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Autonomous vehicles: When will they be here?

Risk bulletin

Nearly every car on the road today has safety features that can help drivers be safer. You may already be familiar with some on your current vehicle. Some, you may not even know your car has available. There are cars on the road right now which can steer, brake and accelerate automatically, but still require a human behind the wheel. There are more than 35 active safety features available which may help prevent a crash. These include Forward Collision Prevention, Braking, Tire Pressure & Anti-Rollover, Driver State Monitoring, Parking and Backing Assist, Lane and Side Assist and many others being added with each new model. (One will even back a trailer for you!)

There are a few totally autonomous vehicles out there as well. In Miami, Las Vegas and Maryland an electric driverless bus named Olli (www.localmotors.com/olli/) operates on a fixed route with no driver. Uber in Colorado has vans delivering beer and UPS has semi-trucks transporting new appliances between California and Texas on the open road. Both of those have drivers sitting behind the wheel but not actively driving the vehicles.

Many miles lie ahead on the road toward mainstream use of fully automated vehicles. The technology could save tens of thousands of lives every year, but it remains years (if not decades) from becoming a reality on the majority of streets and interstates in America. Innovation takes time to fine-tune, and it is reasonable to expect more adjustments along the way as miles driven lead to lessons learned.

In the meantime, several engineering issues must be addressed before fully automated vehicles replace driver-operated vehicles as the most common form of transportation.

Sensors

Cameras and sensors are the eyes and ears in allowing fully automated vehicles to drive safely and effectively. Miniaturization, cost and accuracy are still being worked on. And what happens if snow, ice or mud blocks the sensors? Or if snow covers the lines of the road, which then could block the vehicle from identifying an upcoming curve or lanes merging or anything else?

Drivers know all too well the hazards of driving in snow and ice. Vehicle safety technology might change, but severe weather will remain, and one unresolved issue is how fully automated vehicles will operate safely when roads are snow-covered and visibility is at a premium. Likewise, redundancies will be necessary in case vandals damage or remove high-tech cameras and sensors belonging to new vehicles.

Infrastructure

Poorly maintained roads, signs and lane markings, as well as construction zones, offer additional challenges for engineers to overcome before a high-level rollout of fully automated vehicles. A driver behind a steering wheel can identify orange cones and realize a lane is blocked off a half-mile in front of him or her. Sometimes, vehicles must veer on to the shoulder as they slowly pass by a construction zone. How can experts ensure that fully automated vehicles will be able to process the same type of information in the same way – or better?

Poor road maintenance opens the door to other potential complications with fully automated vehicles. Will these vehicles be able to safely avoid big potholes? What if signs, marking and striping are faded or missing entirely? The smooth pavement of testing tracks is far different than many deteriorating roads.

Urban environments

The first wave of fully automated vehicles is expected to be deployed in dense, urban environments such as San Francisco, New York City and Washington, D.C. Each city features high levels of traffic congestion, not to mention plenty of pedestrians and bicyclists. The driving experience can be very unpredictable.

In addition to unanticipated events, the sheer quantity of vehicles, pedestrians and objects increases the chances that a problem might arise. Traditional drivers and people on the street could lack the training and experience to know how a fully automated vehicle will behave and why.

Connectivity

Fully automated vehicles may have the capability to communicate with other vehicles (commonly known as vehicle-to-vehicle, or "V2V" technology), infrastructure ("V2I") and everything else in its path ("V2X"). But this communication system remains a work in progress during the testing stage of these vehicles.

Driver-operator vehicles currently are not equipped to communicate with fully automated vehicles. The new vehicles also could struggle to establish communication points with infrastructure, which lags behind in many areas and might prove to be particularly challenging in rural communities. The larger-scale V2X technology faces similar complications because not all systems will be equipped to receive and return information that is disseminated by vehicles.

New technology is inevitable

The U.S. Department of Transportation's (DOT) Federal Automated Vehicles Policy asserts that "the rise of new technology is inevitable" and emphasizes the importance of proper planning and follow-through to promote safety. Manufacturers and other stakeholders should follow a systems-engineering approach to help them design highly automated vehicle technology "free of unreasonable safety risks," the document's authors state. That means engineers must develop functions so that highly automated vehicles remain in a safe state in the event of electrical, electronic or mechanical malfunctions or software errors. Cybersecurity threats and vulnerabilities also must be considered during the design process. Meanwhile, as manufacturers race to develop and distribute highly automated vehicles, agencies such as the National Highway Traffic Safety Administration (NHTSA) will benefit from hiring experts in science, engineering and mathematics to conduct pre-market testing on new technologies.

The policy says engineering and design safety considerations should include, but not be limited to, the following possibilities:

- Actuator, sensor and communication failure
- Software errors
- Inadequate control and undesirable control actions
- Collisions with environmental objects and occupants on the road
- Collisions that could be caused by the vehicle system
- Leaving the roadway
- Loss of traction or stability
- Violations of traffic laws and or variance from expected driving methods.

Software and hardware updates initiated by manufacturers could fall under government purview depending on the complexity of the updates, the document states. NHTSA would evaluate each highly automated vehicle system based on a 15-point "Safety Assessment" that covers areas such as data recording and sharing; privacy; system safety; human machine interface; post-crash behavior; object and event detection and response; and crashworthiness.

Engineers already have had a tremendous effect on vehicle safety technology, DOT says.

"New vehicle technologies developed in the 20th century – from seat belts to air bags to child seats – were once controversial," the federal policy document states. "But after having saved hundreds of thousands of American lives, they are now considered indispensable. Advanced technologies developed in the first part of the 21st century – like automatic emergency braking and lane departure warnings – are already making U.S. roads safer. How many more lives might be saved today and in the future with highly automated vehicles?"

** Photos and statistics from National Safety Council www.mycardoeswhat.org

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