TECH

Uber Self-Driving Car That Struck, Killed Pedestrian Wasn't Set to Stop in an Emergency

Pedestrian tested positive for methamphetamine and marijuana

National Transportation Safety Board investigators inspected the self-driving Uber vehicle after the fatal crash in Tempe, Ariz.
PHOTO: NATIONAL TRANSPORTATION SAFETY BOARD/REUTERS

By Tim Higgins

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The Uber Technologies Inc. self-driving car involved in a fatal crash in Arizona identified an object on the road six seconds before impact and didn't determine the need for emergency braking until nearly five seconds later, U.S. safety investigators said Thursday.

The calculation ultimately wasn't acted on as the car's built-in automatic emergency braking system was disabled and the safety operator responsible for performing such a maneuver didn't apply the brakes until after the collision, the National Transportation Safety Board said in its preliminary report on the March 18 accident in Tempe, Ariz., near Phoenix.

The crash marked the first pedestrian death involving a self-driving car and ignited a broader discussion about whether the driverless technology that auto and tech companies are racing to develop is ready for the real world.

It also illustrates the challenges Uber has faced in developing software that can detect hazards on the road and respond appropriately, as the ride-hailing company chases rivals such as Alphabet Inc.'s Waymo and General Motors Co.'s Cruise Automation, which aim to deploy robot taxis that could pose as a threat to Uber's business.

Uber was testing a fleet of Volvo Cars sport-utility vehicles that come equipped with automatic emergency braking and other safety features. The vehicles, however, were modified by the ride-hailing company, which equipped them with cameras, sensors and onboard computers. An operator rides in each vehicle, prepared to take the wheel to ensure safety as needed.

The NTSB said the Uber vehicle's sensors detected the pedestrian walking across the road with a bicycle six seconds before impact. At first, the self-driving system's software classified the pedestrian as an unknown object, then as a vehicle and finally as a bicycle with varying

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expectations of where the bike was headed.

The NTSB said the vehicle was traveling at 43 miles an hour before impact. At that speed, six seconds is enough time for a vehicle to stop, said Todd Humphreys, an associate professor who specializes in robotic perception at the University of Texas at Austin. He said stopping time in those conditions could have occurred within less than three seconds.

It was 1.3 seconds before impact that the system decided emergency braking was needed, the NTSB said. According to Uber, the NTSB said, Volvo's built-in automatic braking system had been disabled during testing to "reduce the potential for erratic vehicle behavior." The safety operator began braking less than a second after impact, the NTSB said.

"The vehicle operator is relied on to intervene and take action," the report said. "The system isn't designed to alert the operator."

Uber's decision to deactivate the vehicle's automatic-braking system and leave it in the hands of the safety operator, who in turn wasn't given an alert, were mistakes, Mr. Humphreys said.

"This was an absolutely inexcusable design decision," Mr. Humphreys said in an email.

"Over those critical 1.3 seconds, the car could have slowed down from 43 to 24 mph before the collision." That would have given the pedestrian a better chance of surviving the collision, he said.

It is common for developers to disable built-in vehicle features such as automatic braking to avoid multiple systems issuing conflicting commands, said Raj Rajkumar, a Carnegie Mellon University professor who founded and later sold an autonomous-car software startup.

The problem with Uber's approach, he said, is the company didn't replace Volvo's system with its own automatic emergency braking. Instead, Uber relied on the safety operator, who was seemingly distracted and didn't receive a warning to brake or swerve, he said.

"Uber's software designers punted the final action to the operator; except that no alert was generated," Mr. Rajkumar said in an email.

At the very least, Uber's autonomous software should have predicted the potential collision and slowed the vehicle or slammed on the brakes, he said.

A video released around the time of the crash showed the safety operator glancing down toward the center console of the vehicle several times before impact. In an interview with NTSB investigators, the operator said she had been monitoring the self-driving system interface.

In addition to being responsible for intervening in the driving of the vehicle, the safety operator is also monitoring diagnostic messages that appear on a digital screen in the center console and tagging events for further review, the NTSB said.

Many autonomous vehicle developers begin with two safety operators and move to one as their systems become more advanced. Uber moved from two to one after more than a year of planning and continues to use two in some scenarios, the company said.

"We decided to make this transition because after testing, we felt we could accomplish the task of the second person—annotating each intervention with information about what was

happening around the car—by looking at our logs after the vehicle had returned to base, rather than in real time," the company said.

Mr. Humphreys said the operator shouldn't be expected to interact with the screen if it means not looking at the road. "A second Uber employee should have been in the car to interact with the system interface," he said.

The pedestrian was dressed in dark clothing and was walking a bicycle across the road, not at a crosswalk, according to the report. NTSB also said the pedestrian tested positive for methamphetamine and marijuana, though it didn't say that played a role in the crash.

Volvo, in statement, said it was helping with the investigation, noting its driver-assistance system was disengaged.

An Uber spokeswoman Thursday said the company has worked with the NTSB and started its own review, bringing on former NTSB head Christopher Hart to advise on its safety culture. She said the company in the coming weeks will detail changes it plans to make.

On Wednesday, Uber said it was closing down its self-driving vehicle program in Arizona, two months after the state barred it from road-testing self-driving technology.

—Austen Hufford contributed to this article.

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