust cam phasing that the production engine has. By having that on the race car, we can optimize the cam phasing and improve the fuel economy. That's definitely an advantage.

Bimmer: Can you adjust that on the fly?

O'Connell: No, it's programmed into the engine calibration, but compared to an engine that doesn't have VANOS, there's a couple of percent fuel economy improvement even when you're running at full power.

Otherwise, our car is a little bit bigger than our competitors, especially in the

frontal area, because it's a 2+2 sedan versus a two-seater, and that means we have to be more efficient. We have to be sure we don't use maximum fuel all the time because it will shorten the number of laps we can make.

Bimmer: What about gearing? Do the gearing and the course itself induce variance? How much variance is there between a car in its most economical state to its least economical state?

O'Connell: Well, the gearing is set up for the best lap time, not the best fuel economy.

Bimmer: Based on the speed at the end of the straight?

Jay O'Connell: Right, in order to get the maximum work or energy out of the engine.

If we need to save fuel, the driver can lift off the throttle on the straightaways, can coast into the corners. That way you can save fuel at the highest speed, and that's a good trade-off, but that takes a little bit for the drivers to learn that technique.

The left-foot brakers tend to hit the brake and stay on the throttle, and that uses a lot of fuel. You've got to make sure you don't have any overlap between the brake and the throttle, because there's no point in fighting



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the brakes with the engine and burning up fuel that you could use to get a little farther.

The more experienced guys are thinking about the strategy while they're in the car and how it's going to play out, while the younger guys are just trying to go fast. The more experienced guys can help, because they can tell you that another car is dropping off. But on the other hand, if they start telling you about strategy instead of driving the car, that becomes more of a distraction. You have to tell them, "Just focus on the car. We know what we're doing! You just do your job, hit this number, go as fast as you can."

We had a driver a few years ago in IndyCar who talked so much during a yellow flag that we couldn't call him into the pits, and he lost four or five positions because he was such a chatterbox. If we're in a yellow, I need the driver to be quiet, because we might have to pit at the last second. When he's talking, he can't hear us.

Bimmer: *What's the worst-case scenario you can encounter in the middle of a race with regard to fuel strategy? What's your nightmare scenario?*

O'Connell: The nightmare scenario is when your competitors are all going laps longer than you and you're forced to wait until after they've pitted. The worst scenario is that they pit with an hour and five minutes to go and you're waiting and waiting, and a couple of minutes later the yellow comes out, and now you come into the pit but you're at the back of the line. You're good to the end, but now you've got to pass all these guys who've pitted just before.

You definitely need to know your game to make sure you don't pit too late and get caught out by late-race yellows that can put you at a disadvantage.

Bimmer: *What did it feel like when you really nailed the fuel strategy last year when everyone else screwed up?*

O'Connell: The race at Baltimore was a good one. We had to go 45 minutes, and since we could make it from 45 minutes to the end we pitted as soon as we could in each car and then the yellow came out a lap later and we were at the front of the line, leading the race. That was great until we got hit by a competitor a couple of restarts later and knocked out of the race, but we were in great shape there.

Bimmer: *Is there any point at which you can relax and your job is done?*

O'Connell: When we see the checkered flag!

It's quite intense. There are two or three people calculating the various scenarios, because you want to have some cross-checking to make sure you're looking at it from every angle. There's some good discussion on the pit stand to make sure we're looking at the best angles and the best chance of success.

There are some situations where we can decide to pit one car out of sequence on strategy A and keep the other car on strategy B. That way you cover both options. Depending on how the race plays out, you'll always have a car at the front. That takes coordination between the timing stands, but that can be quite effective in these endurance races where half the field is on one strategy and half on another and you need to cover both options. That happened at Road Atlanta last year at the end of the race as we tried to figure out how it was going to play out.

Bimmer: Are you working on intuition at this point or are you doing the math?

O'Connell: We have several engineers working on their laptops with programs they've written with race strategies, looking at the scenarios. You can do it by hand, but with all the computer power it's much better to look at these scenarios and look at what happens if we're three hours into the race—can we make it on two more stops or do we need three? If the yellow comes out now, do we take it or do we stay out? We're constantly playing these "What if?" games. The race goes by really fast because we're constantly thinking about all these possibilities, not just sitting there watching the cars go by.

Bimmer: Are there limitations with respect to driver endurance and tire wear that also affect when you bring them in, regardless of fuel or yellow?

O'Connell: We're fortunate that our cars have air conditioning, and that we have a drink bottle system. The drivers don't really get fatigued because their temperature is under control and they're able to stay hydrated. But there are times, like last year, when the first guy broke off the water bottle so there was no water, and the second guy got in and because of the yellow sequence he ended up spending two and a half hours in the car. He eventually came over the radio and said he was getting a little thirsty and really wanted to come in. I said, "Okay, we'll get you in in another 15 minutes." He was okay, but obviously you want all those systems to be working!

Speaking of the tires, usually our tires have been working well. They can at least go an hour and a half if not a little bit further, although the performance continues to slow

down and degrade. Last year, one of our competitors could only go 35 minutes on a set of tires here at Laguna—typically a stint is 47 laps—so they had to keep stopping early because their tires were falling off, and that forces their hand. They're kind of stuck. It's almost like they have a small tank. They have to stop more often, and they have to use the yellows just to catch back up. That put them at a disadvantage, and they were not able to race hard at the end.

Fortunately, our tires from Dunlop have been doing well the last couple of seasons, so we can go a stint and a half if we need to. At the end of the Sebring race, one of our cars double-stinted the tires, and that's what allowed it to get into the lead and win the race. At the end of the race, the car wasn't doing as well as it would on new tires, but it was still doing well enough to capture the win. That's the kind of risk you can take. And a lot of times at the end of the race the track has a lot of rubber on it, so the track's in really good shape, and it may be a bit cooler. All those factors help the tires survive.

Bimmer: You also do the strategy for the RLL IndyCar team. How do the two differ?

O'Connell: The IndyCar is a lot different because you have one driver instead of multiple drivers. You still have the yellow situations, the fuel economy and all the strategy to think about, but you only have one class of car instead of five or six classes. It's a little bit different, but you can apply a lot of the same techniques and strategies to it.

Bimmer: When the same car goes from one driver to the next, how much variance do they create with their use of the throttle?

O'Connell: We have one driver who gets full throttle about 4-5% more per lap than any other driver, which is good for lap times but not so good for fuel economy. When he gets in there, we know we're going to go a lap less because he uses more fuel. He also puts more heat energy into the tires, so we have to adjust the pressures for him so they don't go over, because he's putting more work into them. It's just his driving style, and if we have to we'll ask him to start saving fuel to offset his style, but he doesn't really appreciate that! If he's getting into the car at the end, we know we'd better pit a lap later just to make sure he gets to the end.

We have the drivers run hard during the practice session so we can get a gauge on what their fuel economy is. Once we work with them for a race or two, we start getting some data and can see some trends emerge as to how efficient each driver is.

Bimmer: And I assume you enter that driver data into the computer when you're working on pit wall.

O'Connell: The telemetry is telling us how much fuel is used every lap, so every lap we'll take that number and put it into the program. It's projecting what you think you'll use, and you'll look at what you actually using, and then you can constantly update your projection of how far you can actually go. We're always thinking about, okay we're on lap 23, can we get to lap 50 or 60? How far can we get? And then if the driver starts to save fuel, maybe we can get another lap or two. You're constantly looking at that projection.

Bimmer: And probably calculating the other variables, like how close you are to the end of the race.

O'Connell: How many more stops can we get to the end. You're always playing the race in reverse to make sure you're thinking about the most efficient way to get to the end, to have the fewest number of stops from any given point.

Bimmer: How much is race knowledge and how much is math?

O'Connell: It's a mixture of both. After a couple of seasons of racing, you've seen a lot of scenarios play out, and you start to get a feel for which ones are high-probability strategies and which ones are low-probability but work out. It's always good to go through those scenarios to remind yourself what works well and what's happened the last few years on that particular track, and then you've prepared as much as you can going into the event.

Bimmer: What would you tell people to look for if they're watching the BMWs during the race if they're here at the track rather than watching on TV?

O'Connell: The first thing to look for is how the gap is changing during the race. Is the BMW building a gap or is the gap shrinking? Everyone is going through traffic and fighting other cars, but if the gap is maintaining the same both cars are running the same pace. In the bigger picture, it's how many laps they went before they pitted versus the other guy. The BMWs went 50 laps, and the Corvettes can only go 48 laps. That's going to play out later, having a two-lap advantage on a full fill.

Who's got an advantage? Who's going to have the most options at the end to win the race?