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State Public Safety and Autonomous Vehicle Technology

Recommended Actions for Governors

NGA CENTER FOR BEST PRACTICES
444 North Capitol Street NW, Suite 267
Washington, D.C. 20001
202-624-5300
www.nga.org/center

Executive Summary

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Autonomous vehicles have the potential to revolutionize how we move people and goods.
As states navigate implementing this new technology,
they face a number of potential public safety opportunities and challenges.

Successful deployment of this technology begins with leadership willing to support its development, and governors are well positioned to lead the way.
The challenges and recommendations presented here provide guidance
to states on how best to start down this road.

INTRODUCTION

The expected availability of highly autonomous vehicles (AVs) in the near-term marks a new era in transportation. While research is still emerging, this developing technology—if deployed optimally—holds the promise of greater safety of riders, pedestrians, bicyclists and other road users, as nearly 94 percent of all driving-related fatalities are related to human error.[i]

If deployed with coordinated planning by state and local government, AV technology also offers: improved mobility for seniors, persons with disabilities and the economically underserved; the potential for lower emissions from the transportation sector due to lower congestion and the expected pairing with electric drive trains and increased utilization of ridesharing; and greater worker productivity, and shorter commute times due to less congestion.[ii] Alongside the potential benefits are concerns about the safety of drivers, pedestrians and other road users during the transition period that will see autonomous and non-autonomous vehicles sharing the road. Other concerns include data sharing, worker dislocation, land-use changes that may offset emissions benefits, potential cyber vulnerabilities and lower state revenues.[iii]

For the testing and deployment of AVs to be successful, with benefits optimized and concerns addressed, governors and other state and local leaders need to be engaged alongside federal and private sector partners. A challenge will be creating the right regulatory and policy environment to encourage innovation while ensuring public safety; a critical element will be collecting and sharing data.[iv] This paper identifies some of the challenges related to the testing and initial deployment phases of AVs and highlights the governors' role in bringing this new technology safely to the public.[v]

Potential Benefits to Deployment of AV

The deployment of AVs has the potential to provide a range of safety, economic and mobility benefits If paired with effective policies to overcome the challenges that may arise.

Ensuring public safety for all road users. Just as AVs pose a challenge to public safety and transportation officials responsible for ensuring that all roadway users are safe, AVs also hold the potential to make those roadways markedly safer by addressing the 94% percent of crashes caused by human error.[vi] At the same time, it is important the public understand that traffic fatalities will continue to occur in a future with AVs, just at a much lower level.

Improving mobility. AVs are predicted to greatly improve mobility for individuals unable to drive, including the elderly and individuals with disabilities. The most recent Census Bureau data shows that there are 7.3 million Americans over age 16, or 2.3% of the country's population, with a visual disability.[vii] AVs would allow individuals with visual disabilities to do something they may never have had the opportunity to do before, but most Americans take for granted: ride alone in a personal vehicle to a destination of their choosing.

Reducing congestion. With effective policies in place to incentivize ridesharing and reduce single occupancy trips, congestion could be reduced through the introduction of AVs that are able to travel closer together, and in narrower lanes, maintaining safe speeds to avoid accidents that are frequently a cause of congestion on roadways. This could have the additional benefit of reducing the need to expand highway infrastructure and allow states to spend resources on the maintenance of existing assets.

Increased productivity. With the ability to read emails, watch the news or entertainment programs, or eat breakfast on the way to work, productivity may increase. For some, the interior layout of AVs could allow for business meetings to occur on the road, and technology could encourage video-teleconferences from the vehicle, potentially making the AV an office on wheels.

Potential Challenges to Deployment of AV Technology

As governors facilitate deployment of AV technology in their states, they will need to navigate the following potential challenges.

Ensuring public safety for all road users. State public safety and transportation officials are responsible for ensuring that all roadway users—drivers, passengers, bicyclists, motorcyclists, commercial drivers, and pedestrians—are provided a safe experience on public roadways. Officials must consider how to integrate new automated and driverless-technology with existing modes of transportation so as not to compromise road safety. Some test programs have reported challenges with traditional road users reacting and sharing the road with AVs, yielding in low-speed crashes.[viii]

Regulating a new technology. Laws, regulations, and policies are intended to maintain order and protect the public interest. At the same time, in an environment where technology is rapidly evolving, such rulemaking runs the risk of stifling innovation before it fully matures. A number of states and territories have already adopted some form of AV framework that seeks to strike an appropriate balance between safety and flexibility, including **Alabama**, **Arizona**, **Arkansas**, **California**, **Colorado**, **Connecticut**, **Delaware**, **Florida**, **Georgia**, **Hawaii**, **Illinois**, **Louisiana**, **Massachusetts**, **Michigan**, **Minnesota**, **Nebraska**, **New York**, **Nevada**, **North Carolina**, **North Dakota**, **Ohio**, **Pennsylvania**, **South Carolina**, **Tennessee**, **Texas**, **Utah**, **Vermont**, **Virginia**, **Washington**, **Wisconsin**, and the District of Columbia. Their efforts include passing laws or executive orders providing for further study of AVs, naming a regulatory authority, providing definitions in law for technology and industry terms, providing baseline standards for testing and gathering information for assessing safety and authorizing the use of AVs on state and local roads.

Changes to land-use planning. AVs could have a variety of impacts on the land-use patterns at a state and local level. One example is around parking, where AVs could reduce the space needed in parking facilities because distances between vehicles can be reduced and vehicles can be shared between users. This may free up land currently reserved for parking infrastructure to be used for other purposes such as open space, commercial operations or new housing. AVs could also lead to residential movement away from areas close to job centers and transit to other locations.

Reductions in state transportation revenue. AVs will likely impact a number of the current revenue sources for state transportation funding including those coming from speeding violations, red-light cameras, licenses and other fees that will decline as travel shifts to autonomous shared fleets of vehicles. Additionally, with the potential of AVs also being electric vehicles, as many predict, states can expect a decline in gas tax revenues. States will need to consider how to reorient their revenue streams to maintain transportation system support. On the other side of the equation, state resources for traffic enforcement, and the administrative and judicial responsibilities around such enforcement could be freed up for other uses.

Changes to infrastructure needs. AVs will call for adjustments to the way infrastructure is planned, including the potential for additional electric vehicle charging infrastructure, if, as many stakeholders have asserted, manufacturers pair AV technology with electric vehicle technology. Those developments could also impact the electric grid infrastructure and call for adjustments that account for higher electrical loads. Also to support the ease of successful testing and deployment and improve safety for autonomous and non-autonomous vehicles alike, states will also need to ensure that roads are maintained and repaired quickly, incorporate communications technology into existing and future infrastructure to allow for the full deployment of connected vehicles and vehicle-to-infrastructure technology, and to the extent possible identify opportunities to leverage uniform design standards with respect to traffic control devices.[ix]

Cybersecurity vulnerabilities. Vehicles programmed and operated by computer technology may be vulnerable to hackers seeking to compromise safety features or seize remote control of driving functions.[x] Ensuring the reliability and security of AV technology will be critical to public acceptance of this mode of transportation and its wider adoption. Similarly, as states consider the deployment of new intelligent transportation systems, there is also a need for states to ensure these systems are protected with the appropriate level of consideration.

Liability concerns. In testing and initial deployment of AVs, the balance of liability must be clearly articulated. State insurance commissioners must continue to consider how to apply insurance coverage requirements to AVs and ensure that the responsible persons or entities may be held accountable for any damage or injury in incidents involving AVs.

Training for law enforcement. Many law enforcement officers may require additional training, resources, and tools to understand how to interact with AVs. As AV testing and technology becomes more common, it is important to ensure coordination among law enforcement throughout the state.

Recommended Actions for Governors

The actions below can help governors manage challenges and position their states as leaders in AV testing and adoption.

Designate a lead agency. Governors should identify a lead agency to oversee the testing and deployment of AVs. This agency should work closely with other affected state entities in the adoption of regulations that set forth requirements deemed necessary for the testing and deployment of AVs on public roadways. State entities may include departments of transportation, motor vehicles, public safety, insurance, energy and economic development.

Establish an interagency workgroup. An interagency workgroup can create a framework that will keep pace with technology, and balance the desire for innovation with the need for safety and appropriate oversight. The workgroup should also be responsible for developing any regulatory or legislative recommendations relating to AVs. To ensure cross-agency coordination and collaboration, possible state representatives include the departments of public safety, transportation, insurance, energy, economic development, motor vehicles, the state law enforcement agency, the governor's office, and the state highway safety office. The workgroup should actively engage and consult federal and local partners, the public and private sectors, as well as other stakeholders.

For example, the **Pennsylvania** Autonomous Vehicle Policy Task Force, led by its Department of Transportation, includes state representatives from its law enforcement, insurance, transportation, community and economic development agencies. The Task Force also includes university partners, local and federal government representatives, as well as stakeholders representing the trucking, insurance, automobile, ride-hailing and other industries. The Task Force meets to develop testing policy recommendations, reach consensus, and hear alternate views and opinions on various issues.[xi] **Ohio** and **Colorado** are other examples of a states that have brought together agencies and stakeholders to develop a framework for testing and deployment of AVs and connected vehicles.

Collaborate with local and federal agencies and policymakers. City and local officials are navigating many of the same challenges as state officials, and they should be included in gubernatorial-led efforts. In addition, federal partners have provided policy guidance and resources helpful to states. The National Highway Traffic Safety Administration (NHTSA) has previously released guidelines on AVs, including on cybersecurity. These guidelines and other statements by NHTSA can serve as a useful resource for states looking to create regulatory and policy frameworks. States should work with NHTSA and other federal partners when creating state regulatory policies.[xii]

Facilitate an environment that allows for autonomous vehicle testing and deployment. Governors are at the forefront of encouraging, fostering and spurring economic advancements in their respective states. For example, **Arizona**, **California**, **Colorado**, **Georgia**, **Ohio**, **Michigan**, **Nevada**, **North Carolina**, **Tennessee**, **Texas** and **Washington**, have executive orders or legislation allowing the operation of AVs. State agencies can help foster an environment where AVs are responsibly deployed in a manner that can strengthen economic development and position their states as centers for transportation innovation and investment.

Several states have already begun working with developers to test and deploy AVs on public roads.[xiii] For example, **Colorado** officials coordinated with an AV company to test a self-driving tractor-trailer that transported cargo over 120 miles on its state highway.[xiv] In Pittsburgh, **Pennsylvania**, a fleet of self-driving ride-share vehicles was introduced onto local roads.[xv] Likewise in **Ohio**, a self-driving semi-tractor-trailer made a test run on the Ohio Turnpike.[xvi] In **Virginia**, officials engaged in public-private partnerships to streamline the use of its roads and facilities for AV testing.[xvii]

Retain oversight and maintain regulatory authority over testing. The lead agency should take the necessary steps to implement administrative policies that preserve state authority over testing and operations. Impacted agencies should review state statutes and administration policies to identify any legal or safety issues that need to be addressed prior to the testing and operation of AVs. States are encouraged to require AV entities to report information about AV crashes and malfunctions in order to evaluate safety policies. However, regulations should also be flexible enough to keep pace with changing technology, not restrictive enough to create barriers to the private sector, ensure that such regulations are neutral as applied across the many different companies operating in this sector, and allow for transparency to the public.

Coordinate with law enforcement. Ensuring public safety requires extensive law enforcement coordination during testing and deployment. Law enforcement should engage with the lead agency on any safety issues and standards that may need to be considered for testing and deployment. Given that a mix of autonomous and non-autonomous vehicles will be operating on public roadways for an extended period of time, law enforcement and other state entities need also to consider and prepare for this transitionary period. State public safety officials should also be able to specifically identify effective safety analyses and risk mitigation measures.

Establish a robust training program for law enforcement. Law enforcement should understand how AVs may affect their duties and should have sufficient resources to carry out their jobs. The lead state law enforcement agency should develop a comprehensive operations plan with input from the interagency workgroup, local law enforcement, and other stakeholders. For example, operations plans should address practical issues such as ticketing and responding to crashes, so that efforts are coordinated and seamless. Officers should feel confident with enforcement protocols pertaining to private and commercial AV testing and should have the appropriate guidance if something goes wrong. Additionally, as testing continues to evolve and move towards deployment, states should be flexible with law enforcement training standards and ensure officers are equipped for the mixed fleet of vehicles on roadways.

Explore public-private partnerships between AV operators and regulators. Companies operating AVs and states should identify opportunities for collaborative partnerships to ensure the safety of the public, compliance with state law and regulation, and the success of testing and deployment. For example, the state lead agency could collaborate with the private sector on issues related to data collection and analysis. Entities engaging in testing or deployment are encouraged to establish a documented process for testing—validating and collecting necessary data related to the occurrence of malfunctions, degradations, or failures to help better understand the factors that may have contributed to a crash.[xviii] Learning from crash data is a central component to the safety potential of AVs.

AUTHORS

Kalyn Hill
Policy Analyst
Homeland Security and Public Safety Division
NGA Center for Best Practices
phone number

Lauren Dedon
Policy Analyst
Homeland Security and Public Safety Division
NGA Center for Best Practices
phone number

Sue Gander
Division Director
Environment, Energy and Transportation Division
NGA Center for Best Practices
phone number

Garrett Eucalitto
Program Director
Environment, Energy and Transportation Division
NGA Center for Best Practices
phone number

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NGA CENTER FOR BEST PRACTICES
444 North Capitol Street NW, Suite 267
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202-624-5300
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[i] In 2016, there were a total of 37,461 traffic related fatalities. That number was 5.6 percent higher than in 2015. This follows the record number of traffic fatalities in 2015, which marked the highest number of traffic fatalities since 2008. U.S. Department of Transportation, National Highway Traffic Safety Administration, *2016 Fatal Motor Vehicle Crashes: Overview*, https://crashstats.nhtsa.dot.gov/Api/Public/Publication/812456; The Centers for Disease Control and Injury Prevention has indicated that motor vehicle fatalities rank as the leading cause of death, *10 Leading Causes of Injury Deaths by Age Group Highlighting Unintentional Injury Deaths, United States –2015*, National Center for Injury Prevention and Control, CDC, available at: https://www.cdc.gov/injury/wisqars/pdf/leading_causes_of_injury_deaths_highlighting_unintentional_injury_2015-a.pdf.

[ii] Timothy Blute, *Preparing for the Inevitable: The Future of Autonomous Vehicles* (January 12, 2018), https://medium.com/nga-future/preparing-for-the-inevitable-the-future-of-autonomous-vehicles-e8e7af23b3e6; Governors Highway Safety Association, *Autonomous Vehicles Meet Human Drivers: Traffic Safety Issues for States*, at 18, http://www.ghsa.org/sites/default/files/2017-01/AV%202017%20-%20FINAL.pdf; A number of industries have noted that AVs have the potential to increase work productivity by enabling workers to take on more duties and lower driver-related stress. For example, for the U.S. Postal Service, in the short-term AVs could assist their carriers by reducing the load they have to carry, the distance they have to walk, and the time they have to spend parking and driving, thus being able to complete routes faster, Office of the Inspector General, United States Postal Service, *Autonomous Vehicles for the Postal Service: RARC Report*, October 2, 2017. https://www.uspsoig.gov/sites/default/files/document-library-files/2017/RARC-WP-18-001.pdf.

[iii] Anita Balakrishnan*, Self-driving cars could cost America's professional drivers up to 25,000 jobs a month, Goldman Sachs says,* CNBC Tech (May 22, 2017). *http://www.cnbc.com/2017/05/22/goldman-sachs-analysis-of-autonomous-vehicle-job-loss.html*.

[iv] While still under investigation, a recent crash in Arizona may offer additional lessons learned.

[v] The NGA Center would like to thank the Governors Highway Safety Association, National Conference of State Legislatures, Intelligent Car Coalition, Insurance Institute for Highway Safety, Highway Loss Data Institute for providing feedback.

[vi] National Highway Traffic Safety Administration, "USDOT Releases 2016 Fatal Traffic Crash Data" Press Release, October 6, 2017, https://www.nhtsa.gov/press-releases/usdot-releases-2016-fatal-traffic-crash-data

[vii] National Federation of the Blind, *Statistical Facts about Blindness in the United States,* (December 2017) https://nfb.org/blindness-statistics

[viii] Autonomous Cars Are Getting into Accidents Because They Drive Too Well*, The Drive*, Oct. 10, 2017, http://www.thedrive.com/sheetmetal/15023/autonomous-cars-are-getting-into-accidents-because-they-drive-too-well.

[ix] Advances in vehicle-to-vehicle and vehicle-to-infrastructure communications technologies present significant opportunities to further enhance the safety, efficiency and mobility benefits of connected automation, and will play an important role in ensuring a modern, twenty-first century transportation system. With connected vehicle technology also providing benefits for non-autonomous vehicles, states should identify approaches to support and integrate these types of communications technology solutions as it considers any future transportation planning and infrastructure investment.

[x] An example of cyber vulnerabilities in vehicle computer technology can be seen here: https://www.wired.com/2015/07/hackers-remotely-kill-jeep-highway/.

[xi] Pennsylvania Department of Transportation, Autonomous Vehicle Police Task Force, http://www.penndot.gov/ProjectAndPrograms/ResearchandTesting/Pages/Autonomous-Vehicle-Task-Force.aspx.

[xii] NHTSA's federal guidance *Automated Driving Systems (ADS): A Vision for Safety 2.0* references a number safety elements for states to consider in regards to AVs, including: human machine interface, vehicle cybersecurity, post-crash behavior procedures, data recording, and consumer education and training. *See* Department of Transportation, *Automated Driving Systems: A vision for Safety 2.0,* https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf.

[xiii] In addition to these, other examples of autonomous vehicle testing in the states include, but are not limited to, California, Maryland, Texas, Nevada, Iowa, Wisconsin, Florida, North Carolina, Michigan, Washington. (*See* California Department of Motor Vehicles, https://www.dmv.ca.gov/portal/dmv/detail/vr/autonomous/bkgd; Mitchell Schmidt, *Iowa Driving the way for autonomous vehicles,* The Gazette, Apr. 14, 2017, http://www.thegazette.com/subject/news/education/higher-education/iowa-driving-the-way-for-autonomous-vehicles-20170414; Maryland Department of Transportation,

http://www.mva.maryland.gov/safety/Maryland-AV-CV.htm; Nevada Department of Motor Vehicles, http://www.dmvnv.com/autonomous.htm; Amanda Kaeni, *Autonomous cars to hit Texas roads*, The Daily Texan, Feb. 16, 2017, http://dailytexanonline.com/2017/02/16/autonomous-cars-to-hit-texas-roads; David Shepardson, *Google expands self-driving car testing to Washington State*, Reuters, http://www.reuters.com/article/us-alphabet-autos-testing-idUSKCN0VC26R; Chris Barncard, *Wisconsin proving ground paves way for driverless vehicle registration,* University of Wisconsin-Madison News, Jan, 25, 2017, http://news.wisc.edu/wisconsin-proving-ground-paves-way-for-driverless-vehicle-research/; U.S. Department of Transportation, *U.S. Department of Transportation Designates 10 Autonomous Vehicle Proving Grounds to Encourage Testing of New Technologies*, https://www.transportation.gov/briefing-room/dot1717.

[xiv] Jesse Paul, *Semi completes first self-driving commercial shipment through Fort Collins-Colorado Springs beer run*, The Denver Post (Oct. 25, 2016), http://www.denverpost.com/2016/10/25/self-driving-beer-truck-colorado/.

[xv] *Pittsburgh, your Self-Driving Uber is arriving*, Uber Newsroom (Sept. 14, 2016), https://newsroom.uber.com/pittsburgh-self-driving-uber/.

[xvi] Ginger Christ, *Self-driving truck hits the road in Ohio, state investing $15 million in autonomous vehicle corridor,* The Plain Dealer (Nov. 30, 2016), http://www.cleveland.com/metro/index.ssf/2016/11/self-driving_truck_hits_the_ro.html.

[xvii] *Governor McAuliffe Announces New Partnership to Make Virginia a Leader in Automated-Vehicle Industry*, https://governor.virginia.gov/newsroom/newsarticle?articleId=8526#sthash.xRC0vNm5.dpuf.

[xviii] Department of Transportation, *Automated Driving Systems: A vision for Safety 2.0,* https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf.