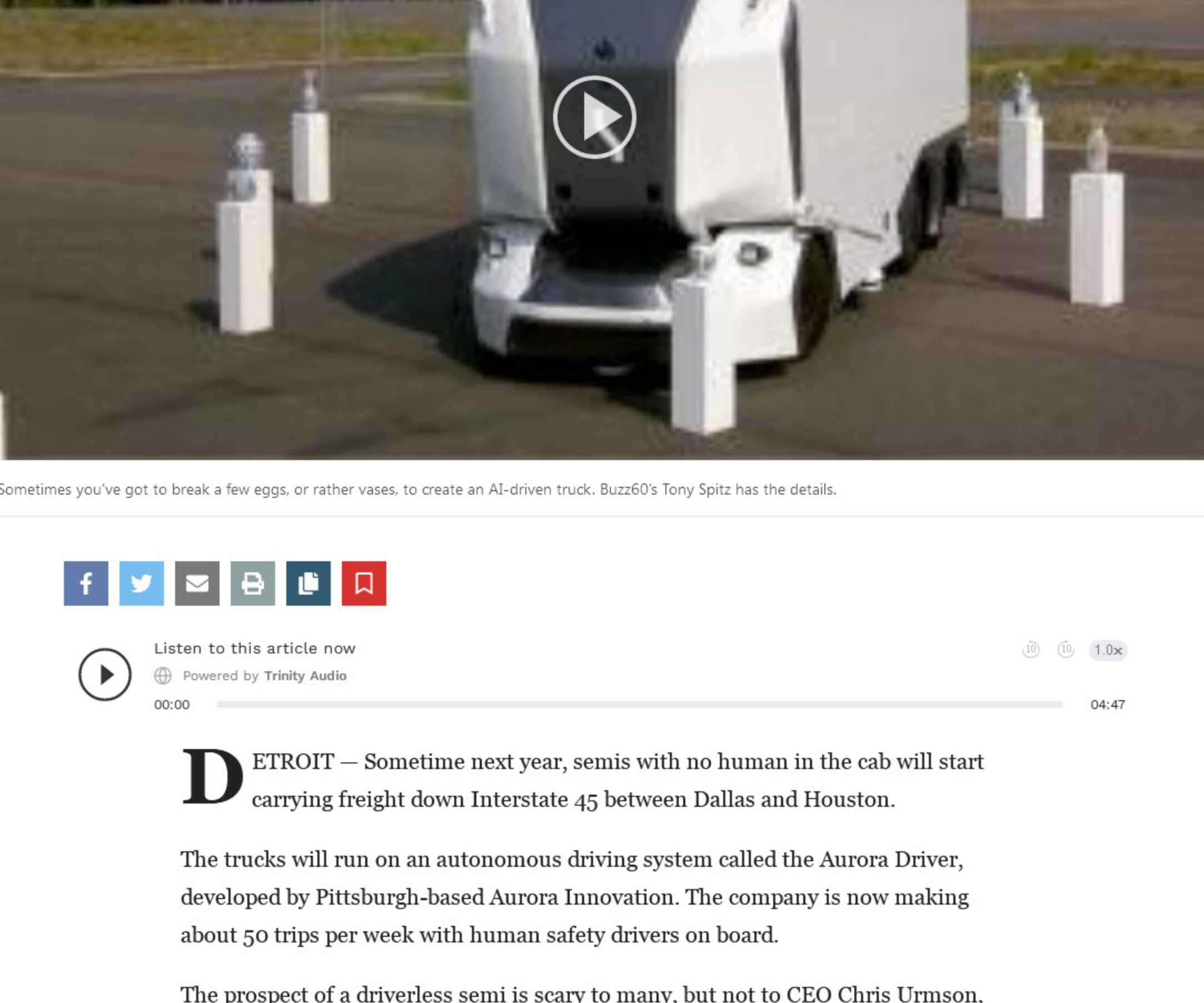


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Insider Q&A: Aurora CEO Chris Urmson on self-driving trucks

TOM KRISHNER Associated Press May 4, 2023 0



Sometimes you've got to break a few eggs, or rather vases, to create an AI-driven truck. Baidu's Tony Spitz has the details.



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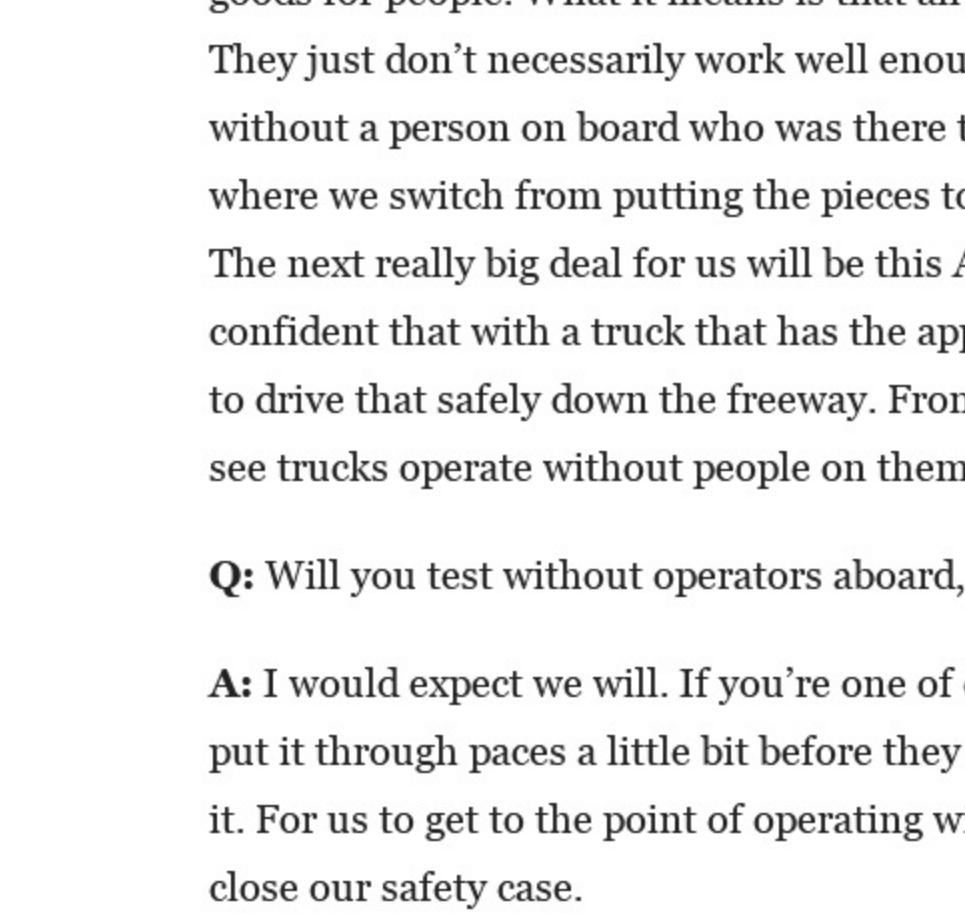
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DETROIT — Sometime next year, semis with no human in the cab will start carrying freight down Interstate 45 between Dallas and Houston.

The trucks will run on an autonomous driving system called the Aurora Driver, developed by Pittsburgh-based Aurora Innovation. The company is now making about 50 trips per week with human safety drivers on board.

The prospect of a driverless semi is scary to many, but not to CEO Chris Urmson, who helped to build Google's autonomous vehicle unit. Urmson, 46, co-founded Aurora in 2017.

He spoke with The Associated Press about the future of autonomous vehicles. The interview has been edited for length and clarity.



Chris Urmson is CEO of self-driving vehicle technology company Aurora Innovation.
Aurora Innovation via AP

Q: Aurora has said its driving system is now "feature-complete." Does that mean you're close to putting trucks on the road without humans inside?

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A: Over a year ago, we laid out how we were going to get from there to actually having these trucks on the road with nobody on board as they drove safely, full of goods for people. What it means is that all of the parts of the system are in place. They just don't necessarily work well enough yet that we would trust it to operate without a person on board who would be there with rare events. It's this moment where we switch from putting the pieces together to refining and validating the stuff. The next really big deal for us will be this Aurora Driver-ready milestone where we're confident that with a truck that has the appropriate redundancies, that we'd be able to drive that safely down the freeway. From there we're off to the races, starting to see trucks operate without people on them.

Q: Will you test without operators aboard, without carrying freight?

A: I would expect we will. If you're one of our customers, they're going to want to put it through paces a little bit before they put their brand stamp of approval on it. For us to get to the point of operating without that person on board, we want to close our safety case.

Q: To many, the sight of an 80,000-pound semi with no human driver is pretty scary. How would you address those fears?

A: We've used machine learning, artificial intelligence, to teach them how to drive the way that a good human driver does. If you're just observing the truck and you're passing it, you probably don't notice. There are so many opportunities in bringing this technology into freight. While it's an incredibly important job, and it's one where I have a ton of respect to the people who do it, it's a really difficult job. The likelihood of dying as a truck driver on the job is 10 times more than the average American. On many long-haul trips, drivers have to sleep away from home. They don't get to spend time with family. It takes a toll on their quality of life. So there's an incredible opportunity to make goods move more safely, to make them more efficient and more cost-effective.

Q: Can you control the trucks remotely if needed?

A: When the truck is driving down the road, it needs to be able to operate safely with or without those remote support people. But there are things that the human mind looks at where it's very easy to understand. Encoding all of those possible things in software is really hard. As we deploy the Aurora Driver, it'll always operate safely, whether that person is there or not. But it can ask for help.

Q: You have said that eventually your trucks are going to hit something. How would you allay fears about that?

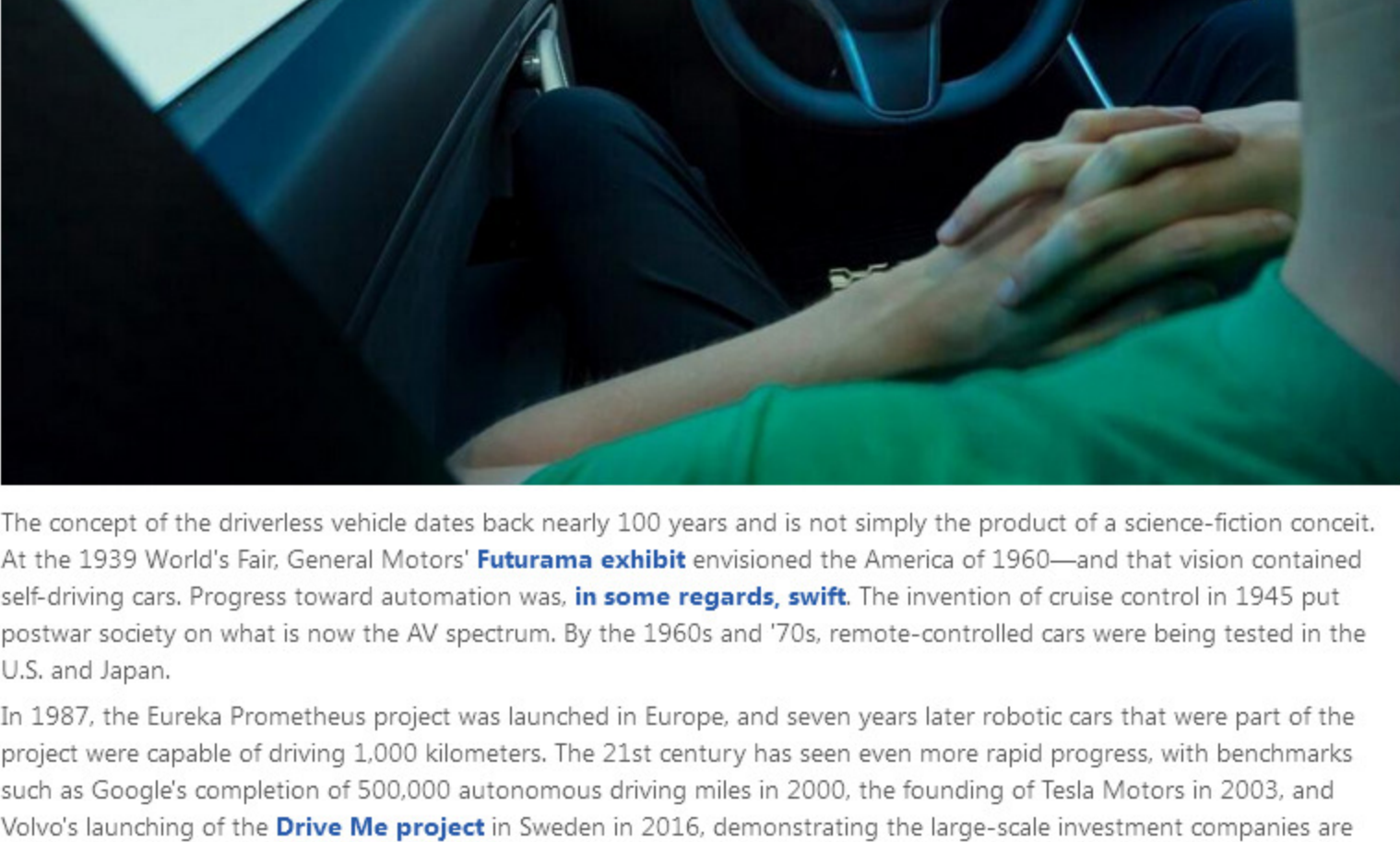
A: It's important to recognize that trucks are involved in something like a half million accidents here today. So we expect to reduce that number. These trucks will be sharing the road with people, and people will do unexpected things. We'll do everything we can to make these vehicles are safe. We'll have a level of confidence on the way this thing's going to behave that will be unprecedented.

Q: Teslas on either Autopilot or "Full Self-Driving" using only cameras have crashed into emergency vehicles, motorcycles and other things. Why should we trust you folks when this keeps happening with other vehicles?

A: They aren't really self-driving vehicles. They're kind of being branded in a way that maybe is a little bit misleading. We've believed for a long time that using a combination of laser, radar, cameras — inventing our own even more capable long-range lidar (Light Detection and Ranging) — that increases the robustness of the system. The likelihood that you miss something becomes vanishingly small. You had to think about how the different sensors might fail and how you can use different sensors to complement the weaknesses and augment the strengths of one another so that you can actually be robust in challenging situations.

Self-driving trucks, AI, and the difficulty of forecasting the future of trucking

Self-driving trucks, AI, and the difficulty of forecasting the future of trucking



Despite the intention on driverless cars that promise to take us to work while we snooze the use of autonomous vehicles for large-scale freight operations has steadily gained traction over the last 20 years. Many experts believe that the first at-scale deployment of autonomous vehicles on AI technology will occur in freight and logistics. Autonomous driving is a concept that isn't easy to define—let alone develop. In fact, there are **at least five different levels** of autonomous driving as outlined by the Society of Automotive Engineers. These range from no automation whatsoever (level 0) to full automation (level 5), where there is no human involvement in a vehicle's operation. The **driving levels** are designed as benchmarks for the incremental development of driverless technology, as well as a fairly strict method of communicating complex mechanical processes to the average person.

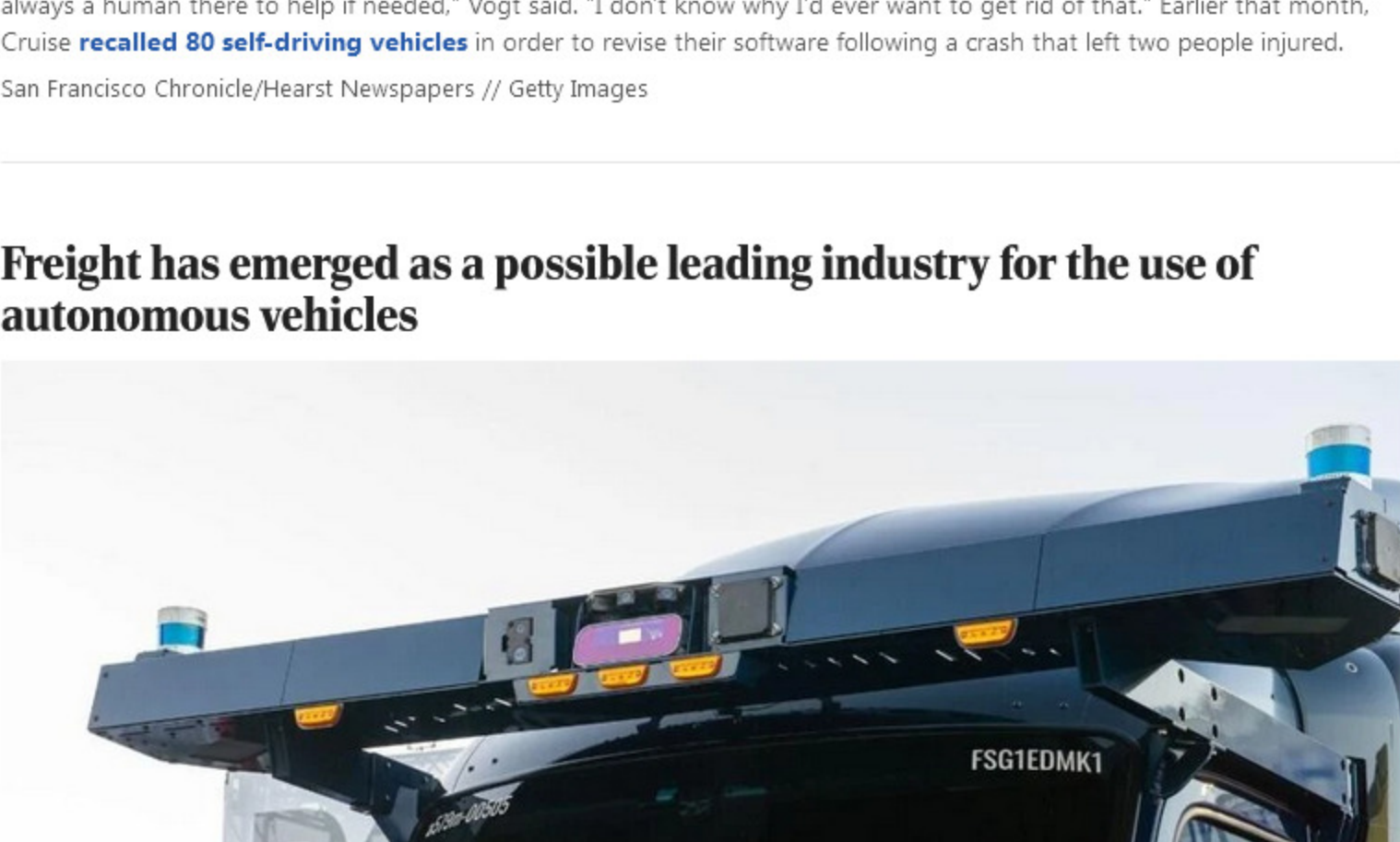
At present, in U.S. mainstream production, the highest level that has been achieved is level 2, which involves advanced driver assistance systems, which have become standard in most new-production consumer vehicles. Some examples of ADAS systems include parking assistance (such as a car being able to parallel park itself), proximity and pedestrian detection, and automatic braking assistance.

There have, however, been some growing pains in the development of autonomous vehicle technology, most recently involving Tesla. Several reported malfunctions and other issues associated with the automaker's Autopilot system have led to an investigation by the National Highway Traffic Safety Administration. The company is also facing a **class-action lawsuit** for claiming that its Autopilot and Full Self-Driving features were fully functioning driverless technology.

While there is much promise in the future of autonomous vehicles in trucking—driverless freight vehicles are **currently operating** in states like California and Texas—it is also important to consider the potential impacts, both positive and negative, on the industry. **TruckInfo.net** gathered information from the **Future of Autonomous Vehicles report**, online technology resources, online freight news resources, and other sources to compile a list of key points regarding the future of automated technology in the trucking industry.

Keep reading to learn more about how automated vehicle technology may change the future of trucking.
Andrey Sokolov/picture alliance via Getty Images

Defining autonomous driving and the autonomous driving levels



While the concept of autonomous driving may sound like it's one thing—a vehicle that can drive on its own without a human driver's input—the reality is that there isn't just one type of self-driving vehicle, nor is there one type of autonomous driving. Rather, there are a variety of automation levels that determine what the degree of autonomous operation a vehicle is capable of.

The six autonomous driving levels as defined by the Society of Automotive Engineers are as follows: Level 0 offers no driver assistance; level 1 offers driver assistance through a single feature, such as a cruise control; level 2 employs ADAS systems; level 3 provides conditional automation by which the vehicle can perform most driving tasks but still requires human oversight; at level 4 the vehicle performs all driving operations under specific circumstances, though environmental infrastructure such as geofencing is required; and finally, level 5 is full automation where the vehicle is in complete control with zero human action necessary.

Level 1 automation has actually existed since the 1940s, when cruise control was introduced. The vehicles being tested in California and Texas are at level 2 automation, which requires a rotating team of human operators to be present and alert at all times.

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From self-steering to false claims of autonomy, the history of robot cars is full of turbulence



The concept of the driverless vehicle dates back nearly 100 years and is not simply the product of a science-fiction concept. At the 1939 World's Fair, General Motors' **Futurama exhibit** envisioned the America of 1960—and that vision contained self-driving cars. Progress toward automation was, **in some regards, swift**. The invention of cruise control in 1945 put positive society on what is now the **AI spectrum**. By the 1960s and '70s, remote-operated cars were being tested in the U.S. and Japan.

In 1997, the **Autonomous Promethus** project was launched in Europe, and seven years later robotic cars that were part of the project were capable of driving 1,000 kilometers. The 21st century has seen even more rapid progress, with benchmarks such as Google's completion of 540,000 autonomous driving miles in 2009, the founding of Tesla Motors in 2003, and Volvo's launching of the **Drive Me project** in Sweden in 2016, demonstrating the large-scale investment companies are now willing to make to develop autonomous driving technologies.

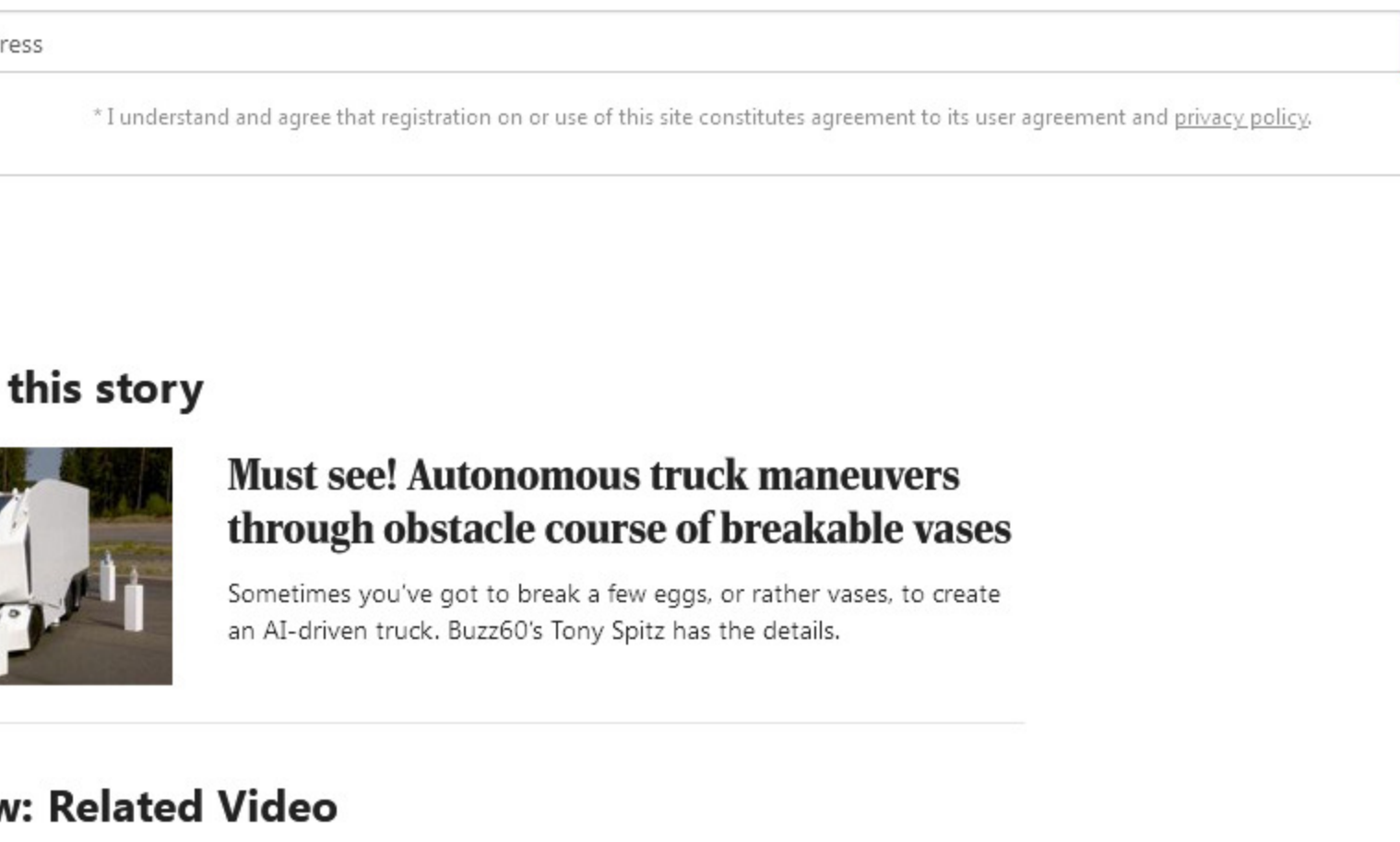
Not all has been sunny. Despite the fact that Tesla is the top-selling electric vehicle in the U.S. and has one of the most advanced ADAS systems in commercial production, the promotion of its Autopilot system has gotten the company into some very hot water with consumers. A 2022 **class action lawsuit** filed in California accused Tesla of misleading the public when it came to its "Full Self-Driving" technology.

According to a **press release** from the law firm that filed the suit, Tesla has been misleading the public "since at least 2016" through marketing materials that made it seem as though the company's driver-assist technology was already fully or nearly autonomously functional. A marketing video released by Tesla that showed a vehicle driving itself turned out to **have been doctored**. It failed to show all of what had been filmed, including when the vehicle crashed into a barrier. The lawsuit has triggered National Transportation Safety Board and National Highway Traffic Safety Administration investigations, as well as investigations by other regulators.

In July 2022, the California Department of Motor Vehicles **filed a motion** against Tesla for making misleading statements about its Autopilot and Full Self-Driving features. The complaint seeks to suspend or revoke the automaker's dealer and manufacturing licenses, as well as possible restrictions.

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Current sentiment towards vehicle autonomy is mixed after many delayed deployment dates



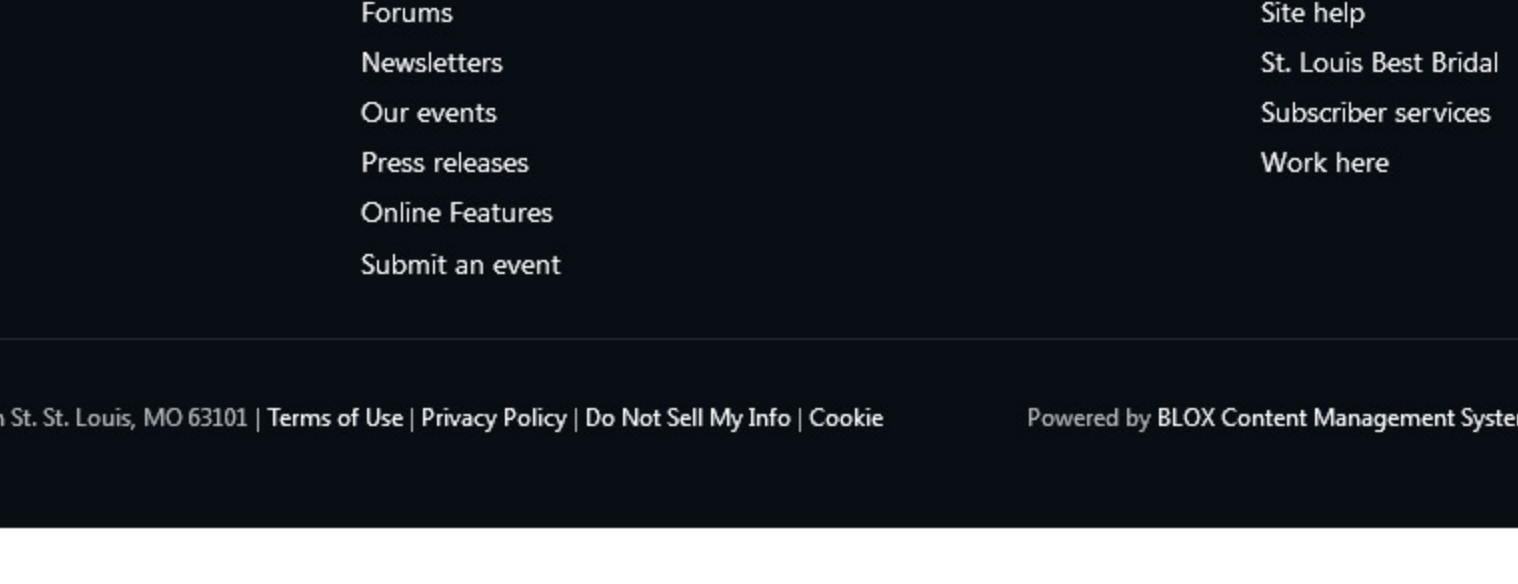
The Future of Autonomous Vehicles report cited a **marked change** in the stance taken by a variety of key influencers in the **AI space** with regard to deployment speed between 2018 and 2019, the year in which many in the industry initially believed **AI technology** would be production-ready. While confidence still remains that the overall direction of development is sound, uncertainty is greater when it comes to how quickly widespread impact will occur and how to get to the point where autonomous driving is readily available for the consumer marketplace.

An updated timeframe for deployment remains murky. A 2022 report estimates that the **commercialization of driverless cars** will likely not happen before 2030—and that date may even be unrealistically optimistic. While AI systems have needed billions of dollars to develop new technologies, skepticism remains with certain major automakers as to the ultimate value of taking the human driver out of the equation altogether.

Speaking with Reuters in Sept. 2022, John Kagi, CEO of General Motors' AI development entity Cruise, fell short questioned why human oversight should ever be removed. "I can provide my customers peace of mind knowing there is always a human there to help if needed," Kagi said. "I don't know why I'd ever want to get rid of that." Earlier that month, Cruise **rescinded its self-driving vehicles** in order to review their software following a crash that left two people injured.

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Freight has emerged as a possible leading industry for the use of autonomous vehicles



The first autonomous truck journey in history was a **beer run**. In 2016, a self-driving Volvo truck, without a human driver in the cab, drove 120 miles down I-25 in Colorado and safely delivered more than 5,000 cases of Budweiser. The truck received assistance from a professional driver only to enter and exit the highway—during the long haul, it operated entirely on its own.

Currently, autonomous trucking doesn't yet mean that there are trucks out bombing down the road with no driver in sight; instead, trucks are equipped with ADAS systems that include self-driving features such as automated gear shifting, cruise control, radar and power steering. Drivers still have to remain in the cabin and know how to use the technology in order to take control in the case of emergency or malfunctions.

The presence of these autonomous trucks on the road is expected to increase in the coming decade as further testing is completed. In fact, the development of AI tech for freight trucks is looking like it will outpace that of passenger vehicles. Autonomous freight truck solutions provider TuSimple expects its autonomous freight-truck technology to be operational by 2024. The company recently went public and plans to use the infusion of cash its public offering has provided to take its current level 4 tech up to level 5 full autonomy. More than 5,700 vehicles have already been put on order from the company by shippers and carriers.

While all this will have to operate within existing infrastructure, it is believed that freight hauling is the most likely means of **seeing new tech** hit the road early, not only because the trucking industry has a significant commercial interest in implementing it but also because of how autonomous technology interacts with the surrounding environment.

Many ADAS systems employ a combination of sensor and radar technology to detect the proximity of other vehicles on the road, as well as pedestrians, bicycles, and stationary objects near the roadway such as power lines. Autonomous technology uses laser, which creates a **three-dimensional map** of the surrounding environment, taking into account each and every object within its scope with laser precision. Lidar mapping is a constant send-and-receive process of millions of light pulses per second.

Because the amount of information an AI will have to send, receive, process, and maintain in real time is so incredibly complex, more widespread adoption will likely begin in freight hauling simply because most of these vehicles' driving environments tend to be "simpler" than those of the average passenger vehicle—multi-lane highways with consistent lane widths and clear striping, few if any pedestrians, and readily identifiable ingress and egress points, as opposed to the relative urban or suburban traffic congestion by your average errand-running sedan.

This technology could also mean much shorter long-haul journey times, which will result in significant time-dollar savings, as well as improved fuel economy. Several truck manufacturers and startups—including Volvo, Traton Group, PACCAR, Daimler, Proton, and Freight Trucks—have all started to get involved in the automation of trucks.

Andrey Sokolov/picture alliance via Getty Images

The future impacts of self-driving trucks are uncertain

Trade-offs in job losses versus job gains related to automation are hard to predict. Over time, automation tends to **create as many jobs** as it takes away—though the jobs it creates can be significantly different from the ones that it replaces. When workers use machines, they're able to produce more of a product in the same amount of time and usually for a lower cost. The additional supply and affordability of the product usually lead to consumers buying more of it, which can lead to the creation of more new jobs; however, workers that do by hand what machines do automatically can end up replaced by them.

In the trucking sector, it is not as simple as self-driving trucks cutting out the jobs of truck drivers, though the introduction of self-operating freight vehicles would have an effect on the number of trucking jobs available and, perhaps more importantly, the number of hours available to those workers.

A March 2022 study published in **Humanities and Social Sciences Communications** looked at what the possible effect would be on driver hours from the automation of AI on long-haul portions of freight routes. The study considered the transferable model, which has been suggested by supporters of AI integration as a solution to concerns over a diminution in truck operator employment levels. The model is set on the idea that "operationally less complex highway driving is automated, while human drivers drive the more complex urban segment of the route." Researchers conducted that with nationwide adoption, 94% of all long-haul operator hours would be impacted. Plus, the suggestion that a greater number of short-haul hours could make up for the long-haul hours lost due to a significant increase in overall shipping volume was unlikely.

The American Trucking Associations reported an **operator shortage of 80,000**—a number that could climb to 160,000 by the decade end. That fact shades concerns that AI trucks could eventually make certain jobs obsolete in the industry, namely those of driver-operators. But even with on-road testing of autonomous trucking technology accelerating ahead of that in commercial passenger vehicles, the road toward ubiquity is a long one, and trained driver-operators will be a necessary part of freight and logistics for the foreseeable future—no matter how that **ATA's recommendation** for the nationwide driver shortage is not bigger investment in new tech, but the hiring of 1.1 million operators over the next decade.

The Future of Autonomous Vehicles report makes a **crucial point** that would seem to buoy the ATA's position. AI's will be expensive, initially at least, and their implementation will only be viable if there is high utilization—which means both the technology and the surrounding infrastructure must be ready for them. With the U.S. facing a \$786 billion **road and bridge capital needs backlog** in order to achieve a nationwide state of good repair, it would seem that, regardless of advances in technology, there is as yet no substitute for the well-trained driver-operator.

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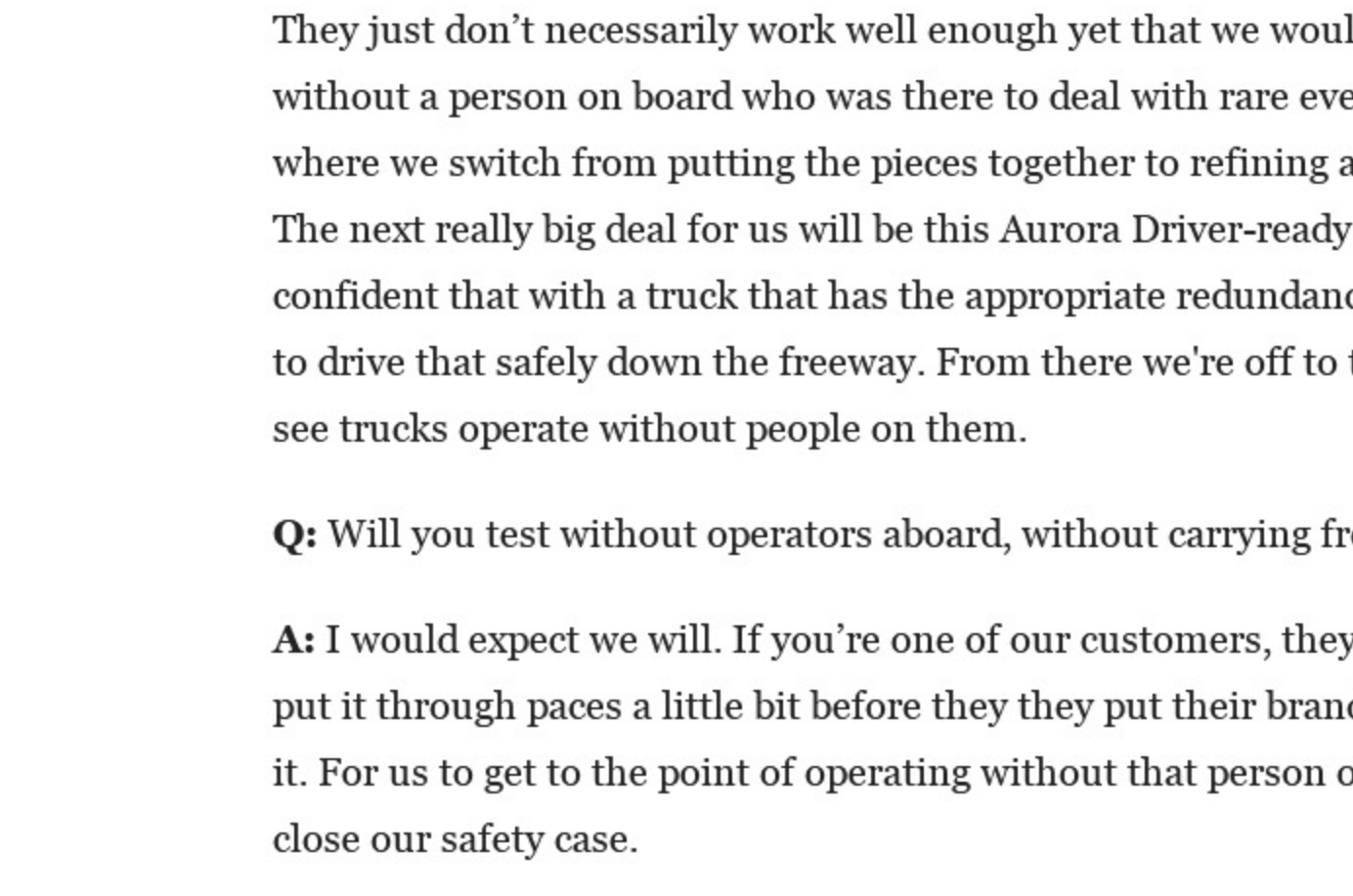
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