ENDURANCE RACING GUIDE:

FROM LEMONS TO LE MANS

BY

Ross Bentley

SPEED SECRETS

Important Stuff

You know that motorsport of any kind is dangerous. Therefore, I provide my advice for you to use in the way you choose. I can't be held responsible for anything that might happen as a result. You're a grown-up - you're responsible for yourself – and by reading on, you are accepting that responsibility.

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*Having said that, I love helping drivers perform better – I enjoy sharing what I've been fortunate to learn through experience, study, and observation. With that in mind, please help me get this eBook in the hands of more drivers. Please recommend to other drivers that they download their own copy. **It's free!** All anyone has to do is download it themselves (i.e., don't send them your copy). Thank you.*

Have fun!

Ross Bentley

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SpeedSecrets.com

Version 1.0, 7-15-15

SPEED SECRETS

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INTRODUCTION

There's something magical about endurance racing… driving long stints and the rhythm you get into, passing and being passed, night driving, adapting to changing conditions, dealing with problems, strategy and teamwork, and finding the perfect compromise of seating and handling setups between drivers.

Watch Steve McQueen's classic movie, *Le Mans*, or Audi's documentary, *Truth in 24*, and you can't help but get caught up in the romanticism of the marathon struggles at the legendary French race. But what about the Rolex 24 at Daytona, Sebring 12-Hour, or Petite Le Mans? Chumpcar World Series and LeMons? Thunderhill 25-Hour? Club enduros? All classics from the day they were born because of what they are, and the tremendous effort individuals and teams put into them.

Endurance racing is challenging, fun, physically and mentally demanding, and… well, sometimes frustrating!

Why frustrating? Because endurance racing can be painful. But like running a marathon, every little bit of pain is worth it. Of course, that's what you often say about a month after an endurance race. Sometimes, you finish an endurance race, and immediately promise yourself (and anyone else who will listen) that you'll never do it again because it was painful, challenging, tiring, and frustrating! And it's because the reward doesn't always seem to equal the demands. Often, the second an endurance race has been run, you can hear dozens of people swearing they'll never do it again.

So, why does that decision change so often? Why do we go back to doing another endurance race, and then another, and then another? Mostly because our memories are flawed. It seems that about three weeks after you swear on a stack of bibles that you'll never do another enduro again, you think to yourself, "Well, I probably will never do another one again. Okay, it could happen, but it's unlikely."

Then, a couple of weeks later, when the pain and difficulty of your previous endurance race has faded from your memory, you publicly announce that you're going to do that race again – and win it! It's drawn you back into its web.

And that's how so many drivers and teams feel about endurance races. They're addictive. They're the ultimate motorsport challenge. It's a love/hate relationship.

Endurance races can be just about any length, from a couple of hours to twenty-four and beyond. One way to define an endurance race is the requirement of more than one driver. I've written this guide with that definition in mind.

This eBook started life as a simple bullet-pointed document full of thoughts, tips, and ideas about endurance racing for a team that I was coaching at the Daytona 24-Hour race. Since then, I've expanded it. While endurance races are long, my goal for this eBook is to make it short and to the point, kind of a sprint race format of information for endurance racers - just enough information to make you think, and to give you the key guidelines to improve your chances of being successful.

Along with my tips and advice, I've added some personal stories, so you can learn from my experiences.

I realize that not everyone reading this will drive at Daytona or Le Mans. Many will be competing in club events or one of the "low-cost endurance" races (LeMons, Chumpcar, American Endurance Racing, World Racing League, etc.). I've competed in almost all levels and types of endurance races, and I've noticed that the approach, the preparation, and how you actually drive in them is very similar. I think you'll find most of what I've written will apply to whatever form of endurance race you're competing in.

SPEED SECRETS

THE APPROACH

The goal is to win. It is racing, after all. We're racers and racers want to win, and long endurance races are too much like work to do it for any other reason. Okay, some may look at an endurance race and think, "I just want to have fun. I don't care where I finish." That's great, and there's nothing wrong with that. But winning is also fun – a lot of fun. So winning should be the goal, a target, even when you don't have all that it takes to win (a competitive car, for example).

Anything can – and will – happen in a long race. And that's why your target, your goal, should be to win, because it's always possible. And get this: it rarely takes any more effort and preparation to win than it does to simply finish. If you prepare to run a consistently strong and reliable race, you have a shot at being at the pointy end of the finishing order.

With that in mind, you should no longer think about winning. *You need to focus on your performance, and that of the team – the only things you can control.* You can't control your competition, and you can't control the results. There are too many variables, especially in long races – changing weather and track conditions, mistakes by others drivers that affect you, the performance by other teams, and so on – that you just can't control. But, by controlling your own performance, you can influence the competition and the result. That's all you can do, so your focus needs to be on yourself and your team.

So, the objectives you need to focus on, and the ones you can do something about, are:

- Learn. The more you learn, the better you'll get; the better you get, the more likely it is you'll perform at a level that will result in winning.
- Perform at your own personal and team's one hundred percent. If you can leave a race – any race – and feel that you got everything possible out of yourself, your car, and your team, you can't feel too bad, no matter where you finish. If you did perform at one hundred percent, and you didn't win, then you need to work at upping your one hundred. But if you perform at something less than one hundred, it's hard to feel totally satisfied – even if you win.
- Have fun. While I said the goal is to win, ultimately it's about having fun. And I mean that, no matter what level of the sport you're competing in. Interestingly, when you're having fun, you're more likely to perform at your

best, and therefore improve your chances of winning. And yes, winning is fun.

Now, I hope you're okay with doing your best, no matter when and how much you drive. The when and how much should be dictated by the team and its strategy for achieving its goals. Don't worry; you will drive - a lot. It's an endurance race. But consider whether it would be more fun to be able to say you won, even if you only drove one stint, rather than saying you drove more than anyone else and lost. That's a personal decision, but it must fit within the team's goals and strategy.

It's important that each driver, and each member of the team, understand their own personal goals. Ideally, everyone would share their goals with one another, to get people on the same page, and so everyone understands why a team member may do what they do. The most important part is knowing and understanding what everyone's personal objectives and goals are, and how they fit with yours and the team's.

If you are basing your participation on how much time you spend behind the wheel versus how much money you've spent, endurance racing – a team event - may not be for you. Go to the local indoor karting track, as that's the only place I know of that guarantees a certain number of laps per dollar.

L.C. Hammer To The Rescue

With about four hours to go in the 1996 Daytona 24-Hour race, we were running second overall, with an honest chance at catching the leaders. Then, coming out of Turn 3, I felt the engine go soft, as though it started running on just seven cylinders. And that's exactly what it was. I pitted.

Sitting in the car in pit lane as the crew pulled the engine cover off our Riley & Scott-Chevy, I couldn't help but feel that the race was over. So close….

"Get me a hammer!" I heard my crew chief, Les Channen yell to a crew member. What?! I'd noticed that he'd pulled a valve cover off, so a hammer is not what I considered the tool of choice for a little engine maintenance – or even a major repair. Through the mirror, I saw Les take a swing at the engine.

Then another. And another. A minute or so later he began bolting the valve cover back on, the crew put the rear deck back on the car, and I got the call over the radio, "Go, go, go!" I fired the engine, dropped the clutch and headed back on track.

The engine was still running on seven cylinders, but it was okay. Kinda. Over the radio, I was told the engine had broken a rocker arm, so Les had pulled it off, lifted the valve up, hammered it over on an angle so it wouldn't fall into the cylinder, slammed the valve cover back on, and crossed his fingers.

Because I got into a good rhythm and found I could turn laps within a second of my fastest by adapting my driving style, I drove the final four hours of the race (yes, there was some discussion about the legality of me driving that long – it was against the rules for a driver to do more than four hours at one time, but the team manager "managed something," so no one noticed). Despite losing a number of laps to make the engine "repairs," we finished. In 4th place. Not a bad recovery.

To this day, Les Channen is "L.C. Hammer" to me. He and the team were a perfect example of doing "whatever it takes" and never giving up. And that's something I think about going into every endurance race.

SPEED SECRETS

DRIVING

At all times keep in mind the job description of a race driver, whether endurance race driver or F1 driver: **Drive the car at its limit, and no faster**. In sprint races, I add “and no slower” to that job description, but there will be times in endurance races where your job will include driving at something slower than the limit.

Drive the car to its limit, and no faster.

If your objective is to try to impress people with your speed or daring passes, you're in the wrong place. Endurance races are no place for a driver with an ego, and something to prove (other than proving to be a great team player, and following the team’s strategy). And it's not a place for trying to set a new lap record every lap and over-driving the car.

The key to winning endurance races is to stay out of the pits, and put in consistent, quick laps. Given the choice between taking a chance of being hit when passing or being passed by another car resulting in a pit stop just to check the car over, and giving up a second or two of lap time, go for the second option. Your goal: **stay out of the pits, and never stop on track** (now, see the next paragraph).

Stay out of the pits.

Having said that, if you ever have any doubts about the car (a possible mechanical problem), come in and have it checked – especially if it’s a safety factor. It’s far better to have the crew check the car over than for you to do another lap or two trying to sort it out yourself and having to stop out on the track. If you stop on track, it becomes next to impossible to win.

In the race, one fast lap means very little. What means something is turning the most consistent laps - quickly. In other words, if you add up all your lap times, the less time the better. That should be your goal – to do your stint in the least amount of time.

Modern pro endurance races are long, flat out sprint races. The cars are so reliable, so durable, that they can be pushed to the limit throughout the race.

Some may have a small weakness that, as a driver, you might have to protect – perhaps the gearbox, or the brakes – but that is becoming the exception, rather than the rule. For other levels of endurance racing, this flat-out approach may not be possible, as the car is not strong enough to handle that type of punishment for an entire race. *You need to know your car, and its strengths and weaknesses before deciding just how hard you can push it.*

Racecraft

Even if your car can handle being pushed to the limits for the entire length of an endurance race, one thing it won't be able to handle is crashing into other cars. Traffic is the biggest challenge in endurance racing. *You've got to pass and be passed without any contact; you've got to stay on the track.* Even what seems at first to be a minor off-track avoidance maneuver, cutting through the grass inside the apex of a corner, for example, can be disaster. Tear some component off your car by going over a bump, or pick up a bunch of grass in the radiator and the result is time spent in the pits.

Traffic – both slower and faster cars - can cost you many seconds on one lap if you hit it just wrong. You can't worry about it. Many drivers worry that the crew back in the pits are going to make nasty comments about them being slow. Wrong! The only time I've seen good crew members grumble is when a driver has torn the car up by clipping a slower car after attempting a risky, ill-advised pass. Think about it. If you lose five seconds every now and then, you're still miles ahead of where you'll be if you crash the car.

Having said that, you can be too cautious. And never forget - this is a race. *An endurance race will be won – or produce the most fun and a solid result - through being consistent, smart, and quick.*

You need to be decisive in traffic, making smart decisions. You need to decide when to be assertive to get past another car; when to hang back and be patient; when to ease up for a fraction of a second to let a faster car by; when to hold your line until out of a corner before letting another car pass you; when to back off knowing that you or another car you're dicing with is going to pit within a lap or so; and you need to know when to pick a fight, and when not to. You need to think ahead! Endurance racing is a high-speed game of chess.

It is more important in endurance racing than in sprint racing to "present" yourself when passing, putting your car in position so the other driver can and will see you. That means getting up beside the other car far enough when out-braking it,

and lining your car up close to it. If, when out-braking another car on the inside entering a corner, you move two or more car widths away from it, it will be harder for the other driver to see you; if you line your car up just a few feet to the inside of it, it will be easier for the other driver to see you.

“Sneaking” up on another car to make a pass might be a good strategy in some forms of racing, but not in endurance racing. If you can’t make a pass while being obvious, you’re taking a big risk. Be obvious, present yourself to the other driver, and make clean, well-deserved, smart passes.

Present yourself when passing.

But don’t expect others to pass you the same way. They will make last minute dives to the inside, position their cars so you can’t see them, try to surprise you, and generally make ill-advised passing maneuvers. So, don’t be surprised when that happens. Sure, you can blame the other driver after the fact… while you’re standing in pit lane waiting for your crew to repair your car. You may be in the right, but it doesn’t really matter if your car is damaged.

Knowing how to be safely passed, losing as little time as possible, is just as important as being able to pass other cars.

The closing speeds between classes of cars make passing a real challenge. You will catch or be caught by some cars at an alarming rate. The most difficult cars to pass are those that run lap times about a second or two slower, but are fast on the straightaways. You can’t take all day to pass cars like this, so you need to get yourself into position to take the line away entering a corner (difficult since the other car will be far ahead at the end of the straight, so out-braking is a challenge), and make absolutely sure that the other driver has seen you. You’re going to need to use your superior momentum coming out of the corner leading onto the straight to make this happen.

Learning how to be passed is critical. There will be cars several seconds a lap quicker than you, and some just barely quicker. Your goal is to be affected by these cars as little as possible - to lose as little time as you can when being passed. Rather than arriving at a corner side-by-side, for example (with both of you being off-line through the turn), backing off slightly just before the braking

zone and following the other car through the corner will cost you less lap time. The best drivers have the ability to know just how little easing up it takes to let a faster car by, but not enough to slow up too much. You want the other car to just barely pass you, and for you to tuck in behind, carrying as much momentum as possible.

Be predictable.

Be predictable. Cars planning to pass you expect you to stay on your line, not move over for them. They don't expect you to brake early and hard. If a faster car (even one just slightly quicker than you) is right on your tail, you can ease off the throttle a little early to allow him to go by, but don't brake hard early.

Think about being the "stealth" driver/car. You want to get involved with as few a cars as possible. You want other drivers to never notice you, to never have problems getting by you, or you getting by them. That means thinking ahead, planning on how you can pass and be passed as easily as possible.

Be a stealth driver.

Adapting

It's obvious that track conditions are going to change over the course of a long endurance race, either through changing weather, or simply from rubber build-up and fluids on the track surface. Visibility will also change – the setting or rising sun, cloud cover, precipitation, and your windshield or helmet visor covered in grime or pitted from being "sand-blasted."

Driving long races is all about adapting. It's all about learning. Things change, from the way the car is performing to the track conditions (not to mention your own mental condition, and that of the other drivers), and how you respond to these changes will make a huge difference. Having an attitude that you're constantly learning is critical. You should be learning something new every single lap.

SPEED SECRETS

Learn and adapt.

Endurance racing is a balance between consistency and adaptation. Yes, a goal is to be consistent, but sometimes that means experimenting with different lines from lap to lap to take advantage of changing track conditions. Your overall goal is to be consistent, but how you do that may be different from lap to lap. *To be consistent, some times you need to be inconsistent!*

With many cars on track of varying speeds, it's usually easy to observe others and see what seems to be working for them, and what isn't. Learn from other cars and drivers. But don't forget to drive your own car! It's easy to get caught up watching other cars, and make a mistake by doing that. I've seen drivers follow a car that went off track, simply because the driver was overly-focused on it. Be aware of what others are doing, learn from them, but drive your own car and race.

Dealing With On-track Incidents

In most race series, when the track goes full-course yellow, the safety/pace car will come out and pick up the overall leader of the race. In some series or races, for that to happen, the safety/pace car may have to wave cars past – you may get a wave-by past the safety car. Only pass the safety car if waved by. No matter what, if there's a full course caution, your job is to close up on the pack in front of you as safely and quickly as possible.

That may even mean pulling up almost directly to the side of the car in front of you and giving the driver a signal to pick up his/her pace to catch the pack.

If you pit during a full-course yellow, do not pass the safety car that is on track as you enter pit lane – maintain the speed it was traveling. And watch when you re-enter the track: In some races/series, they will hold you at pit-out until the pack goes by, and only allow you to re-enter once it goes by. If not, then watch the pack of cars coming by and merge into them.

Again, never pass the safety car unless directed to. This includes after it pulls off the track as the track is about to go back to green – maintain the safety car speed until the green flag is dropped.

Local yellow flags can be an opportunity to gain on your competition. Now, let me be very clear: I do not recommend or suggest you ever, ever put turn workers or

safety crews in danger. You know what a yellow flag means, so respond appropriately (if you don't know what a yellow flag means, go find out – this eBook is not meant to teach you the meaning of all the flags). Never take chances around an on-track incident or safety crews. However, some drivers over-react to yellow flags, and slow down too soon, too much, and/or take too long to get back to speed.

If you're able to see clearly through a yellow flag zone, it might – and I have to emphasize "might" – be an opportunity where you can maintain speed a little longer, or regain your speed a little sooner than your competitors. Often, gaining even a second on them gives you a clear advantage.

Having said that, I again want to reinforce that you should never take chances and put safety workers in any kind of danger. If in doubt, err on the side of being conservative. But always look and think ahead to see if you can also gain an advantage.

Driving Style

There are at least two different driving styles: the "point-and-shoot" and "momentum" styles. Endurance racing is not the best place for a "point-and-shoot" style of driving. This is a place for a "momentum" style of driving. Can you be fast with a point-and-shoot style? Yes, for a while.

But the great endurance drivers always use momentum – they are the ones who win a lot. It's quicker, more efficient, and easier on the car, using less fuel and brakes (and sometimes, less tire).

A point-and-shoot style involves late and heavy braking, slowing the car, changing its direction quickly, and then standing on the throttle to re-accelerate it. A momentum style uses a slightly earlier and lighter brake pedal pressure, carrying more speed through the middle of the corner, and a more gentle application of the throttle.

Which is faster? *Point-and-shoot versus momentum: All things being equal, they're equal.* One isn't faster than the other. Okay, sometimes, the point-and-shoot style is good for a one-lap-wonder, or works best in high-horsepower cars. Sometimes the momentum style is faster, especially in lower-horsepower cars. But over time, they're… well, equally fast.

So, if they're equally fast, use the one that results in the best fuel mileage, and the least wear and tear on the car: the momentum style.

SPEED SECRETS

Use a momentum driving style.

If you think "squeeze" every time your foot goes on the brakes, you may be able to make the brake pads last just a little bit longer - and that little bit may be the difference between winning and losing.

Every time you slow a car, you need to re-accelerate it again. If you slow it less – even one MPH less – it requires less to regain its speed. That means less fuel is used. It also means that you spend less time on the brakes, or the pressure on the brakes is less, meaning less wear on them. See a pattern here?

Squeezing the throttle, rather than using it like an off-on switch, can make a difference to the fuel mileage. If you can get just one more lap out of each tank, that's a huge help over the course of an entire race. So, use the brakes as little as possible (that does not mean using the engine to slow the car – that will break the engine).

The hard braking and acceleration that's used in a point-and-shoot style is hard on the tires. But, you say, *what about carrying more cornering speed – isn't that harder on the tires, won't that wear them out faster?* All other things being equal, yes, but no harder on them than the point and shoot's heavy wear from braking and acceleration. So, it's a wash in the tire department.

The bottom line is to use a momentum style of driving, one where you brake a little lighter, carry speed through the middle of the corner, and gently squeeze on the power - it will result in less fuel used, and less wear on the brakes. And that's a good thing.

Bringing It Home

With an hour to go in a club endurance race at Portland, we were in second place, but I was catching the leader by a couple of seconds per lap. Then… I felt something was not right with the brakes. The pedal had been long for quite some time, and it got longer – it almost went to the floor before the brakes really started to slow me down. And it felt pretty mushy, soft. But the worst feeling was the vibration coming back through the pedal, and the sound. It told me the pads were gone, and I mean gone: it was the backing plates on the rotors, now.

Decision time. I could stop and have the crew change the pads, and give up any chance of winning, or I could figure out how to use the brakes as little as

possible, and have a chance at winning. But that would require going fast, without using the brakes much. I had to nurse the car home – quickly! To me, the decision was easy: go for the win.

I braked earlier, but much lighter than ever before. In fact, there were places were I barely touched the brakes, and that meant entering the corners at higher speed, but scrubbing off some of that speed with the steering. I carried more speed through the middle of the corner than I had before, and focused on getting on the power smooth and early. In other words, I gave up late braking for corner and exit speed. Of course, by this point in the race, with seven hours of rubber build-up on the track, the mid-corner grip levels had come up (but most drivers were still driving as though it hadn't). My lap times didn't change much, and with about fifteen minutes left in the race, I passed for the lead. We won!

After the race, even though I was happy, I was also a little frustrated with myself. If I could turn lap times that almost equaled my best while barely touching the brake pedal, why hadn't I driven that much faster when I did have brakes? While the extra grip from the rubber build-up on the track was part of the answer, part of it was that having the great Porsche brakes drew me into driving with a particular style earlier in the race.

It was a good lesson: never assume that the way you're currently driving is the best. There is more than one way to drive fast, and sometimes you need to try different approaches to see if you're able to be even faster (and easier on the car).

Night Driving

Some drivers love driving at night, and others don't. For many drivers, they find it easier to get in the zone and have a great rhythm in their driving at night, since there can be fewer distractions. For some drivers, the inability to see as much creates anxiety, so they avoid driving at night.

The key to driving at night is what you do during the day. If you soak up more reference points during the day – ones that you can rely on at night – night driving is relaxing and fun. It's very focused. References like the distance past the end of a pit wall before turning into a corner, paint marks on the track surface, a turnworker station, bumps in the track that tell you you're on line or not are all critical. The more of these you have, the easier it is to drive at night.

SPEED SECRETS

Collect more references during the day to help you drive at night.

Before getting into the car to drive a night stint, avoid looking directly into bright lights (tough to do if you have to look up pit lane to spot your car coming into the pits for a driver change). These lights will constrict your pupils, making it harder to focus in the dark. Some drivers go so far as to wear sunglasses right up until the time they hop in the car to drive to keep their eyes used to the darkness.

Part of driving at night is like driving in fog or in the rain: it's the fear of the unknown that is the real challenge. In each of these cases, it's the fear there is something that you can't see that makes you want to drive conservatively. You look ahead and can't see anything, so you assume there is something you should slow for, but the best night drivers turn that around and assume that if they can't see anything, it's because there's nothing to see. It's a bit like a pilot flying using just the instruments. In this case, the only instruments you have are the reference points you can see (which are limited), the ones you feel, and the ones you hear. Notice that the things you can feel and hear are not affected by the darkness. What does that tell you? Yes, you need to pay more attention to those things when night driving.

Okay, there is one other "tool" that you rely on when driving with restricted vision, and I'm talking about your memory. If you're able to close your eyes and imagine driving a lap of the track – in detail, all the things you see, what you feel, and what you hear – then driving at night is not as scary. I highly recommend doing mental imagery, or visualization of driving the track. The more you do this, the more detail you'll fill in about the track, and that will help you greatly at night. Done enough, you could almost drive around the track with your eyes closed, simply relying on your memory, or mental programming to find your way. And you might just have to do that!

Driving Blind

The first year I drove the Daytona 24-hour race, it was in a Camel Lights Tiga-Mazda, and we finished second. The Lights cars at the time (1993) were closed-top coupes, much like today's LMP1 cars. After midnight, during a triple stint I was doing, the windshield became so pitted and covered in oil and grime that as I turned from the apex of Turn 5 all the way to the turn-in point for Turn 6, I was

practically blind. The way the lights from the grandstands glared off the windshield, I couldn't see a thing (this was before they lit up the track as much as they do now).

No problem. By this time I'd had enough laps that I could have sat in front of you with my eyes closed and imagined a lap in my mind, moving my hands and feet as though they were working the steering wheel and pedals, and you would not have been able to tell I wasn't actually in the car. If you'd put a stopwatch on me, my "mental laps" would have matched my real lap times within tenths of a second. I had memorized every detail of the track, along with every action I needed to perform to get around the track quickly. They had become part of my mental programming.

As I turned into Turn 5 and headed for the apex, the glare off the windshield in that direction blinded me. I arced the steering wheel in, held it for a fraction of a second until I felt my right-side tires run over the apex curb, and then I gradually unwound the wheel while feeding in the throttle. A second or two later, I felt the left-side tires run over the exit curb, and I held the steering straight as I accelerated up and into third gear. Holding the wheel straight, my view completely blinded, I shifted up to fourth gear, and counted, "One, two, three… now." At "now" I hit the brakes, skip-shifted down to second gear and turned left, still not sure exactly where the car was headed – but trusting that I got it right. My left-side tires ran over the apex curb, and by now the lights of the grandstand were no longer directly aimed at my windshield, and I could see a little bit again as I accelerated up on the banking of NASCAR Turn 1.

For some period of time – perhaps ten seconds or so - I drove totally relying on just feel, hearing, and my memory of the track and the actions I needed to perform. For a couple of hours I did this over and over again, every minute and fifty-something seconds (after my stint, the crew replaced the windshield). Where this became most challenging was when I had to pass another car, or a faster GTP car passed me, and my timing and routine got interrupted. I relied even more on catching a glimpse of something on the side of track with my peripheral vision when that happened, and "improvised" the rest of the time.

I learned a lot about night driving, and the importance of using references that are not just visual during that Daytona race.

SPEED SECRETS

PROBLEMS

If you have to stop on the side of the track with a mechanical problem, try to get where the crew can assist you. In some race/series, only the driver is allowed to work on the car to make a repair while it's on or near the side of the track – the crew is not allowed to touch the car. But they can direct you and hand you tools and spare parts.

Having said that, most races/series don't allow any work on the car on the side of the track. Instead, they will have the car towed back to the paddock, pit lane, or at least to a safe area where you can work on it. These are just some of the rules and procedures you absolutely need to be aware of.

If you have a problem with your car on the track, and you have to stop, you should have a track map in the car so you can tell your crew over the radio (assuming you have one) where you are stopped.

If you think the car has a problem, get on the radio immediately to tell the crew. If you don't have radio communication, you should work out some type of hand signals to communicate with your crew about the most basic problems you might face (tire, engine, shifting, brakes, etc.). *If you have any doubts, come into the pits. It's far better to have the crew work on the car in pit lane than having you work on it on the side of the track.*

Never give up.

Never give up. If the car has a problem, do whatever it takes to get it back to the pits.

You should have at least a very basic tool kit in the car. Also, before the race you should have the crew go over the simple repairs you could do to get the car to the pits, so you have a basic idea of what you can and cannot do, and how.

SPEED SECRETS

THE PITS

No matter what happens, do not back up in pit lane. In practically all races/series, it's against the rules to put the car in reverse and back up in pit lane (again, be aware of the rules and procedures about this, just to be sure). If you overshoot your pit, let the crew advise you what to do – they will either tell you to do another lap (better not overshoot a second time!), or they will pull you back, depending on how far you've overshot the pit.

When pulling into your pit stall, make sure the car is lined up straight and close enough to the wall that the fuel hose can reach. If that means slowing down and taking your time to get it right, that's far better than having to have the crew reposition the car. Taking an extra second or two to get it right is far better than having to move the car so a fuel hose can reach, and the crew to change the tires.

When you get waved out of the pits, check your mirrors. Yes, the crew should be making sure you have room, but a double-check is smart. Many drivers have crashed in pit lane! Or they've crashed at the end of pit lane after leaving on cold tires, so be careful. *Prior to the end of pit lane, always pump the brake pedal a couple of times to bring the pedal back up, to make sure you know what you have with the brakes.* During a pit stop, if you're the driver getting out, do not do any work on the car. Do not even pick up or move a tool. You will be counted as a crew person if you do so, and there are only a certain number of crew members allowed over the wall at one time (know the rules).

Make your "in" and "out" laps count.

While on track, understand that your "in" and "out" laps can make the difference between beating another car or not. Too many drivers get the signal to pit, and begin slowing down over the course of that entire lap; the best drivers are flat-out until the very last second before diving into pit lane. The difference between these two drivers could be many seconds. "Out" laps are similar. Your goal is to get up to speed as quickly as possible, keeping in mind that you may be on cold tires. Again, the difference between a fast "out lap" driver and slow one can be many seconds. Add up those in and out laps up over the course of an entire endurance race, and it can often make the difference between winning and losing.

SPEED SECRETS

COMMUNICATION

Since pit-to-car and car-to-pit communication is so important in endurance racing, having quality radios and helmet kits are important.

Always tape your ear plug jack into your helmet, and loop it through your chin strap. This will reduce the chances of it being pulled out by getting caught on the shoulder belts. Too many drivers (me included) have had it pull out, and then not be able to hear the crew calling them in to pit for fuel. Trying to reach up and plug it back in, with gloves on and while driving, is… well, let's just say it's "challenging." And ensure your radio microphone in your helmet is pushed back against your mouth. The crew can understand you better that way. Even a small gap between your lips and the microphone will make it more difficult for your crew to understand you.

Talk slowly and clearly on the radio, no matter what. If you sound panicked, the crew will not be able to understand you, nor will they be able to help you. The best drivers sound as though they are having a casual conversation while sitting in their living rooms. The "not-the-best" drivers are rushed and hurried in their radio communication, making it difficult for the crew to understand (and for most, feeling less confident in their driver).

Always respond to anything you are told over the radio, by saying, "copy" or by at least keying the mic. The crew needs to know if you've heard and understood the information.

Always inform the crew when you're entering pit lane. Say, "In pit lane" as you enter. If possible, give your crew even more warning by telling them when you are exiting the last corner prior to pit lane, giving them as much notice as possible when you're pitting.

If the track goes full-course yellow, try to estimate how long the yellow will last (2 laps, 5 laps, etc.), and let the crew know by radio. This info will help them call the pit strategy.

If you use a radio and it stops working, pit for fuel based on the fuel light, gauge, or the fuel remaining counter. In some cars with a data system (and if your team have done their homework), there should be a number on the dash that indicates the amount of fuel left in the tank when they want you to pit - if the counter gets to that number, come into the pits.

SPEED SECRETS

As a team, know when you should pit under a full course caution if you don't have communication. Some teams use the following strategy: If there is a full course yellow and you are halfway or more to needing fuel, get caught up to the pack, and then pit when the pits are open.

As with most things, a team can never over-communicate. Don't assume anyone knows what you're thinking. It's okay to ask questions. If you ever begin telling the crew too much, they will probably let you know. Until then, over-communicate.

Over-communicate.

Good Breaks, Bad Breaks

Sometimes things just go your way, and sometimes they don't.

Anthony Lazarro and I co-drove an IMSA World Sports Car race at Texas World Speedway together in 1996. We were driving a Riley & Scott Mk. III powered by a Chevy engine. The bad news was we were down on power to the Ford-powered cars, and the Ferrari 333SP. The good news is this lack of power resulted in better fuel mileage. However, we didn't know exactly how good since we hadn't had time in practice to do a proper fuel run, and we weren't exactly sure how much fuel the car would pull out of the cell before it started to sputter. We had an idea of what our mileage was, and we figured we could run about two laps longer than our competition on a tank of fuel – but we weren't sure.

I had qualified the car and started the race. During that first stint I ran in the top six, but we really didn't have anything for the front five cars in terms of outright speed. Part way through my stint, I lost radio communication with the pit, and therefore did not know when to pit for fuel. I found out during the pit stop that my earplug wire had come unplugged from my helmet – it had got caught on the buckle of my shoulder harness and pulled out. With no way of knowing when to pit, I decided I'd just drive until the car sputtered (and hope that I could make it back to the pits).

As I said, we did have a guesstimate as to when we'd stop, but we ended up going six laps further – and eight laps further than our competition. All of a sudden we were in contention, since we could complete the 6-hour race with one fewer stop. With an hour to go in the race we were leading. At the wheel again, I suddenly got a very bad vibration from what felt like the rear of the car. Running

flat out in top gear on the banking of the super-speedway portion of track – and somewhere close to 190 MPH – the thought of a tire blowing was not very appealing! And the vibration was getting worse. A discussion with the team manager over the radio resulted in us deciding I needed to pit to check the tire. We were a small team, and a big crash would have been a big blow to the budget. We couldn't take a chance, so I pitted for a new set of tires. It turned out the tires just had a bunch of pick-up on them, causing one to go out of balance. It was no more likely to blow than any other tire. Playing it safe had cost us the lead of the race.

In the end, we finished a close second. But it wasn't a win – something we'd come so close to. I was devastated, and happy at the same time. Devastated that I had not been able to determine that the vibration was caused by rubber build-up on a tire, resulting in a second place finish. And happy that we'd taken what was probably a sixth-place car and brought it home in second.

We'd gotten a break when my earplug came undone, otherwise I would have pitted six laps earlier. And we lost a break when I got rubber build-up on a tire. Sometimes things go your way, and sometimes they don't.

SPEED SECRETS

BETWEEN STINTS

Unfortunately, you can't drive the entire endurance race all on your own! And that means you're going to have time in between driving stints.

Always let someone know where you are at all times when you're out of the car. Even though it may not be your turn to drive, someone else could get sick or have a problem. The crew need to know where to find you in an emergency. If you're going to the bathroom, to lay down for a nap, have something to eat, or whatever, let the crew know where you'll be. I've seen too many teams running around the paddock searching for one of their drivers to replace another driver who has had to pit and get out of the car for some reason.

After each stint, try to get as much rest as possible. Early in the race (especially with your adrenaline pumping), you won't feel like it much, but force yourself to lie down and relax. You don't necessarily have to sleep, but do rest as often and as much as possible. And stay warm. Change out of your sweaty driving suit and put on dry, warm clothes. This will reduce the chances of your muscles cramping.

Relax, stretch, and rest between stints.

Prior to your stint, do some type of physical movement to get warmed up. A tennis or basketball player wouldn't start playing without having done some type of warm-up, and neither should you. At a minimum, take a quick walk. Better yet, ride a bike, or run a short distance. And be sure to stretch to loosen up your muscles. *In fact, stretching is one of the most important things you can do between stints.*

Ideally, when you get out of the car after a stint, give any information you can about the car and track conditions to the crew, then let them know where you'll be in case they need to find you. Get changed immediately into some dry, warm street clothes. Then have some food, and relax. Try to sleep. Make sure you then have enough time once you get woken up to eat another small amount of food, and get dressed in your driving suit (do everything you can to make sure it is dry – some teams bring clothes dryers to the track for this reason), and head back to pit lane for your next stint.

SPEED SECRETS

PREPARATION

Think and plan ahead. If your next stint in the car is in the dark, install a clear visor right away. While you may not use the visor (you do need some form of eye protection), it's nice to know you have one to help fight sun glare or dirt and dust in your eyes if you need it. Don't wait until just before you're about to get into the car. If you've been driving in the night, prepare for the sunrise. Obviously, the worst situation is when you are going to start in daylight and drive into darkness, or vice versa. Again, think ahead. If you think there is any chance you will be driving in darkness, make sure you have a clear visor on your helmet.

Some drivers will install a tinted visor on their helmet at night, but keep it open, using some type of glasses or goggles for eye protection. And then, as the sun comes up they remove the glasses/goggles and flip the tinted visor down to help with the glare from the sun.

Think and plan ahead.

Have spares of all your safety equipment: gloves, shoes, socks, underwear, balaclava, earplugs. There is nothing more uncomfortable than having to put on wet, sweaty underwear. Worse yet, if you lose something, it can be next to impossible to find a replacement in the middle of a long race. After all the preparation that goes into the car and team, it would be a shame if you jeopardized the team's results by not having, for example, a spare pair of gloves or ear plugs.

Provide the team with emergency contact/procedure when you arrive for the race. This should include whom you would want contacted should you be injured – your family, insurance person, etc. Nobody wants to think about things like that, but it's best to be prepared. If nothing else, it's one less thing you need to worry about during a race, and that can help you perform better.

SPEED SECRETS

Prepared To Win

In 2005, I was asked to coach three young drivers who would be competing for their first time in the Daytona 24-Hour race. When I say young, I mean it: they had all just turned 16 years old. I was also going to be co-driving with them, and the funny thing was their three ages added up to mine (yup, I was 48). Each of these young drivers had raced karts for years, and had one to two years of open-wheel racing. But none of them had ever driven a race longer than 30 minutes; they had never driven a car with an H-pattern transmission (the open-wheel cars had sequential shifters that didn't require the use of a clutch, other than to get started and stopped); and they had never braked with their right foot (they were all left-foot-brakers).

My job was to teach them the driving techniques to be fast and reliable in a Porsche GT car, and prepare them to drive a race that was 48 times longer than anything they'd ever driven! Fitness, nutrition, how to make pit stops, how to save the car if it had a mechanical issue, driving style, radio communication, media interviews, teamwork, sponsor and team relations… everything. It was one of the most enjoyable and rewarding coaching experiences of my life.

Most of my "work" came well before the race, and one of the most productive things we did was spend an entire day testing, simulating all sorts of scenarios. To begin, I had each driver set a lap time – their fastest, a baseline time. Looking at the data, we noted what the maximum brake pedal pressure they used to turn that lap time. Then, we set up a warning light on the dash that came on whenever they exceeded 90% of that pedal pressure. I then sent them out with the goal of never having that light come on – they had to drive their fastest laps without exceeding 90% of the brake pedal pressure they had to turn their fastest laps. With a little advice and coaching, and a number of laps for each to figure out how to go fast without using the brakes as hard, they all got down to the same baseline lap time. The goal was to use the brakes less, since that would ensure we could make the pads last longer than 12 hours – and that meant only one brake pad change during the race. Another benefit was that it resulted in slightly improved fuel mileage – the less they slowed the car, the less it took to re-accelerate it. It taught the drivers how to use a momentum style of driving, which was easier on the car. In fact, it forced them to do so.

Later, I had the drivers experience a few different scenarios, with one in particular that proved super valuable. Again, with a baseline time in mind, I asked each driver to drive laps without using a specific gear. For example, I told them they couldn't use 4th gear, so they had to skip from 3rd to 5th, and 5th back to 3rd.

After a number of laps, they each got to the point where they could turn lap times that were very close to their baseline times. What we were doing was having them develop the experience that I had from driving dozens of endurance races over decades. But in this case, through deliberate and specific practice, they were learning this in a very short period of time.

In the race, we had a transmission problem, and drove the last eleven hours without using 4th gear. If we hadn't prepared, our young guns would have struggled. Instead, they drove in a way that most people never noticed they were missing a gear. Had there not been a problem during a pit stop, we would have finished on the podium. Not bad for three talented young drivers – who prepared extremely well.

SPEED SECRETS

FOOD

Food is your body's fuel, so think about what you eat before and during the race. You wouldn't expect your car's engine to perform well if you gave it low octane gas, and the same can be said for your body.

During the race, it's better to eat small amounts of food often, rather than eating one large meal. And try to do that as close to just getting out of the car as possible, to give your stomach time to digest it. Try not eating just prior to getting in the car.

For sure, stay away from greasy track or fast food. Burgers and fries are not the meal of champions! Ideally, a mix of carbs and protein is best. Don't load up on heavy red meat throughout the race. Pasta with tomato sauce and grilled chicken is a great meal during a long race. Peanut butter and fruit jam sandwiches are good, as are power bars. Whatever you do, do not eat spicy food before and during the race. But eat bananas, as they provide lots of potassium. When your muscles get tired and cold - and they're in one position for a long time - they are susceptible to cramping. Potassium helps reduce the chances of you getting muscle cramps.

Drink lots of water. Staying hydrated is critical. Another reason for muscle cramping is dehydration, and your brain will not perform at its best when you're dehydrated. It may be cold and you may not be thirsty, but that should not be an excuse. Force yourself to continue to sip water. Don't wait until you are thirsty – that's too late!

Stay hydrated, rather than trying to re-hydrate.

Drinking fluids throughout the race is absolutely critical. While driving, you might have the option of using a drink bottle. There are pros and cons for doing this. Staying hydrated is the obvious pro. The cons are that it is one more thing to install and remove during driver changes; and it is one more thing that can go wrong (if you have planned on using a drink bottle, and something goes wrong and it doesn't get hooked up during the driver change, you will be affected). The alternative is to drink lots between stints, and have a drink bottle handed to you during each pit stop. It's your decision – but stay hydrated.

Energy and mineral replacement drinks, from Gatorade to Red Bull are mostly a matter of personal preference. Do not experiment in the middle of a race. If you don't drink energy drinks, don't try one out during a race, as it may negatively affect how you feel (I know too many drivers who have done this – looking for some quick energy or recovery between driving stints - and regretted it afterward!). Soft drinks, especially ones with caffeine, can actually lead to dehydration, so go easy on them. Coffee is much the same. In the end, you can't go wrong with a small amount of something like Gatorade, and lots of water.

SPEED SECRETS

DRIVER CHANGES & TEAMWORK

I wish I could tell you how exactly to make a fast driver change, because they can sometimes be the limiting factor during a pit stop. Sometimes the fueling and tire changes can be completed in less time than the driver change. Unfortunately, there are far too many variables for me to be able to tell you what to do. *What I can tell you is that rushing rarely results in a fast driver change.*

Like driving, you can't beat lots of practice to fine-tune and make your driver changes faster and more consistent. For many teams, driver changes seem to be an afterthought, and they rarely get practiced as much as they should. The act of getting out of the car and another driver getting in, including belts, radio plugged in, and drink bottle hooked up is something that needs to be choreographed. Having someone watching, looking for subtle procedural changes that'll make a difference, and coaching you and your co-drivers, is an important part of making changes go well.

As you work through the procedure, and practice getting faster, I recommend the following approach:

1. Start slowly, almost at a "walking" pace, just working through the various things that need to happen.
2. Once you've gotten to the point where everyone knows what needs to happen, go as fast as you can. During this stage you'll likely find problems with the order in which you're doing something, or how you're moving or positioning your body. Make changes, then practice it as fast as you can, again.
3. Go back to the beginning again, and "walk" through it, noticing the smallest details of how you're doing things.
4. Finally, practice it at what seems like a fast but relaxed pace. Pretend you're in the race, but not rushing it. This is most likely the speed you'll want to keep practicing at, and ultimately the pace at which you'll do your driver changes during the race.

Again, practice, practice, practice.

No doubt, endurance races are team events. And like most team efforts, the overall performance is limited by its weakest member.

SPEED SECRETS

Practice driver changes. Then practice them some more.

Given a choice between you getting more practice time on the track to shave a tenth or two off your best lap time, or you giving a co-driver – one who is a second or more off the pace - more laps, which makes most sense? Obviously, assisting your co-drivers to get closer to your lap time is going to help the most. Yes, there is that ego thing that makes you want to be the fastest driver on your team, but you need to ask yourself which is most important: being the fastest driver on your team, or getting the best result for the team?

I often see teams have their fastest driver pound around the track, over and over, tuning the car's handling, and shaving a tenth or two off their fastest time. At the same time, there is a co-driver who is a second or more off the pace of the fastest driver, and this driver is not getting practice time to learn to be faster. Be smart. Help the slowest driver be faster. *In most scenarios, improving the slowest driver on your team will have a bigger positive impact on your overall result than fine-tuning the car's handling to find another tenth or two of ultimate lap time.*

The Perfect Imperfect Race

In 2003, the car I co-drove in the Daytona 24-hour race was a Lola-Nissan SR-II (LMP2) car. Between 2002 and '03, the series mandated a spec rear wing, and to say that it made the Lola an aerodynamic disaster is an understatement. Driving the car on the straight, it would wander from side to side, taking up almost three lanes; when another car was near, the aero was disturbed even more, making the car nearly impossible to keep pointed in the right direction (a teammate spun and crashed our sister car during practice while driving on the banking, which is typically as easy to drive as a straightaway). It was like driving an arrow with the feathers pointing the wrong way. When the spec wing design was sent to the engineers at Lola, we got a quick message back saying, "Do not drive that car. It'll be dangerous." Too late. We were racing it for 24 hours.

In practice, we couldn't get within three seconds of the fastest cars in our class, it was so difficult to keep pointed straight. In qualifying I made one banzai lap, taking huge chances, and came within a few tenths of the pole. Our competitors suddenly thought we'd been sandbagging, and now thought we were a serious threat to them.

I started the race, and pushed as hard as I could without taking too big a chance of crashing. We stayed within sight of the leaders, and they seemed to be spending more time looking back at us, wondering when we were going to come storming past them. In fact, in the first twelve hours, our competitors pushed so hard to stay in front of us, they each made some kind of mistake that eventually put us in the lead. A couple of them used their superior speed to retake the lead a couple of hours later, but we stayed close enough to worry them. And they made more mistakes.

All the while, we knew that we didn't have the fastest car, but that if we executed the perfect race – one with no mistakes from the drivers or crew – we would put ourselves in position to fight for the lead at the end of the race. And that's what happened.

With less than two hours to go, in the lead, I was driving and got a call from the pits: our brake lights were no longer working. Just like our sister car, the wiring had broken. But unlike our teammates, who pitted for repairs (the rules state all cars have to have brake lights, and they had been black flagged), I looked at the dash and noticed the switch for the rain light. So as I passed the start-finish line with the officials watching the back of our car (we'd been warned that they were taking this lap to observe the problem and then black flag us the next lap) and began to brake for Turn 1, I reached over with my left hand and flipped the rain light on. After braking and downshifting from sixth to second gear, I reached over and flipped the switch off again. I did the same for the next corner, the next one after that, and for every other corner. Because a light was coming on every time I braked, we didn't get black flagged. In fact, we ran the remainder of the race like this, flipping the rain light on and off for every brake zone.

We won the 2003 Rolex 24-Hours of Daytona by staying focused on our own performance (not worrying about anyone else), performing perfectly for 24 hours, and dealing with our problems better than anyone else. It was one of the most rewarding victories I've ever experienced.

SPEED SECRETS

THE LAST LAP

Finally, a reminder of what I mentioned earlier: one of your goals should be to have fun. If you keep this in mind at all times, you and the rest of the team will perform better, increasing the chances of winning (which is the most fun). Of course, when I say have fun, I don't mean not taking the preparation seriously. I mean have fun taking it seriously. Serious fun.

Again, endurance races can be a lot of hard work. Too much work to not enjoy it, too much to not prepare as best you can, too much to not work together as a team, too much to not be focused on doing the right things. But when you do the right things, there is not a race in the world more fun and rewarding than an endurance race. And that's true to some extent, no matter where you finish.

There are so many variables in endurance racing that you can't control, that you really cannot have complete control over where you finish. *All you can do is prepare the best you can, and then perform as best you can.* If you can walk away from an endurance race knowing that you did everything you could, and you performed as best you could – and you learned how to do an even better job next time – you can never be completely unhappy with that. Sure, you may want to do even better next time, but at least you have a place to work from.

My hope is that this eBook has given you at least a few tips and pieces of advice that will help you and your team perform a little bit better. And with that, you'll get an even better result, and have even more fun.

Have fun!

BUT WAIT, THERE'S MORE…

That's all I have to share with you… for now. At least regarding endurance racing – at least until I learn more and update this eBook. If you'd like to make suggestions for future updates, or you have questions, please email me at ross@speedsecrets.com.

I definitely have more to share on other topics, though:

- I love doing seminars, presentations, and talks for car clubs and other organizations. If you'd like information about this, go to SpeedSecrets.com/presentations.
- If you're interested in my coaching services, learn more at SpeedSecrets.com/coaching.
- You can never learn too much. One of the best ways I know how to stay on top of your driving game is to subscribe to *Speed Secrets Weekly* at SpeedSecretsWeekly.com. It's "entertaining education, conveniently delivered."
- If you're a HPDE instructor (or are thinking about being one), download the free Brake, *Brake*, BRAKE!: The HPDE Instructor Manifesto eBook at HPDE-Instructor-Tips.com.
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- I have more driving tips available at SpeedSecrets.com, along with eBooks about shock tuning (Shocks For Drivers), and using mental imagery to improve your driving (Mental Imagery Guide).

Have fun!