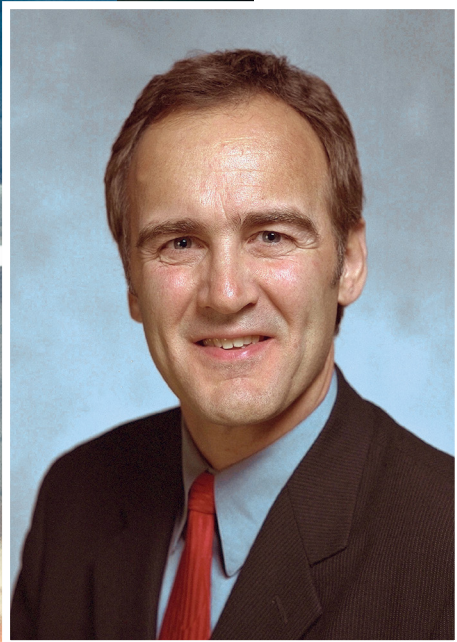




DESIGNING
THE **FUTURE**
OF MOBILITY



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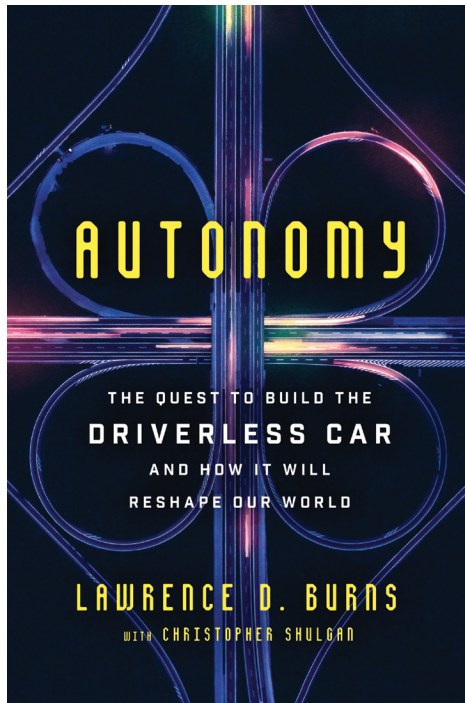
An interview with autonomous vehicle guru Lawrence Burns about the future of transportation, how we'll get there, and what parking and mobility professionals should be doing now to prepare.

START TALKING ABOUT AUTONOMOUS VEHICLES and how we'll all get around in the future, and it won't be long before somebody mentions Larry Burns. Longtime head of research and development for General Motors and consultant to Waymo (formerly Google's self-driving car project) since 2011, Burns' book, "Autonomy: The Quest to Build the Driverless Car—and How it will Reshape Our World," made huge waves when it was published in August 2018. Burns was also one of the principal minds behind Babcock Ranch, the first community designed for a shared, autonomous transportation system (see the December 2017 issue of *The Parking Professional* for more), and is considered one of the world's leading experts on autonomy and the next generation of transportation.

He recently sat down with *The Parking Professional* to talk about autonomy, parking, mobility, and where they all fit together.

The Parking Professional: Why did you write “Autonomy?” Why now?

Larry Burns: I wanted to teach a mainstream audience about autonomous vehicles. That was the goal from the beginning. So much is going on in the whole area of transportation, and it’s all going to affect everybody’s life in some way. People haven’t had a chance to think about how their lives are going to change in the next 20 years.



It was my co-author Chris Shulgan’s idea two and a half years ago to take on this project. It really was the belief that people didn’t see how autonomous vehicles and electric vehicles and the transportation-service business model could combine in a much more dramatic way than just autonomous vehicles by themselves or electric vehicles by themselves. Having had a chance to connect those dots when I was leading the program for sustainable mobility at Columbia University and having thought about transportation technology for a long and big part of my career, I thought we needed to let the companies that were going to be impacted in a big way get out in front of this and let the people whose jobs are going to be impacted get a sense and appreciation of what was going on.

We thought we had great characters so we wrote the narrative about this race to build the driverless car.

Positioning it as a quest and a narrative was very compelling and a story people were going to want to read. We modeled it after “The Big Short” and “The Right Stuff,” and that’s what we were reaching for. I’ve always believed autonomous vehicles were real ever since the DARPA Challenge in 2007, and I could see this inevitable ticking point for electric vehicles was really getting close. Then certainly Uber and Lyft and others started changing the transportation model. Those pieces were in place, and I think what was missing was connecting the dots.

There’s a moment in the book when you’re at the Defense Advanced Research Projects Agency Challenge [a series of long-distance, autonomous-vehicle races in different environments] and watching it all happen. Was that the moment when it clicked in your head and you thought this was really going to be a thing?

The actual moment was when they were handing out the trophy and \$2 million check. Of course the check didn’t come to me personally. General Motors and Carnegie Mellon, I think, ended up splitting the check. It wasn’t for us as individuals. Tony Tether, the head of the DARPA transportation project, the folks who had these races across the desert and the urban challenge, I asked him when the next race would be. And he said there wouldn’t be another race because we’d had three already. I asked him why not, and he said, “mission accomplished.” All of the teams competing had proved to Tony and DARPA that autonomous vehicle transportation was real, and Tony said it was really up to the commercial sector to run with it and develop it to its full potential.

When Tony reached that conclusion, it was pretty impactful to me—that was November 2007. I never dreamed it would go as fast as it has. If Google hadn’t stepped up and said they were going to go for it, I don’t think the auto industry would have done this on its own. They’re just not inclined to disrupt themselves to the extent of taking the driver out of the car. It took Google and Lyft and Uber and those folks to really shake the auto industry into this opportunity and almost force them to get skin in the game.

You talk a lot in the book about the auto company executive car guys—guys who are into their cars and the size of their engines and how fast they can go—and how hard it was to get them to see this as really where the next steps were going to be. Was there a moment where you turned them around or when they bought in?

What will convince you is when you get your first chance to take a ride in a truly autonomous car. You ride in those cars and you're blown away by what they can do. Are there things they can't do still? Yeah. But the things they can do are phenomenal.

I didn't turn them around by myself. I've spent most of my life in Michigan, and I've been employed by General Motors, but I didn't have any personal gain from this success other than the way it would affect my state and the community. I also saw how profoundly transformational this could all be and how different the business model was.

I was giving a lot of public speeches, and they just seemed to be in denial, not just the car guys but auto executives in general. They kept saying it was a nice idea, but it was years away and there would always be a driver in the car. I credit that to a few things: Auto executives tend not to be schooled in computer science and what I call the digital economy. They tend to be either

finance people or marketing people or mechanical engineers. Their plans are defined by how well the driver feels integrated into the car—a lot of work goes into what the acceleration feels like and what the steering feels like and what cornering and braking feel like. A lot of work goes into packing an engine and a transmission and an exhaust system. This is where the know-how of the auto industry resides.

I think the pivotal moment was when Uber decided it was an existential threat to their business model if autonomous vehicles truly occurred. They hired the cream of the crop out of Carnegie Mellon's robotics center. So they're hiring all these people and here we have the auto industry still not believing this is happening. That's what woke up a lot of people—the press coverage of what Uber had done. You had Google and you had Uber, both of which have much higher market capitalization than any of the individual auto companies, and suddenly, the car guys said they've got to get into this. You have to give them credit. They made several very good moves in my judgement since that awakening.

So how do you balance the revolution with consumers as this all moves forward? How do you get drivers, especially drivers who love the act of driving, to decide they're going to buy in?

I understand people when they say they love driving but do people love commuting? Do they love getting stuck in traffic? Do they love the anxiety of getting to work on time with the traffic jam? When traffic starts to back up, I notice people start to reach for their cellphones and start sending texts.

When you begin to look at all the other aspects of car ownership and operation, the industry has taken assumption of what consumers will put up with. Do you like to shop for a car? Do you like to shop for insurance? Do you like to get gas and pay to maintain your car? Do you like to spend your time tethered to the wheel and have that time when you're not enjoying the open road with the top down? Most consumers say they don't like those experiences.

What we see now is a once-in-a-century chance to design a transportation service that gets rid of all those negatives and at lower cost than owning and operating a car, and it's much safer. People loved horses when Henry Ford came along, and people still love horses. No one is going to say you can't drive your car. If you want to do all the things I just described and still drive your car, that's fantastic. I suspect you'll be asked to pay more insurance than what's requested of autonomous cars because they'll



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crash one-tenth as frequently or maybe one-one-hundredth as frequently as you'll tend to crash.

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I loved your story in the book of the first time you rode in an autonomous vehicle and your revelation that this was really amazing.

I first rode in it in late 2010, and now we're eight years past that moment. All the additional things the car can do behind that first moment is phenomenal. But it has to do almost everything, so this is that 99.999 percent tale: If I told you your speech recognition system could identify 99 words out of 100, you'd say, "That's pretty good. I think that'll work." But when we talk about a car, now, that 1 percent is pretty scary. What's fascinating about this journey is that the time it took to go from zero to 90 percent was shorter than the time it took to go from 90 to 99 percent, and that's proving to be shorter than the time it's taken to go from 99 percent to 99.999 percent. This is quite a journey toward nearly perfect, and the progress has been remarkable. I think people are going to love the experience. I really do.

You talked a lot about the fact that this isn't just about autonomous cars. This is about autonomous cars and electrification and mobility-as-a-service all coming together, which seems to say some of these arguments that it's all going to make traffic worse may not actually be true?

There are a lot of people who can't afford to own or operate a car or are too old or too young or not capable of owning a car. They don't have the freedom to go where and when they want to like people who own and operate cars have. We're going to provide transportation services that are better than car ownership has been. I suspect they're going to make more trips, and you can argue that's going to cause more congestion. When you get the crashes out of the system, when you get parking off the street, when you get traffic flowing in a much more uniform way, when you get the intersections, to be much smarter, we're going to have improvements and we can handle more traffic, and we'll have higher capacity.

The other thing that's really important is that you may have read New York City is going to cap the number of Uber and Lyft drivers. That's because they're not optimizing fleet size. If you are in the business transportation services based on autonomous vehicles, you're going to size your fleet to be optimized to be responsive to your customers, get to them quickly, have your utilization really high and your empty miles as low as possible. You're not going to have these extra miles of vehicles driving around looking for business. With all of that combined, I think it's going to be managed just fine.

I'd like to talk about unanticipated consequences—the ones we really believe are going to happen, like getting off of oil for transportation, eliminating 90 percent of crashes, and in your business, reducing the amount of land committed to parking, reducing the cost of travel by more than 50 percent and perhaps as much as 80 percent. Those anticipated consequences are very much worth going after.

People in our industry are shifting, watching this happen, from parking to parking and mobility. What do you think our members' priorities should be to prepare themselves?

The traditional model of parking having to be adjacent to the destination is going to be disrupted considerably. Think about parking for a Walmart store. I worked with developers to develop a piece of land in Florida—and

Larry Burns led a popular TED talk about the future of cars and transportation, available at ted.com.





Waymo's fully self-driving
Jaguar I-PACE electric SUV 4

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There will be different locations for parking, and parking companies will be part of a different service ecosystem that involves recharging the vehicle and maintaining the vehicle. I arrive at work and my car goes to a place to wait for me; maybe it goes to get charged while it waits for me because it knows it needs to recharge. I think you're going to see a lot of the charging happening in a depot-based terminal.

it's a really valuable piece of land—and part of it is a Walmart. The parking lot for the Walmart is twice as big as the land for the store itself. People want the parking to be adjacent, and they want to park as close to the door as they can, and that type of parking assumption needs to be challenged.

Let's say I have an autonomous vehicle. Maybe I didn't buy it, but I'm leasing it for my own dedicated use. I ride from my home northwest of Detroit and the vehicle drops me off at the door of my office building in the downtown area. What happens to that vehicle now? It's mine—it's not part of a shared fleet. I'll have a service standing behind me that will make the right decision on where my car goes and stages itself. Notice I'm using a different word than "parking." So where does it go to wait for me? If it knows I'm going to be in my office for eight hours, it might go four or five miles away to find a place to stage that's lower cost than

the parking garage next door. That tradeoff between the empty miles my vehicle might be willing to travel and the cost of my parking becomes very interesting.

Now, let's say it makes a decision on where to stage itself, and in the middle of the day I realize I forgot to pick up my dry cleaning and I don't want to hassle with it on the way home. So I send the vehicle to pick up my dry cleaning and when it picks me up at the end of my work day, my dry cleaning is there in the vehicle. And then an hour before I go home, I remember I don't have anything at home for dinner and I decide to get Chinese take-out. So I send my car to get that. I might have even dispatched my car to pick up my wife or my mother in law to take them somewhere during the day. So there's this whole question of where does my car go to wait for me? I think it's at the heart of the future of parking.

Then there's the whole other part of this, which is a

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transportation service like Uber without a driver that spends most of its day moving people and isn't going to park much. That's going to fundamentally reduce the need for parking. An analysis in chapter 9 of my book suggests we can get by with 15 percent of the vehicles we have now if we use a shared model. So my premise for parking is No. 1, the need for parking is going to go down in line with the market share of the trips that are in shared vehicles; two, parking doesn't have to be located next door; three, people are still going to be using dedicated vehicles that have to be parked but don't have to be parked on the land or in the way they park now; and four, for cities that have a lot of street parking, sometimes that's the second-biggest source of revenue for a city, so cities have to start thinking about that. I think you're going to see a different kind of parking, which that is my car is parked instantaneously on the roadway for a second and I should pay for that. This whole concept of charging for a space a vehicle occupies, whether it's moving or not moving, becomes very interesting as well.

I think there will be parking. There will be different locations for parking, and parking companies will be part of a different service ecosystem that involves recharging the vehicle and maintaining the vehicle. I arrive at work

and my car goes to a place to wait for me; maybe it goes to get charged while it waits for me because it knows it needs to recharge. I think you're going to see a lot of the charging happening in a depot-based terminal.

Parking is a really important part of this future story. A really important part. People who have a stake in the industry need to anticipate what's coming. I think there will be some big winners, but I think there will be some big losers too. Commercial real estate developers realize the game is changing on parking, and new parking structures are being designed to convert to something else. The whole set of regulations on how many spaces do you need to put in place when you're building condos or apartments is getting a lot of debate right now.

There's also the debate over curb use. How do you share the curbs and manage them so everyone can use them for all of this dropping off and picking up along with other uses?

Hugely important question. People want to be picked up precisely and dropped off precisely. At a shopping center, maybe the driverless cars will stage to the side of a store instead of right at the door. They're not parking right at the curb. Maybe there are a dozen spaces for autonomous vehicles to stage.



Waymo's fully self-driving reference vehicle, Firefly 1

So here's the million-dollar question: When is all of this going to happen?

It's neat that you ask that because that's a climactic point of my stump speech. I ask the audience how many think it's a 2030 story, a 2025 story, or a 2020 story? The audience usually lands at 2025. I position it as a right now. I think the tipping point, the magical moment where the technology is proven to be real, the value customers get from the technology is proven to be real, the opportunity

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Larry Burns to Keynote 2019 IPMI Conference & Expo



Autonomous vehicle expert and author Larry Burns will keynote the 2019 IPMI Conference & Expo, talking about his book, his work in the field, and how parking and mobility professionals can prepare for the next generation of transportation. It's an event you won't want to miss. Visit IPIConference.parking.org to register!

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to make money from that is proven to be real, and companies are allowing it, I think we're in a three- to five-year window. You have to be preparing now. I think parking professionals need to be preparing now. Don't bet the farm, but give that deep insight and take a look and understand what's taking place and the shifts that are happening. Once the tipping point hits, the people who are involved in the industry are going to start thinking differently about those assets. There will be a dramatic impact on valuations.

The tipping point and that three-to-five-year window doesn't mean everybody's going to have an autonomous vehicle in that time. It means smart money is going to accept this at that point, and it's going to influence asset values and land valuations in a big way. If you get behind that eight ball and you haven't positioned yourself to know what you need to be doing, you're going to be left behind. The biggest mistake is to anticipate it happens later and plan that it happens later, and it happens sooner. If you plan for it sooner and it happens later, at least you're prepared.

When do I think you will have a chance to actually hit an app and ride in a driverless car? I think there's a good chance given the importance of some cities, you'll be able to hit an app and get this service in the 2025 to 2028 timeframe. Let's say we wanted to provide 10 percent of the miles in the U.S. in a driverless, shared, electric vehicle. Over 50 percent of the people in the U.S. live in suburbs. So that's 300 billion miles. That would mean about 4 million driverless, shared vehicles being used 75,000 miles a year. That sounds like a lot. But the U.S. auto industry is building 16 million vehicles a year so all I need to have is 25 percent of one year's output in the U.S. industry to cover 10 percent of the miles. Very, very doable.

The next year or two are the final proof points of the technology, the regulators getting comfortable, and then you have to have the hardware that's environmentally rigorous. I think that's very, very possible, and that's why I think it's a right-now story. 