**As more driverless cars hit the road there are still a few kinks to work out**

I didn't think I was gonna be so terrified. But as I watched a steering wheel turn and felt the car accelerating I was really wishing there was somebody in the driver's seat.

I had just hopped into a fully autonomous vehicle from the company Waymo. An experience akin to using an iPhone for the first time. But instead of figuring out how to swipe on a screen, I was putting my life into the hands of a robot and hoping it knew what it was doing.

The whole experience felt similar to an Uber ride. On an app I chose a destination, and then I waited for a vehicle to be assigned. When my car arrived 12 minutes later I unlocked its doors through the app and got in. I put my seatbelt on and started driving.

While this was a foreign concept to me, vehicles from companies like Waymo, Cruise, and Zoox have been on the roads in San Francisco testing since 2018. From December 2022 to November the 1,603 autonomous vehicles operating in the state of California logged 9,068,861 miles.

While each company uses its own proprietary technology these vehicles all have a similar model that allows them to operate safely.

“They have a series of sensors that help build in redundancy, but also provide a wide range of visibility out on the roadway,” said Eric Jackson, the executive director of the Connecticut Transportation Institute and Connecticut Transportation Safety Research Center.

Three main components constantly communicate with each other. A camera system that can be either black and white or full color is constantly scanning the road. Next, radar systems can see in situations like fog and darkness where cameras may have obstructed views.

Then there is lidar. It sends out pulses of laser beams that then bounce back to the car creating a 3D of the roadway they are driving down.

Put together these systems give the vehicle a 360-degree audit of its surroundings. Then machine learning and AI algorithms use that, and data from millions of miles on the road to classify different objects that are on the roadway.

That's how my driverless taxi knew how to stop at red lights and change lanes seamlessly. I was in awe at how good of a driver it was. Then I hit a rather weird point in my ride. In the middle of an intersection, my car just stopped for ten seconds.

We had a green light and there was a car waiting to make a turn that would not impact our right of way. After a few honks from the car behind us, and after the other car left the intersection, the car continued on the route.

“A lot of the vehicles themselves will have what's called a safe mode that if they encounter a situation where they cannot move or cannot process the information, they'll go into this lockdown safe mode,” Jackson said.

This safe mode procedure has been one of the biggest frustrations for responders in San Francisco. In August of 2023, California's Public Utilities Commission approved an expansion of autonomous vehicle access in California. The city's fire and police departments strongly opposed the decision.

The fire department compiled a list of [55 instances where their operations were impeded](https://missionloca.s3.amazonaws.com/mission/wp-content/uploads/2023/08/av_reports_2_Redacted.pdf) by autonomous vehicles in the one year period leading up to the vote. Reports included numerous instances of vehicles stopping on or driving over fire hoses, and blocking in fire trucks.

Then there is the issue of collisions. In October of 2023, one of Cruise's vehicles [struck and dragged a pedestrian 20 feet](https://www.cbsnews.com/sanfrancisco/news/cruise-robotaxi-runs-over-hit-and-run-victim-in-san-francisco-sparking-renewed-criticism/) after a drunk driver hit and launched her into the car. Cruise subsequently lost its license to operate in California.

Jackson believes that large numbers of collisions go unreported even though they are mandated by the National Highway Traffic Safety Administration to do so within 24 hours.

“It's really up to the manufacturers themselves right now to report these types of events. And we know that these events are underreported based on past deep dives, post events that have taken place like with companies the Cruise,” Jackson said.

I reached out to Waymo, Cruise, and the Autonomous Vehicle Industry Association for this story. None responded.

But an internal study from the Waymo website claims the company's fleet has a 57% reduction in police-reported crashes, and an 85 % reduction in injury-causing crash rates when compared with data on human drivers.

Waymo now has footprints in Phoenix, Austin, and Los Angeles. As the cars continue to increase their presence on the road and their machine learning gains more data Jackson thinks they will continue to improve.

But he believes they will never be able to respond properly to every situation they will face on roadways. Because there will always be new outliers in the behaviors of humans and even other driverless cars.

“That first 90% or 99% [of situations] is kind of the easy thing to handle and control. It's that last 1% of those edge cases that we may never actually fully resolve,” Jackson said.

As my drive continued everything went smoothly and without incident. Overall it was a pleasant experience. The next day I needed to get to the library a couple miles from my hotel. So I got on the Waymo app and I ordered a ride.