



FEATURE

## The power of “and”

Former GM executive Larry Burns discusses how Detroit and Silicon Valley both look to have critical roles in the future of mobility

Derek Pankratz

Few people are as deeply familiar with both the automotive industry and the technology community as Larry Burns, who spent more than three decades at General Motors, ultimately serving as corporate vice president for research, development, and planning. He is also an academic and a longtime adviser to Waymo, Alphabet’s self-driving car program. Burns’ recent book, *Autonomy*, offers an inside account of the efforts to develop self-driving vehicles.<sup>1</sup> In a wide-ranging discussion, he shared his views about the future of mobility.

**DEREK PANKRATZ:** You’ve been thinking about changes in transportation for a long time. Looking back at what you believed or expected 10 or 15 years ago, what has surprised you?

**LARRY BURNS:** There were a couple of really big surprises. When we finished the [Defense Advanced Research Projects Agency, or DARPA] Urban Challenge in 2007,<sup>2</sup> we asked the head of DARPA, “What’s next?” And he said, “Well, you’ve proven this is viable. It’s really up to the commercial sector to run with it.” So, all of us expected that everyone would be knocking on the doors of these young engineers to go make driverless cars happen—and quite honestly, except for Google launching its self-driving car program in 2009, very little happened. I was really surprised that the commercial sector didn’t jump at it. So, I’d say my biggest surprise was how long it took for a lot of people to accept that this was real and was possible, especially the auto industry, which is so significantly impacted by what’s going on. And now there’s this stampede. Suddenly everybody’s an expert.

One other thing in terms of my own journey. When I left GM, I went to Columbia University and led a program for sustainable mobility. We looked at what you could do with a driverless, electric, shared vehicle model, and the results were pretty remarkable in terms of the number of vehicles required and the cost per mile.<sup>3</sup> But the reality is there are almost 200 million cars and trucks in the United States,<sup>4</sup> and a lot of people who want to have their own. So, I’ve given thought to the idea of an autonomous vehicle that can be personal-use as well as shared-

use, because I think the future is going to be both of those.

**PANKRATZ:** It’s an interesting challenge. I know Deloitte’s surveys suggest that the biggest reservation people have about shared mobility is exactly that: It’s the issue of personal space and not wanting to share a confined area with somebody else.<sup>5</sup>

**BURNS:** I don’t think people will be owning their car like we do today—I expect it will be more like a lease or subscription. If you have an autonomous vehicle for your own personal use, you’ll likely want to be picked up at your door and dropped off at your door. And you won’t want to be hassled with parking your vehicle—you’ll want that vehicle to be smart enough to go somewhere and refuel or recharge and wait for you. I think that vehicle would get a lot more usage than my personal car now: When I arrive at work, it drops me off at the door, and then I could dispatch it in the middle of the day to go pick up my dry cleaning, and I could dispatch it again to go get takeout dinner and then go pick up my kids and then pick me up at work and take me back home. This whole world of a robotic personal valet is very intriguing to me; I think it’s going to eliminate the need for owning a second and third car initially and, ultimately, owning a car altogether.

Some worry that additional road miles from both shared and personal usage will cause more congestion, but for those people who are taking trips they couldn’t before—due to their age or a disability, for example—and are now able to participate more in society and the economy, that’s a good thing. We

should be celebrating those miles. It’s also worth keeping in mind that if vehicles are operated as a fleet, you’re going to be optimizing the use of that fleet. Ride-hailing providers don’t operate like a fleet—they are a bunch of individual agents trying to get matched up with a ride. Our work at Columbia showed that you want to simultaneously have very high fleet utilization and very low *empty miles*—miles with no passengers in the car. The business reality of fleet management will help us on the congestion front.

**PANKRATZ:** I think about that personal-valet model a lot. I live in a fairly rural area in Colorado where a shared fleet model doesn’t seem to make sense. There are all of these small and medium towns where it’s hard to see how you get the utilization to make it worthwhile, so the dedicated-use approach seems natural.

**BURNS:** Fifty-three percent of Americans say they live in suburbs, and 21 percent in those rural towns that you’re talking about, which is a nontrivial slice of the population. And that’s what’s so exciting about the future autonomous electric vehicle market. There are going to be a lot of market segments, and that provides great opportunities for innovative companies to define their brands, find their niches, and deliver real value tailored to those opportunities.

**PANKRATZ:** You briefly mentioned electric vehicles. When you were working on the *AUTO*nom<sup>y</sup> concept car at GM in the early 2000s, you built around hydrogen fuel cells.<sup>6</sup> My impression today is that there is a lot more activity around battery electric vehicles. Any thoughts on the pros and cons of those two different types of power sources and their future prospects?

**BURNS:** If I could change one thing in my public rhetoric in my role at GM, I probably would never have uttered the words *fuel cell*. I would have called it a hydrogen battery instead, because to be honest, they’re very similar. And progress on hydrogen

storage, production, and distribution and fuel cells has been very impressive. Germany just announced that it’s going to have trains operating on hydrogen fuel cells,<sup>7</sup> and there are over-the-road trucks being developed that use hydrogen fuel cells.<sup>8</sup> So I think this is not battery *or* fuel cell. I think it’s an *and*. You’re going to have a lot of synergy in the propulsion system around that *and*; depending on which market you’re dealing with, hydrogen and fuel cells are going to find their role.

**PANKRATZ:** That *and* point is really interesting, because it’s always presented as one versus the other.

**BURNS:** One of my biggest lessons is the power of *and*. A lot of business leaders get trapped thinking they have to select between A or B. And they forget to ask the question, “What about A *and* B?” What I have found over the years is that “A and B” often beats A or B by themselves. I think it’s hugely important to find the power of *and*.

**PANKRATZ:** Another topic that’s often posed as a dichotomy: the role of vehicle-to-vehicle [V2V], vehicle-to-infrastructure [V2I], and vehicle-to-everything [V2X] communication. Some people say it’s critical and we’ve got to have it in some form. Others say it’s actually superfluous, or that it would be nice to have but is too expensive and takes too long to build out, so we’re going to keep everything onboard the vehicle.

**BURNS:** It’s another beautiful example of the power of *and*. For two cars to talk to each other, both need to have enabling hardware and communications technology. For V2I, the infrastructure is pretty expensive to deploy. But in time, as we get to Gen-2, Gen-3 autonomous systems, I think you’re going to see V2V and V2I become a way to reduce cost and perhaps even improve performance. I’ve learned to never rule out any technology. I dedicated my book *Autonomy* to engineers. Engineers make what’s possible real; that’s what we do.

**PANKRATZ:** Let’s talk about yet another apparent binary choice between developing advanced driver assist features like automatic emergency braking or lane departure correction, and aiming for “fully” autonomous systems that don’t anticipate a human taking control. How do you see Level 2 and 3 automation playing into this whole picture?<sup>9</sup>

**BURNS:** I’ve been an adviser to Waymo, Google’s self-driving car project, since January 2011, and they made a really important decision that they were going to develop autonomous systems for only where there’s no human involved at all. If our goal is to eliminate over 90 percent of crashes, we really need to go for Level 4 and Level 5, full autonomous. I believe the right thing to do is to get the driver out of the loop altogether: The situational-awareness chal-

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lenge of asking someone to reengage in the driving task when they’ve been sitting there not driving for 20 or 30 minutes is a tougher problem to solve than getting the system to autonomously handle 99.99 ... percent of the stuff that happens in the world. With that said, I think it’s useful to be developing emergency braking systems, full-speed adaptive cruise control, lane keeping, stability control. That’s been good for safety purposes. But at the end of the day, I believe the objective should be to get to Level 4, starting in a geo-fenced area that’s big enough to have commercial value.<sup>10</sup>

**PANKRATZ:** It seems safe to say that you’re a believer in the opportunities around autonomous vehicles. What do you see as the biggest hurdles

to widespread adoption? Is it technological, social, regulatory, or something else?

**BURNS:** My biggest fear is that people will make premature judgments about what we’re doing, whether out of fear or just not knowing. Have you had a chance to ride in a driverless car?

**PANKRATZ:** I have.

**BURNS:** So, you have a different experience than someone who hasn’t. My first ride on public roads was in late 2010. I engaged the system. My hands were shaking over the steering wheel. My feet were nervous over the pedals. But within five minutes, I was relaxed; I realized this car was doing everything I would do as a driver and even better. And I suddenly realized I had no desire to change lanes and try to get ahead of somebody in front of me because I had my time to myself. I think this is all about people understanding what’s possible in their lives and what’s possible with the technology. I worry about people coming to a premature judgment and therefore resisting. And I very much worry about players who have a strong vested interest in the existing roadway transportation system.

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**PANKRATZ:** It’s another *and* moment, although maybe one that could slow progress. You can imagine hesitation or uncertainty by the public combined with a variety of vested interests that are able to capitalize on a moment where there’s no broad popular support.

**BURNS:** It’s going to play out with a tipping point. There’s this tendency to want to look into the future to know how big it’s going to be and when, to predict market shares and penetrations. That’s impossible. I focus more on that magical moment when market value exceeds price and price exceeds cost. The technology is proven, the customer value is proven, the business opportunity is proven, the regulatory barriers are not there, and it becomes clear this is now just a question of scaling through a series of generational deployments. That magical moment is within a three-to-five-year window, unless these vested interests push back so hard that they slow things down.

**PANKRATZ:** Related to the hurdles, I’m personally very interested in the psychology or sociology of car ownership, particularly in the United States. Car culture is deeply embedded in a lot of places. The car is more than just a way to get around—it’s a longstanding symbol of who we are and who we want to be.<sup>11</sup> Is that a significant barrier?

**BURNS:** Another very good question. I think about it through the lens of my two daughters, who are 30 and 27. My coming of age was when I got my driver’s license and my first car. Their coming of age was their first cellphone, not their first car. Over the last 10 or 15 years, I’ve asked them what would you give up first—your cellphone or your car? And they say they’d give up the car before they’d give up their handheld device. Younger generations are expressing themselves in a much different way than just through car ownership.<sup>12</sup>

**PANKRATZ:** What about some of the nightmare scenarios or unintended consequences of these new mobility innovations? Many cities are already dealing with an influx of ride-hailing vehicles, and you mentioned sending your self-driving car to pick up your dry cleaning. You’ve done detailed modeling on a number of cities looking at what shared autonomous vehicle adoption could look like. Any insights?

**BURNS:** At Columbia, we asked the question: “To make all the one- or two-person trips that automobiles currently make, how many tailored-design driverless electric vehicles would you need?” In city after city that we studied, you could replace all of the cars with a fleet that’s 15 percent the size and still make all the trips that are being made. In simulations, those vehicles were picking people up in two to three minutes. We had empty miles on the order of 5 percent of loaded miles. How? It has to do with population density. In cities like Ann Arbor, the probability that somebody is requesting a trip nearby just as I am being dropped off is pretty high. So, a properly managed, optimized fleet would take a lot of cars out of the system.

Now, not everybody’s going to want to share a car. I accept that. Let’s say I’m at home cooking dinner for friends, and I realize I forgot to buy wine. I dispatch my personal robotic valet to the wine store to pick up the wine and come back. Would you call that an empty mile? I still would have made that trip driving my own vehicle. Today we have a system that is not optimized for fleet utilization. It just isn’t. But if you’re in the fleet business providing transportation services, a penny per mile really matters.

**PANKRATZ:** We’ve largely been focused on the movement of people, but there are big changes happening with the movement of goods as well.

**BURNS:** There are really two big opportunities with goods movement, and we may see commercially viable businesses at meaningful scale sooner with goods movement than people movement. The first opportunity is in long-haul trucking. The most recent numbers from the American Trucking Association indicate that an average driver makes about 73 cents a mile, wages and benefits.<sup>13</sup> That’s 47 percent of the cost per mile for over-the-road trucking. But not only would self-driving trucks save the 73 cents a mile—you have the opportunity to expand your daily service area because you don’t have driver work rules; an autonomous tractor could conceivably go 24/7 or 23.5/7 based

on maintenance. That’s really important for e-commerce. And when you think about all of the parts on a tractor that are there because there’s a driver—the windshield, doors, side windows, seats, air-conditioning, heating, driving controls—it’s easy to convince yourself that the pile of parts you no longer need will cost more than the parts you’re going to add to make the tractor autonomous.

On the other side is package delivery, and it becomes even more interesting when the vehicles doing local package delivery can be the same vehicles you’re using for moving people around, and they can have different temporal patterns throughout the day. Maybe more of the packages are getting delivered at night. That might improve fleet utilization and congestion in urban areas.

**PANKRATZ:** Speaking of urban mobility, we talked about autonomous vehicles and changes to the car. We’re also seeing other kinds of micro-mobility popping up: bikesharing, e-scooters, micro-transit vans. How do you see those fitting into a world of shared autonomous fleets?

**BURNS:** Well I think it’s that key word again: *and*. This isn’t about picking one winner to replace the more than one billion cars in the world. I’m very excited by all of those modes that are cropping up, and I think they’re going to be enhanced by the ability to seamlessly interface with them via apps. My long-term vision is for one totally integrated transportation system where you’re able to coordinate the movement of people and goods using these different modes in a seamless way. Deloitte is doing some important work on that, and I think that’s where this is headed.

**PANKRATZ:** We’re pretty bullish on the idea of digital mobility platforms for cities.

**BURNS:** I think you should be.

**PANKRATZ:** We’ve talked here about some pretty momentous changes unfolding. What does all of

this mean for players in various industries? You’re in a somewhat unique position in that you’re a long-time veteran of the automotive industry and also been closely involved with one of Silicon Valley’s most prominent projects in this area.

**BURNS:** The original subtitle for the book *Autonomy* was “The race to build the driverless car and how it will reshape our world.” Our editor suggested we change the word *race* to *quest*. It seems like a simple change, but we kicked off the book with a sense of Silicon Valley versus Detroit, and by the end of the book it’s Silicon Valley *and* Detroit. The tech community has brought enormous insight and value; they have been the catalysts to bring this change about. But in those early days, those tech players were not fully appreciating how hard it is to design, engineer, validate, and manufacture a car at the scale at which the auto industry operates. What’s reassuring to me now is that the auto industry is working with Silicon Valley on their autonomous R&D. And Silicon Valley has turned to the auto industry for the kinds of vehicles they need to keep learning. So, I think you’re seeing it as an *and*.

People ask me a lot, “Who’s going to win?” I think you’re going to see an ecosystem emerge not unlike the one that emerged with the internet. I’m not at all convinced that there’s going to be a single vertically integrated player that emerges from this that can do the driving system, the vehicle, the transportation system operations, the brand building, and all of that. I think you’re going to see quite a bit of codependency emerge. But those who become dominant in certain parts of that ecosystem could do really well.

**PANKRATZ:** *And* does seem to be the theme of a lot of things happening in mobility. Let’s focus in on the automotive industry. If you were in an automaker’s shoes today, what do you think they should be doing to be ready for the future to best position themselves?

**BURNS:** They’re in a tough position because they have to continue to keep their legacy business viable while trying to pivot to these new businesses where they don’t have the core competencies and they don’t have infinitely deep pockets. That’s a really, really tough puzzle to solve.

With all of that said, autonomous vehicles won’t work without the vehicle, and the vehicles are hard to do. I think the big concern for the industry is that those vehicles are going to become more commodity-like. The engineering of the vehicle becomes much simpler down the road when it’s electrically driven, doesn’t require a human driver, and you get most of the crashes out of the system. And I don’t think the differentiator in the market is going to be chrome and fenders and fascia and the shape and the color. It’s going to be very much the overall experience that customers have, and that experience is going to be determined more by software and data and analytics than the traditional basis of competition in the auto industry. There are going to be some really tough portfolio decisions. Which parts of the traditional business do I want to hang with? Where is the profit? How do I pivot to this future of mobility that we’re talking about today? Can we attract the best talent to play in that race? Bottom line: The traditional players in the century-old roadway transportation system, including auto, energy, insurance, and finance companies, must get in front of the inevitable and make hard choices on “where to play” and “how to win” in the future.

**PANKRATZ:** You’ve neatly framed the challenges of balancing today’s business with tomorrow’s needs. When you think about the future of mobility, what’s your greatest hope?

**BURNS:** My greatest hope is that we realize what I call the age of *automobility*—a convergence of autonomous electric vehicles deployed in transportation services—as fast and as soon as we possibly can with appropriate risk management. We shouldn’t lose sight of the fact that this is a once-in-a-century opportunity to simultaneously deal with 1.3 million fatalities worldwide per year on roadways, to deal

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with congestion, to deal with dependence on oil in transportation, to deal with the land use that comes with three parking spots per car in the United States, and to deal with equality of access. The deaths and injuries from crashes alone—it’s epidemic in scale. If I just created a cure for cancer and it held promise to save a lot of people with cancer but some could still die from the treatment, I think we’d get on with it; we’d find a way to manage that. We ought to look at autonomous vehicles as a cure for the roadway transportation epidemic and think about their deployment the way we test and deploy vaccines.

So, I have this fixation: I want to get to the anticipated benefits. This convergence of technology and business models really can have a significant, meaningful impact and bring more transportation services at lower cost to more people. There’s an opportunity to have radically better services at radically lower consumer and societal costs.

## Endnotes

1. Lawrence D. Burns with Christopher Shulgan, *Autonomy: The Quest to Build the Driverless Car—and How It Will Reshape Our World* (HarperCollins, 2018).
2. The Urban Challenge was a 2007 competition sponsored by the Defense Advanced Research Projects Agency in which teams had to construct an autonomous vehicle able to navigate an urban environment, including merging, passing, parking, and crossing intersections. DARPA, “Urban challenge,” accessed October 15, 2018.
3. For instance, see Benjamin Zhang, “This study revealed the staggering potential of self-driving cars,” *Business Insider*, June 2, 2014.
4. Bureau of Transportation Statistics, “Number of U.S. aircraft, vehicles, vessels, and other conveyances,” accessed December 10, 2018. Number cited is for light-duty vehicles, short wheel-base, 2016.
5. Deloitte Global Automotive Consumer Study 2019, forthcoming.
6. “AUTonomy” was a GM 2002 concept vehicle built around hydrogen fuel cell motors, drive-by-wire technology, and a skateboard-like chassis. See Burns and Shulgan, *Autonomy*.
7. AFP, “Germany rolls out world’s first hydrogen train,” *France 24*, September 17, 2018.
8. Kristin Lee, “Toyota’s new hydrogen fuel cell truck has a 300-mile range,” *Jalopnik*, August 1, 2018.
9. The Society of Automotive Engineers has identified five levels of vehicle automation, which the National Highway Traffic Safety Administration (NHTSA) subsequently adopted. See the NHTSA, “Automated vehicles for safety,” accessed December 12, 2018.
10. David Roberts, “Here’s how self-driving cars could catch on,” *Vox*, May 9, 2018.
11. Robert Moor, “What happens to American myth when you take the driver out of it?,” *New York Magazine*, October 17, 2016; Brandon Tensley, “How will pop music adapt to autonomous cars?,” *Slate*, March 15, 2018.
12. Millennials may be only delaying car purchases rather than eschewing them, but their attitudes toward driving do seem distinct from those of previous generations. See Henry Miller, “How traveling by car is changing under millennials,” *Matador Network*, January 22, 2018; Mary Wisniewski, “Why Americans, particularly millennials, have fallen out of love with cars,” *Chicago Tribune*, November 12, 2018; and Kevin Drum, “Raw data: Kids and their cars,” *Mother Jones*, May 12, 2018.
13. American Transportation Research Institute, “An analysis of the operational costs of trucking: 2018 update,” October 2018.



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