Connected and Automated Vehicle Primer

By Philip Barnes, May 2018

Transforming Delaware

Connected and automated vehicles (CAVs), also known as self-driving cars, will fundamentally transform Delaware. The transportation-related impacts are apparent since CAVs will provide mobility for individuals who are currently unable to drive, and the technology could initiate new land use development patterns, shift demand for parking, and change roadway congestion and capacity. Significant economic and social impacts are also expected. Like all disruptive technologies, some sectors of the State's economy could experience job losses while others see job gains. The full impact of CAVs is unknowable due to the complex variables that will influence the technology's development and deployment, but what is certain is that the Delaware of the future will not look or function like the Delaware of today.

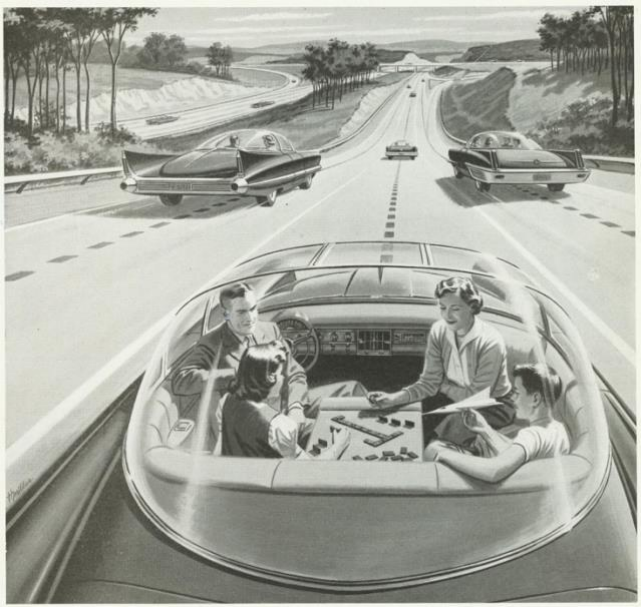
Technology

The technologies that allow CAVs to operate safely are classified into three related systems. The first connects the vehicle to the transportation infrastructure, other vehicles, and the cloud. Examples include receivers and transmitters for GPS, Bluetooth, 5G WiFi, and short-range radio. To navigate independently in an environment featuring detours, pedestrians, and other obstacles, the second system of sensors is mounted on the vehicle itself and generates continuous streams of analyzable data. Lasers that can "see" in the dark and low-visibility situations, radars, and cameras are common sensors that generate the data needed for vehicle situational awareness. The third system includes the software that processes the internally and externally generated data to

execute movements through space by delivering instructions to the vehicle's controls. The software is designed for machine learning, meaning that some rules of the road are straightforward (e.g., stopping at red lights), but decision-making in complex and irregular situations—for instance involving pedestrian movements—are continuously analyzed and improved with each successive experience.

Availability and Timeline

Connected and automated vehicles are already here. Most automobile manufacturers currently offer some CAV technologies in newer models. GPS and Bluetooth are standard in most vehicles, and advanced features like adaptive cruise control, emergency braking, automatic parking, and lane centering technologies are increasingly common. Hands-and-feet free operation—under certain roadway and weather conditions—is currently available in some high-end models. Estimates vary on the timeline for commercial availability of 100% fully autonomous vehicles.



Some manufacturers claim they intend to release such vehicles in the early 2020s, although postponements can be expected due to low levels social acceptance, especially after accidents involving test vehicles and demands for greater accountability and oversight. The factors that will slow the arrival of fully autonomous vehicles are political and social processes, not the technology itself. Therefore, a more reasonable estimate for commercial availability of fully autonomous vehicles is the late 2020s or early 2030s. As more fully autonomous vehicles are purchased and replace manually driven models, Delaware can expect a transition period lasting well into the second half of the century, where the two technologies exist side-by-side.

Delaware's Readiness

Delaware is well positioned, technologically speaking, to expedite the integration of CAVs. The state's Integrated Transportation Management System (ITMS) comprises 300 miles of fiber optic cable in the state, with another 300 miles planned, resulting in a state-owned telecommunications system—a backbone for AV functionality and success. The Delaware Department of Transportation (DelDOT) already coordinates the transportation infrastructure and collects data (signal timings, delays, travel times, volumes) that CAVs will need for full functionality. Data collection is processed through an open-architecture, state-owned database that can be readily amended and adapted to incorporate emerging data.

In anticipation of CAV deployment, DelDOT is taking additional proactive steps to facilitate integration of these advanced transportation technologies by extending the reach and capacity of the state's ITMS. DelDOT is enhancing connectivity in Dover by installing a state-owned 4.9 GHz wireless system. They are testing signal timing priorities at 11 intersections along U.S. 13 in Smyrna, and they are partnering with the Federal Highway Administration to develop an artificial intelligence system for northern Delaware that will semi-automate decision-making and operations in the area. On the administrative and policy front, Governor Carney created an Advisory Council in 2017 to investigate opportunities for CAV deployment and to provide policy recommendations by September 2018.

Further Reading

Barnes, P., & Turkel, E. (2017). *Autonomous Vehicles in Delaware: Analyzing the Impact and Readiness for the First State*. Newark, DE: Institute for Public Administration. http://www.ipa.udel.edu/publications/autonomous-vehicles-2017.pdf

Delaware Department of Transportation. (2018). Advisory Council on Connected and Automated Vehicles. https://deldot.gov/Programs/autonomous-vehicles/

Delaware Department of Transportation. (2017). *Integrated Transportation Management Strategic Plan*. Dover, DE: Delaware Department of Transportation. https://deldot.gov/Publications/reports/ITMS/pdfs/2017_Delaware_ITMS_Strategic_Plan.pdf

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180 Graham Hall | Newark, DE 19716-7380
302-831-8971 | ipa@udel.edu | www.ipa.udel.edu