



May 14, 2019

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The Driverless Car – Ready or Not, Here It Comes

As we roll into 2019's peak travel season, automakers are hitting the gas on developing the necessary tech to support their self-driving (or "autonomous") vehicle platforms. To be clear, there are varying degrees of vehicle autonomy, and automakers have yet to release a fully autonomous (or "Level 5") car into the market. However, at least one industry leader is promising just that, and sooner than you might think – by 2020. Other leaders maintain that the industry is still at least a decade away from fully autonomous cars hitting the road. Regardless of how the actual timeline plays out, vehicle autonomy is developing more quickly than many realize.

The Levels of Vehicle Automation

Asking whether a car is autonomous is not as meaningful as asking to what *extent* it is autonomous. Modern cars presently on the road already incorporate partial autonomy in the form of advanced driver assistance systems (ADAS), such as adaptive cruise control, automatic braking, blind spot detection, collision avoidance systems, and lane keeping assistance, among others.

The full spectrum of vehicle autonomy can be broken into the 6 levels established by the [Society of Automotive Engineers](#) (SAE):

Level 0 – No Automation. All driving functions are performed by the driver, though the vehicle may still have traditional fixed-speed cruise control. (E.g., a 2005-era sedan)

Level 1 – Driver Assistance. The vehicle can assist the driver by taking control of either steering or speed while the driver controls the other, and the driver actively monitors the vehicle's progress at all times. (E.g., a modern vehicle with adaptive cruise control or lane-keeping assistance)

Level 2 – Partial Automation. The vehicle can control both steering and speed in limited situations, but the driver must still actively monitor the vehicle's progress at all times to intervene if necessary. (E.g., a modern vehicle with adaptive cruise control and lane keeping assistance that coordinate together)

Level 3 – Conditional Automation. The vehicle is capable of fully controlling the drive under certain operating conditions and will

instruct the driver to resume control if those operating conditions are no longer met. The driver must remain sufficiently alert to resume control at any time when conditions require.

Level 4 – High Automation. True autonomous driving enters the stage here. The vehicle is capable of completing an entire trip without driver intervention (or in the complete absence of a driver). However, automated control of the vehicle is still confined by certain operational parameters, such as speed or geographic location (i.e., via “geofencing”).

Level 5 – Full Automation. This is the endgame of vehicle autonomy. The vehicle is capable of completely hands-off, driverless operation under all conditions. Level 5 vehicles may thus omit traditional driver input features such as a steering wheel and pedals. The vehicle is unconstrained geographically and capable of operating at all speeds in a safe manner based on sophisticated software and sensor systems.

Current State of Automation

As of early 2019, vehicles on the consumer automotive market generally feature Level 2 autonomy capabilities. While Level 3 (conditional automation) is the next sequential step, automotive industry leaders are focusing their engineering efforts on jumping straight to Level 4 (high automation) vehicles. Why? As noted above, Level 3 vehicles still require a human driver to remain constantly alert and ready to promptly resume control of the vehicle under certain conditions. In a society whose eyes are drawn to smartphones and other distractions whenever immediate attention is not demanded elsewhere, Level 4 vehicles can operate completely autonomously and thus eliminate the risk of human inattention and error.

Waymo, which began as the Google Self-Driving Car Project in 2019, launched the first commercial autonomous ride-share service in the U.S. in late 2018. The ride-share service, Waymo One, comprises a fleet of 600 vehicles that feature Level 4 autonomy and service a limited geographic region centered on Phoenix, Arizona. Other industry players that are actively developing and testing

autonomous vehicles with an eye toward Level 4 autonomy include Argo AI (partnered with Ford), Cruise Automation (owned by General Motors), Volkswagen, Uber, and Tesla. While several of these companies anticipate having Level 4 autonomous vehicles ready for ride-sharing applications by 2021, there is no telling when such vehicles will become available for consumer purchase. This question likely centers on federal and state regulations yet to be enacted.

But is society ready for fully autonomous cars to hit the roads? Like the automation of any other technology, the efficiencies and conveniences to be gained with self-driving technology are not without their risks. In March 2018, a vehicle being tested by Uber in autonomous mode, though still containing a human driver, struck and killed a pedestrian in Tempe, Arizona. That same month, the human driver of a Tesla vehicle in Mountain View, California was killed when his vehicle, while operating in autonomous mode, crashed into a concrete highway divider. Such tragic incidents, though rare in occurrence, underscore a need for autonomous vehicle systems to be designed and implemented with the utmost precision and reliability.

U.S. Regulations on Autonomous Vehicles

U.S. federal and state governments have recognized a need to regulate the development of autonomous vehicle technology to ensure a safe integration onto our roadways.

In September 2017, the U.S. House of Representatives passed the Safely Ensuring Lives Futures Deployment and Research In Vehicle Evolution Act ([SELF DRIVE Act](#)). The SELF DRIVE Act establishes the federal government's role in ensuring the safety of "highly automated vehicles" by regulating their testing and deployment. The act preempts states from enacting laws concerning the design, construction, or performance of autonomous vehicles or automated driving systems unless such laws impose standards comparable to federal standards. The act also charges the Department of Transportation with managing safety assessment certifications of such vehicles and systems, and it requires manufacturers to develop written cybersecurity and privacy plans for such vehicles before offering them for sale. While having passed the U.S. House in

2017, the SELF DRIVE Act still has yet to pass the U.S. Senate.

Also introduced in Congress in 2017 was the American Vision for Safety Transportation through Advancement of Revolutionary Technologies Act ([AV START Act](#)), aimed at creating a framework for regulating, testing, and deploying safety technologies for highly automated vehicles. The AV START Act differs from the SELF DRIVE Act in some ways, while presenting a similar objective, but the former stalled in the Senate at the end of 2018. Thus, as a result of neither act passing fully through Congress, the U.S. has yet to enact federal regulatory legislation directed specifically to self-driving cars. However, the U.S. National Highway and Transportation Safety Administration (NHTSA) has issued federal guidelines that provide voluntary guidance and technical assistance focusing on Levels 3–5 of vehicle autonomy.

At the state level, over 20 states to date have passed legislation relating to autonomous vehicles, and the governors of another 10 states have issued executive orders relating to autonomous vehicles. In Ohio, for example, former Governor John Kasich signed an executive order in May 2018 permitting the testing of autonomous vehicles within the state. The order dictates, among other items, that autonomous vehicles being tested must have a designated operator, though the operator is not required to be located within the vehicle.

Conclusion

A society where our roads are populated by vehicles that drive us rather than us driving them is difficult to imagine, and indeed reminiscent of a scene from a futuristic movie. However, progressive degrees of that reality may materialize sooner than we think. Advancement of autonomous vehicle technology brings with it new engineering challenges for our automotive manufacturers, new regulatory challenges for our governments, and new lifestyle decisions for consumers.

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