
# Autonomous Vehicles: Driving Employment for People with Disabilities

Online Dialogue Report


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## Introduction to the Dialogue

New technologies are increasingly changing how individual vehicles get people from point A to point B. In particular, autonomous vehicles (AVs) are a focus of much research, testing, and legislative discussion. As these new transportation technologies enter the mainstream, they offer increased potential for reducing transportation and employment barriers for Americans with disabilities. Capitalizing on these technologies will help a large segment of the population reach its full potential and increase their contributions to society, in turn strengthening our social fabric and economy.

AV technology is still in the early stages of development, but there is no guarantee that it will be designed to accommodate everyone, including individuals with disabilities. Across the country, AV legislation is also being discussed, but limited attention is being given to the role this technology can play in serving individuals with disabilities. There is a need for the disability community to organize, learn more about the technology, and enhance its advocacy efforts. Additionally, there is a need for technology developers to become better educated on the necessity and value of designing their vehicles with the disability community in mind.

The U.S. Department of Labor's Office of Disability Employment Policy (ODEP) and Securing America's Future Energy (SAFE) (a non-partisan organization committed to innovations in transportation) hosted the "Autonomous Vehicles: Driving Employment for People with Disabilities" online dialogue in order to promote innovative thinking around the design and deployment of AV as it relates to employment. Using the ePolicyWorks crowdsourcing platform powered by IdeaScale, the dialogue gathered insights and ideas to help ensure AVs support employment options for people with disabilities once they are deployed.

This dialogue was divided into two main dialogue topic areas:

1. Accessibility of Autonomous Vehicles
2. The Government's Role

Participants were asked to keep the following concerns in mind when commenting on these topics and voting on submitted ideas:

- Developing autonomous vehicles and the transportation system of the future to be universally accessible has technological and economic challenges. What is required to ensure that AVs are accessible to everyone?
- Federal, state and local transportation policies can greatly impact the employment of people with disabilities. What role should the government play in ensuring that everyone benefits from AV technology?

The complete results of the "Autonomous Vehicles: Driving Employment for People with Disabilities" online dialogue can be found at the Transportation Innovation ePolicyWorks community page at TransportationInnovation.ePolicyWorks.org.

## Outreach Efforts

In order to engage a broad range of participants in the "Autonomous Vehicles: Driving Employment for People with Disabilities" online dialogue, ePolicyWorks engaged in a multitude of strategic outreach efforts, including emails and social media posts. Email blasts were sent to previous ePolicyWorks dialogue participants, key stakeholders and subject matter experts in transportation policy and AV.

**Total Dialogue Outreach Emails**

- ODEP Email Blasts: 11
- ODEP Emails Delivered: 24,886
- ODEP Emails Opened: 4,956 (19.91 percent open rate)
- ODEP Total number of clicks on links in emails (excluding multiple clicks of the same link): 625
- SAFE Email Blasts: 4
- SAFE Emails Delivered: 8,268
- SAFE Emails Opened: 1,571 (19 percent open rate)
- Total clicks on links in SAFE emails (excluding multiple clicks of the same link): 93

**Total Tweets**

- Tweets and retweets linked to dialogue home page: 20
- Tweets from SAFE Twitter account linked to dialogue home page and Twitter chat: 24

To further increase awareness of the dialogue and encourage a wider audience to participate, ePolicyWorks hosted the "Autonomous Vehicles: Driving Employment for People with Disabilities" Twitter chat on October 20, 2017 with Dr. Amitai Bin-Nun, vice president of AVs and mobility innovation at SAFE; Dylan Hedtler-Gaudette, government affairs specialist at the National Federation of the Blind (NFB); and Kent Keyser, policy fellow at United Spinal Association. More detailed information regarding the twitter chat can be found at the end of this report.

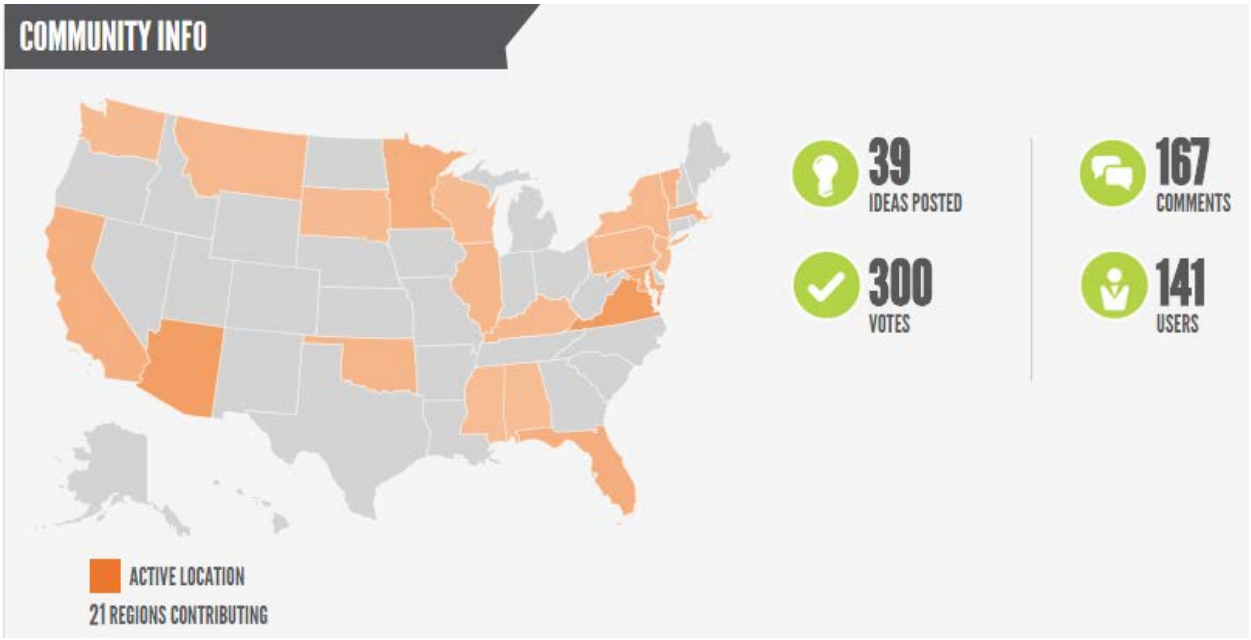
ePolicyWorks also live-tweeted during "The Promise: Autonomous Vehicles and the Disability Community," an event hosted by NFB. By using the hashtag #AVPromise to share information

about the dialogue, ePolicyWorks promoted it to all event attendees and those following the conversation.

## Participant Summary and Dialogue Activity

The "Autonomous Vehicles: Driving Employment for People with Disabilities" online dialogue opened for participation at 8:00 a.m. ET on Oct. 2, 2017 and closed at midnight on Oct. 27, 2017. Below are details about the dialogue registrants and participants, including the community map of participants, statistics on the number of dialogue visitors, users and participants, and demographic information as provided by registrants.

**Map of Active Participants across the United States**




**Visitor and Participants during the Dialogue**

- Total Transportation Innovation community members (number of individuals who registered): 141
- Total unique visitors during the dialogue: 1,570
- Total page views: 8,889
- Average pages per visit: 3.64
- Average visit duration: 4:28
- Returning visitors: 16.59 percent
- Bounce rate (percentage of participants who leave after viewing the first page of the dialogue): 52.83 percent

**Number of Ideas, Votes and Comments per Topic**

In total, 39 ideas, 300 votes and 167 comments were left by the 141 registrants throughout the duration of the dialogue.

Accessibility of Autonomous Vehicles

- Total Ideas: 19
- Total Comments: 175
- Total Votes: 108

The Government's Role

- Total Ideas: 20
- Total Comments: 125
- Total Votes: 59

## Top Ideas by Vote

Participants in the "Autonomous Vehicles: Driving Employment for People with Disabilities" online dialogue contributed to a robust discussion on different ideas around the accessibility of AVs, engaging the developers early on to involve people with disabilities in the process, AV legislation, and the potential for employment opportunities. The following are the most popular ideas by participant votes:

### Accessibility of Autonomous Vehicles

#### 1. Achieving Wheelchair Accessible On-Demand Transportation

*Received 16 votes and 19 comments during the dialogue*

As someone who's been exploring the idea of equal on-demand transportation for people with disabilities, I feel we need to first solve the lack of wheelchair-accessible vehicles (WAV) on the networks of major TNCs like Uber and Lyft.

In most U.S. cities, simply getting a human-driven on-demand WAV ride through Uber or Lyft is nearly impossible.

I believe solving this problem first will bring us much closer and move us much quicker towards accessible autonomous vehicles. It will provide opportunities to gradually test automated systems that allow wheelchair users to safely load, unload, and secure their wheelchairs independently.

Essentially, by focusing on achieving accessible on-demand transportation through TNCs today, we will in return solve the autonomous vehicle accessibility issues of tomorrow.

**2. Accessibility for the Deaf/Hard-of-hearing community**

*Received 12 votes and 8 comments during the dialogue*

As a health care provider for the Deaf/Hard-of-hearing community, I believe it is vital that autonomous vehicles include universal design features. Individuals with disabilities miss many days of work due to limited access to transportation and it is important that autonomous vehicles include design features that benefit those in the disability community. For individuals who are Deaf/Hard-of-hearing, that may look like visual screens with keyboards so that the individual can interact with the vehicle and tell it where to go. It may also include visual pictures of the mapped route to that location and written or pictorial output of turn by turn moves the autonomous vehicle is making along the route.

**3. Engaging AV Developers (Tech Companies, OEMs, and TNCs)**

*Received 10 votes and 2 comments during the dialogue*

We have a unique opportunity through conversations like this to communicate to those who are developing driverless technology the need for baked-in accessibility features. For example, my computer is not usable right out of the box to me as a person with a visual impairment, so I have to have assistive technology (screen reader and magnification software) installed on it in order to be able to do my job. In fact, I couldn't have even applied for jobs without the ability to magnify online job applications. In the same way, autonomous vehicles need to hit the streets (through mass market and on-demand fleets) ready to use by people who use wheelchairs (power chairs and manual ones), people who are blind or visually impaired, autistic people, and people with all other types of disabilities. This is essential because AVs can provide a way out of poverty and dependence on government benefits for so many unemployed people who can't even get to a job interview due to a lack of access to transportation. However, we'll have to think creatively about how to achieve this universal accessibility. Is it possible to develop one driverless car that can pick up my friend in a power chair, drop her off, then pick me up and let me program my destination into the vehicle using verbal commands, then pick up my autistic colleague and provide him information on trip progress? Or is it more reasonable to develop a range of AV options that could be purchased or summoned through a software application that would allow the rider to choose a vehicle that would best meet their needs? How can we incentivize AV developers to think through these questions and produce products and services that will truly result in equal access for all?

**4. Access to Employment**

*Received 10 votes and 10 comments during the dialogue*

As a Vocational Rehabilitation professional, I know autonomous cars could decrease the cost of mobility for people with disabilities by millions. For someone with severe physical disability using a wheelchair, the cost of modifying a vehicle is often over $100,000.00 per person. Using paratransit often adds up to four hours to a daily commute (two hours allowed each way). Autonomous vehicles will allow better access to employment, therefore making them tax paying, instead of tax using, for people with disabilities.

**5. Feature to Locate AV**

*Received 10 votes and 4 comments during the dialogue*

Autonomous vehicles should include a feature that would enable a user to help locate the vehicle. This would be especially important for persons who are blind/low-vision when attempting to find an AV on request, such as an automated Uber. Typically, when an individual who is blind uses Uber, they require the assistance of the driver to locate the vehicle. Autonomous vehicles, having no driver, would need a feature to fulfill this need, such as an alarm, chime, or user-specified music/tone that can be activated on request to help locate the vehicle.

## The Government's Role

**1. Highly Automated Vehicles Should Not Require a Licensed Driver**

*Received 24 votes and 13 comments during the dialogue*

Many individuals with disabilities are unable to obtain a valid driver's license. Some will never be able to obtain a license under the current regulatory structure, while others, such as those with epilepsy, may experience temporary restrictions on driving until an improvement is seen in that condition. In either case, requiring autonomous vehicle passengers to hold a valid driver's license is a needless restriction that would significantly inhibit the potential benefits of autonomy to those in the disability community. While driver's license strictures may be necessary in today's environment, a dramatic change in technology that allows autonomous vehicles requires the development of an updated regulatory paradigm.

**2. We Need More Affordable, Accessible and Available Transportation**

*Received 10 votes and 6 comments during the dialogue*

I would like to see the government encouraging stakeholders in the community to begin talking and planning for the future of transportation, maybe via creative grants or prioritizing transportation collaborations with various agencies. We need more affordable, accessible and

available transportation options. We all should be looking for options that create a "win-win" situation.

**3. Traveler Information Sharing and Management Policy**

*Received 7 votes and 2 comments during the dialogue*

Travelers with disabilities may be willing to share certain personal information to receive customized services based on their disability. For example, mobility impaired persons may benefit from a service tailoring the pickup locations or vehicle types, or vision impaired persons may benefit from assistance locating the vehicle. Sharing personal information can enable benefits, but also has potential privacy and safety implications. For example, this information may make it easier for nefarious persons to identify persons with disabilities and take advantage of them.

The sharing of personally identifiable information has specific legal context and policies, which should be revisited for the deployment of autonomous vehicles and other robotic mobility platforms. Research and development in the areas of best practices, policies, public opinion, and cost-benefit analyses are needed to build a robust information management framework that will enable persons with disabilities to benefit from autonomous technologies.

**4. An Iterative Approach to Accessible Transportation**

*Received 7 votes and 5 comments during the dialogue*

An increasing number of local and regional government and transportation agencies are establishing offices of innovation and embracing initiatives that test and offer cutting edge technologies to improve the wellbeing of the people they serve. Autonomous vehicle technology that serves people with disabilities can be implemented iteratively, improving at each stage. This is not a traditional approach for the public sector, but funding opportunities such as Federal Transit Administration Mobility on Demand Sandbox grants are perfectly aligned to this approach, which might look like this in practice: explore and pilot connected vehicle technology on a small scale in a community where mobility for people with disabilities is a challenge, e.g. on a VA campus; procure and pilot a partially autonomous vehicle (driver-assist technology such as an autopilot button) using a demand-response model; procure and pilot an accessible autonomous vehicle in a traffic controlled community such as a retirement community; use the results of these pilots to inform fuller implementations.

**5. Disadvantaged Populations in Rural Areas**

*Received 5 votes and 3 comments during the dialogue*

There is a lack of research and no clear vision for self-driving vehicles in rural areas. The transportation needs of tribal nations must be considered.

## Dialogue Results Summary

ODEP and SAFE conducted the "Autonomous Vehicles: Driving Employment for People with Disabilities" online dialogue to explore AV development and its potential for people with disabilities as it relates to employment. The multitude of ideas and comments showed the importance of bringing people with disabilities into the conversation early on – to ensure that they're represented from the beginning.

In total, 141 participants shared 39 ideas, 300 votes and 167 comments throughout the duration of the dialogue. At the conclusion of the dialogue, subject matter experts from the fields of AV development, disability advocacy and disability and transportation policy reviewed the ideas and provided further insight on the importance and feasibility of the ideas. From the original 39 ideas, 15 ideas were shared during the May 24, 2018 Federal Interagency Meeting to inform the policymakers present. Appendix A details the analysis process.

## Appendix A – Subject Matter Expert Dialogue Review

The "Autonomous Vehicles: Driving Employment for People with Disabilities" online dialogue collected 19 ideas on how AVs can be leveraged to expand access to competitive, integrated jobs for people with disabilities and 20 ideas on what issues policymakers should consider when developing legislation, regulations, or other policies that govern AVs. At the conclusion of the dialogue, policy advisors at DOL/ODEP reviewed all 39 ideas through the ePolicyWorks crowdsourcing platform using IdeaScale's Assessment Tool, an analysis tool offered as part of the suite of IdeaScale tools. The Assessment Tool required reviewers to rate each idea on a scale of one to five. After an in-depth discussion with the ODEP team, 23 ideas—that received a rating of four or five—moved on to the next stage of analysis to be assessed using a different IdeaScale tool, ReviewScale.

During the next stage, subject matter experts (SMEs) were invited to analyze each of the 23 ideas. The reviewers included Amitai Bin-Nun, the Vice President of Autonomous Vehicles and Mobility Innovation at SAFE; Doug Birnie, an independent consultant on mobility management and human service transportation activities; Henry Claypool, a policy consultant for the American Association of People with Disabilities (AAPD); and Mohammed Yousuf, the Program Manager for the Accessible Transportation Technologies Research Initiative at the U.S. Department of Transportation's Federal Highway Administration (FHWA). The SMEs were asked to review each of the ideas based on its value (importance to disability community and ODEP – High, Medium or Low) and its level of effort to implement (High, Medium or Low). Then they were asked whether or not the idea should be included in a report to be put together by ODEP (Yes/No). Based on that analysis, 15 ideas have been moved forward for consideration by ODEP and other partner agencies participating in the autonomous vehicle federal interagency meeting on May 24, 2018, as well as through other appropriate efforts.

The following factors were considered by the SMEs as part of the ReviewScale process:

*Value factors:*

- The level of importance you think this idea would have to the disability community.
- The level of feasibility that the U.S. Department of Labor (DOL), together with a partner agency (or agencies), could assist in implementing this idea.

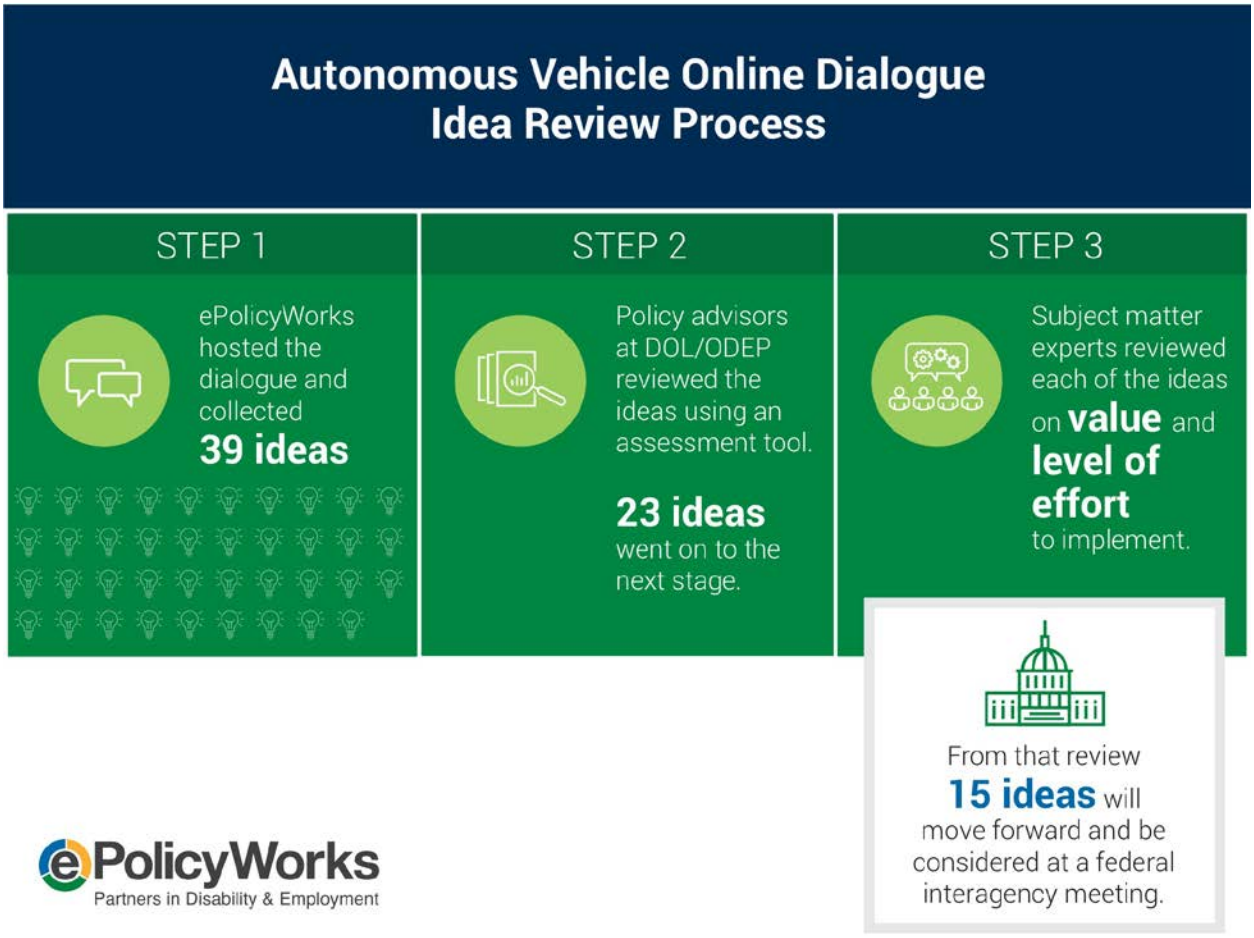
*Cost factors:*

- The level of effort that would be required for DOL and its partner agency (or agencies) to implement this idea.

*Inclusion in agency planning efforts*:

- Should this idea be included in a plan developed by ODEP and its partners?

## AV Idea Review Process




***The following five ideas were rated positively on all three factors (i.e., high value, low level of effort and should be included in the agency plan).***

**1. Include Accessibility in Your Voluntary Safety Self-Assessment**

*Received 4 votes and 0 comments during the dialogue*

The National Highway Traffic Safety Administration's (NHTSA) 2.0 AV policy guidance includes a voluntary safety self-assessment. Waymo, the first AV developer to publicly release their Voluntary Safety Self-Assessment (VSSA), included a section on accessibility, which detailed features benefiting several disability types. Check it out here:

http://links.targetedvictory.mkt5241.com/ctt?kn=8&ms=MzEwOTI1NzkS1&r=NTYzNjI3NjQ1NDQ4S0&b=0&j=MTE0MjQ3MzE3OAS2&mt=1&rt=0.

It would be great if all other companies developing AVs could follow in Waymo's footsteps and include accessibility in their VSSAs.

**Subject Matter Expert Comments**

- "NHTSA already asks that the accessibility of the Human Machine Interface (HMI) be addressed. I am uncertain as to the "hook" in the Federal Motor Vehicle Safety Standards (FMVSS). These standards are about safety and for most of the accessibility issues, they require the use of an exemption to the FMVSS. I suppose one could argue that the HMI interface could be integrated into the FMVSS for AVs at level 4 and 5."
- Together with a partner agency (or agencies), DOL could assist in implementing this idea with the support DOT and NHTSA.

**2. Required Features**

*Received 8 votes and 6 comments during the dialogue*

As a person with a disability and a retired Wells Fargo IT manager, I want to ensure the following features will be included in all self-driving vehicles:

1. Passengers can communicate with self-driving vehicles through speech, text, and via an app on the passengers' mobile device.

2. There must be space in self-driving vehicles for at least two powered wheelchairs and an attendant.

3. There must be a way for people using powered wheelchairs to get into and out of self-driving vehicles independently without using their hands.

4. There must be a way for people to control the temperature inside self-driving vehicles independently without using their hands.

**Subject Matter Expert Comments**

- "This would result in more paratransit vehicles that serve multiple people. It's difficult to see this improving how people secure competitive integrated employment relaying on large expensive vehicles."
- "Vehicles need to be available to meet the expected demand, but not necessarily every vehicle."
- "I think this idea is highly complementary to the idea of convening stakeholders and manufacturers. Essentially, this is an idea to help develop performance

'specs' for what an accessible AV should look like. If there would be agreement on that, that would be very valuable."

- "This is a convening exercise which agencies are well-suited to do."

**3. Feature to Locate AV**

*Received 10 votes and 4 comments during the dialogue*

Autonomous vehicles should include a feature that would enable a user to help locate the vehicle. This would be especially important for persons who are blind/low-vision when attempting to find an AV on request, such as an automated Uber. Typically, when an individual who is blind uses Uber, they require the assistance of the driver to locate the vehicle. Autonomous vehicles, having no driver, would need a feature to fulfill this need, such as an alarm, chime, or user-specified music/tone that can be activated on request to help locate the vehicle.

**Subject Matter Expert Comments**

- "Foster wayfinding systems. This doesn't need to be done just for AVs; it is a larger problem of orientation and mobility. ODEP should look at 5G and the deployment of small cell technology."
- "This be accomplished through funding private sector and universities to design new functionalities for AVs to improve accessibility."
- "This idea is sound but is formulated too specifically. I would suggest reframing it as a general request to increase research and development and implementation for accessibility features."

**4. Engaging AV Developers (Tech Companies, OEMs*, and TNCs**)**

**Original equipment manufacturer (OEM); **Transportation Network Company (TNC)*
*Received 10 votes and 2 comments during the dialogue*

We have a unique opportunity through conversations like this to communicate to those who are developing driverless technology the need for baked-in accessibility features. For example, my computer is not usable right out of the box to me as a person with a visual impairment, so I have to have assistive technology (screen reader and magnification software) installed on it in order to be able to do my job. In fact, I couldn't have even applied for jobs without the ability to magnify online job applications. In the same way, autonomous vehicles need to hit the streets (through mass market and on-demand fleets) ready to use by people who use wheelchairs (power chairs and manual ones), people who are blind or visually impaired, autistic people, and people with all other types of disabilities. This is essential because AVs can provide a way out of poverty and dependence on government benefits for so many unemployed people who can't even get to a job interview due to a lack of access to transportation. However, we'll have to

think creatively about how to achieve this universal accessibility. Is it possible to develop one driverless car that can pick up my friend in a power chair, drop her off, then pick me up and let me program my destination into the vehicle using verbal commands, then pick up my autistic colleague and provide him information on trip progress? Or is it more reasonable to develop a range of AV options that could be purchased or summoned through a software application that would allow the rider to choose a vehicle that would best meet their needs? How can we incentivize AV developers to think through these questions and produce products and services that will truly result in equal access for all?

**Subject Matter Expert Comments**

- "Everyone in the community is taking this approach. The one stakeholder that is left out is the aftermarket modifiers that make vehicles accessible."
- "This could be done in a low-key fashion for relatively little investment, but a more impactful engagement will require investment of resources."

**5. Highly Automated Vehicles Should Not Require a Licensed Driver**

*Received 24 votes and 13 comments during the dialogue*

Many individuals with disabilities are unable to obtain a valid driver's license. Some will never be able to obtain a license under the current regulatory structure, while others, such as those with epilepsy, may experience temporary restrictions on driving until an improvement is seen in that condition. In either case, requiring autonomous vehicle passengers to hold a valid driver's license is a needless restriction that would significantly inhibit the potential benefits of autonomy to those in the disability community. While driver's license strictures may be necessary in today's environment, a dramatic change in technology that allows autonomous vehicles requires the development of an updated regulatory paradigm.

**Subject Matter Expert Comments**

- "Develop model state policy."
- "Today's licensing structure is inappropriate for people with disabilities. Autonomous vehicles free people with disabilities of these strictures."
- "DOT has the ability to issue guidance on this issue to states, although it might require legislation for full implementation."
- "Would require DOT to determine that they have standing to issue guidance, and then for them to follow up and actually do so through its AV policy documents.
- "These are state laws. If the provision in the Senate bill doesn't get passed, then they will remain state law. The best ODEP could do is develop model policy

regarding driver's license and training requirements and that they are unnecessary for riding in level 4 or 5 AVs."

***The following <u>five</u> ideas were rated positively for two of the factors (high value and should be included in the agency plan), but also rated as a high level of effort.***

**1. Include PWDs in the Design Process**

*Received 3 votes and 2 comments during the dialogue*

Groups representing the disability community should communicate with automakers to ensure vehicles are being designed to meet their needs.

**Subject Matter Expert Comments**

- "Key point for success."
- "Any product developer will tell you that feedback from users is essential. This is no different for the design of accessible vehicles."
- "While requirements for taxi fleets and the like are usually regulated locally, federal leadership could highlight and create uniformity in the process."
- U.S. Department of Transportation (DOT) should take the lead.
- "There are huge market forces at play. They shape the automobile marketplace. It is unrealistic to think that ODEP could formulate a compelling argument that accessible AVs will increase employment of people with disabilities that would result in the original equipment manufacturers changing their orientation to building accessible vehicles. Better to look at other market factors that indicate an increase in demand for an accessible car and use those in conjunction with the legal requirements under the ADA."

**2. Include Accessibility from the Start**

*Received 0 votes and 0 comments during the dialogue*

I have some concerns that most pilot projects with autonomous vehicles seem to be leaving accessibility and universal design-related issues as secondary. We see a lot of publicity for autonomous vehicles in public transit and/or personal vehicles and how they will benefit the disability community and older adults, yet the pilot projects are not remotely accessible. Designing the vehicles with universal design NOW is critical, even if rough around the edges. Otherwise, we will likely end up in the same place we are now, where people with different needs will have to take different vehicles or use different services. When inclusive design is the afterthought, we fail. Inclusive design needs to be prominent in the innovation phases of the development of these technologies.

**Subject Matter Expert Comments**

- "It really depends on how the autonomous vehicle is going to be used. Packages providing accessibility to various disability groups need to be incorporated as needed. However, it may be that all packages are incorporated into the vehicle and displayed only when appropriate. An important subject for further development."

### 3. Cost

*Received 4 votes and 3 comments during the dialogue*

The average cost of car ownership in the US today is $750 per month – including gas, insurance, maintenance, depreciation, etc.

I think that is a reasonable threshold cost for at will utilization of a shared AV for anyone - including a person with disabilities that might require a specialized vehicle or with specific accommodations.

A "regular" shared AV might be used 80 percent of the time and have minimal downtime between users and minimal dead head miles traveling from one user to the next.

For a specially equipped AV for disabled individuals there are two concerns – the higher initial cost of a vehicle with specialized interfaces and equipment – and the lower expected utilization between riders (fewer trips, further distances between trips). These both will substantially increase costs. In my experience in metro Phx, the difference is about 4-5x.

So, if we agree that people will give up their cars if they can get from point to point and spend $750 per month or less and utilize a shared AV, and that the cost of a shared AV equipped to safely transport people with disabilities, would be, say, closer to $3,000 per month. The difference will have to be covered somehow.

There are generally two choices. It could be a tax on all shared AV's – raising the cost to maybe $760 per month (this is how mass transit works – everyone pays a little more to cover the higher costs of accessible equipment or paratransit, etc.) or the government just subsidizes it. Of course, the government pays for the subsidies via taxes, so in the end, the result is essentially the same.

Overcoming the barrier to higher costs for shared accessible AVs is a critical step to full deployment. It is only "fair" that every pays the same amount despite differences in the costs of providing services – but the logistics and methodologies are still to be determined.

**Subject Matter Expert Comments**

- "Cost is a big issue. Not so sure about the specifics raised in this comment. This issue presents a big challenge and is the reason we need more data on users. For specially equipped AV for disabled individuals there are two concerns: the higher initial cost of a vehicle with specialized interfaces and equipment, and the lower expected utilization between riders (fewer trips, further distances between trips). These both will substantially increase costs."
- "This raises a fundamental issue. In shared use fleets, do software and people with disabilities' capacity packages need to be available in all, or just enough, vehicles to meet the needs of the existing disability population? This needs to be explored further."
- "I think this question is really asking how paratransit will evolve with AVs and how it will be funded. An extremely important question."
- This could be accomplished through a study.

### 4. Traveler Information Sharing and Management Policy

*Received 7 votes and 2 comments during the dialogue*

Travelers with disabilities may be willing to share certain personal information to receive customized services based on their disability. For example, mobility impaired persons may benefit from a service tailoring the pickup locations or vehicle types, or vision impaired persons may benefit from assistance locating the vehicle. Sharing personal information can enable benefits, but also has potential privacy and safety implications. For example, this information may make it easier for nefarious persons to identify persons with disabilities and take advantage of them.

The sharing of personally identifiable information has specific legal context and policies, which should be revisited for the deployment of autonomous vehicles and other robotic mobility platforms. Research and development in the areas of best practices, policies, public opinion, and cost-benefit analyses are needed to build a robust information management framework that will enable persons with disabilities to benefit from autonomous technologies.

**Subject Matter Expert Comments**

- "This is both an important and well-formulated idea. My only concern that it is 'second-order' and I would prioritize projects that work directly on the accessibility of AV technology and businesses. This issue only comes up once those are achieved."

**5. An Iterative Approach to Accessible Transportation**

*Received 7 votes and 5 comments during the dialogue*

An increasing number of local and regional government and transportation agencies are establishing offices of innovation and embracing initiatives that test and offer cutting edge technologies to improve the wellbeing of the people they serve. Autonomous vehicle technology that serves people with disabilities can be implemented iteratively, improving at each stage. This is not a traditional approach for the public sector, but funding opportunities such as FTA MOD Sandbox grants are perfectly aligned to this approach, which might look like this in practice: Explore and pilot connected vehicle technology on a small scale in a community where mobility for people with disabilities is a challenge, e.g. on a VA campus; procure and pilot a partially autonomous vehicle (driver-assist technology such as an autopilot button) using a demand-response model; procure and pilot an accessible autonomous vehicle in a traffic controlled community such as a retirement community; use the results of these pilots to inform fuller implementations.

***The following idea was rated positively on two of the factors (low level of effort and should be included in agency plans), but was not rated to be of high value.***

**1. Adopt the Policies in 2015 NCD Report on AV**

*Received 4 votes and 5 comments during the dialogue*

Autonomous vehicles (AVs) developed with the proper policies will help make independence and economic self-sufficiency possible for people who are blind or have other disabilities. To ensure that people with disabilities can access and benefit from AVs and ensure state and federal policies do not preclude people with disabilities from accessing AVs, ODEP and SAFE should adopt the National Council on Disability's (NCD) "Recommendations for Preventing or Eliminating Technological, Policy, and Societal Barriers to the Independent Use of Autonomous Vehicles by People with Disabilities" listed in NCD's 2015 Self-Driving Cars: Mapping Access to a Technology Revolution. Please see the link below for a complete copy of the NCD publication. Specifically, ODEP should work with the Department of Transportation (DOT) to create a framework recommendation that ensures state licensing rules do not preclude people with disabilities from operating level 4 and 5 autonomous vehicles. Finally, people with disabilities should be consulted by NHSTA throughout the process of creating any legislative recommendations to the states and federal government on AVs.

Please feel free to contact Leif Brierley with any questions or comments at Leif.Brierley@powerslaw.com.

Link to NCD Publication "Self-Driving Cars: Mapping Access to a Technology Revolution": https://www.ncd.gov/sites/default/files/NCD_AutomatedVehiclesReport_508-PDF.pdf.

**Subject Matter Expert Comments**

- "NCD has impactful recommendations, including idea that non-compliant states could lose federal funding,"
- "Some of the NCD recommendations might require Congressional action, and it is unclear whether federal agencies could adopt all of their policies."

***The following idea was rated positively on two of the factors (high value and low level of effort), but only half the reviewers thought it should be included in the agency plan.***

**1. AVs in Rural Areas**

*Received 4 votes and 11 comments during the dialogue*

The question of rural connectivity with autonomous vehicles (AVs) raises some thorny issues. Long distances will translate into higher costs even for AVs due to distance-related vehicle maintenance and lack of accessible streets for people to reach the AV at common points, though the cost of software updating should be a fixed cost for every type of area. If AVs are not a profitable enterprise in rural areas (the reason companies are happily considering city and inner suburban areas), then the issue is whether governments will subsidize this type of transportation or whether rural areas can in some way promote economic development in ways that contribute to AV services. In the last transportation revolution of the automobile, rural areas in general lagged far behind.

**Subject Matter Expert Comments**

- "This is better addressed through DOT programs for rural development."
- "Some AV fleets may be privately owned, but others may be publicly owned and operated as a part of public transportation. Additionally, human service programs often provide subsidies to ensure the availability of rides."
- "Agencies can ensure subsidies are available to endure service availability."

***More than half of the reviewers agreed that the following ideas should be included in the agency plan, but rated them as a high level of effort and low value.***

**1. Different Levels of Accessibility**

*Received 0 votes and 0 comments during the dialogue*

I think for accessibility, some things should be universal – like choosing different languages, have text to voice, enhanced visual warnings for the deaf, wide doors, and things like that. But I don't think it would be cost effective – or maybe not even possible – to have all vehicles have all accessible options. For instance, my company provides accessible transportation which includes transportation for people confined to a stretcher/gurney – they can't sit up – but just like everyone else, they have places to go, things to do, and meetings to get to. But for every

AV, to accommodate a stretcher might be somewhat impractical. We need to balance accessibility and tailored transportation and measure success by equal access, availability, flexibility, and cost.

**Subject Matter Expert Comments**

- "Topic for engagement with the OEMs
- "Reasonably argued and worth considering."

**2. States' Leadership on Accessible AVs**

*Received 4 votes and 1 comment during the dialogue*

State and local governments can demonstrate their commitment to employment access for their employees with disabilities by owning and operating accessible AVs.

**Subject Matter Expert Comments**

- "Would reformulate this idea to make it more valuable. We absolutely should look at transit agency procurement policies to ensure that they can enter into agreements to integrate new technologies to improve accessibility."
- "Modernizing procurement policies would be really helpful."
- "Again, develop model state policies and hope that they are adopted."
- "This is a deep-in-the-weeds but impactful issue (as I formulated above). It may take a lot of effort to really dig into but would be worthwhile."

**3. Unmanned Transport System and Reservation/Reminder System**

*Received 9 votes and 7 comments during the dialogue*

We need more rapid development and sprints to flush out operational issues for those with disabilities and continue to build trust in autonomy. A good example is the Applied Robotics for Installation and Base Operations (ARIBO) program.

ARIBO is a nation-wide program that joins technology with operational needs in order to demonstrate and evaluate autonomous systems in real-world, semi-controlled environments. ARIBO aims to familiarize people, whether users or non-users, with autonomous and semi-autonomous technologies in order to build trust and confidence in these new technologies while collecting valuable operational and performance data.

The Autonomous Warrior Transport On-base (AWTO), an ARIBO Program, is addressing the real-world needs of the Warrior Transition Battalion (WTB) at Fort Bragg. The soldiers in this battalion, some of whom have mobility difficulties, often require transportation assistance from the barracks to the Womack Army Medical Center (WAMC). The United States Army Tank Automotive Research, Development and Engineering Center and robotic research are utilizing

robotic technology to provide an unmanned transport system and reservation/reminder system for these soldiers and caretakers. The program has expanded to include WTB cadre and WAMC staff.

The AWTO transportation system is an on-demand service, where users can request a ride from their mobile phone or on-site kiosks. The shuttle transports participants over a roughly 1 square mile area with five pickup/drop-off locations. https://youtu.be/ZwqQ3zWcceU.

**Subject Matter Expert Comments**

- "Proof of concept deployment projects are of very high value. It would be good to have one that is focused on the civilian population as well."

***The remaining ideas were submitted during the dialogue but did not meet the criteria for further consideration; however, they may include pertinent information for future efforts.***

**1. Don't forget the costs of infrastructure and building community**

*Received 4 votes and 4 comments during the dialogue*

Inherent in discussions about autonomous vehicles (AVs) are the costs associated with them. These costs are often presented in terms of cost of design/manufacture, purchase/lease, maintenance costs, insurance costs, and tax/licensing policy which promotes the development and deployment of AVs. The one aspect of government policy that has been overlooked in this discussion, so far, is the topic of the actual infrastructure associated with the operation of ALL vehicles, including those that are autonomous.

One of the costs associated with AVs is the anticipated growth in traffic to city streets that are often, in many urban areas, at capacity. In the ideal version of AVs people abandon car ownership in favor of using AVs. People of all stripes will be able to motor about in increasing numbers. This will increase traffic. The traditional answer to this is to build more lanes, even some dedicated to AVs. The challenge with this is the concept of induced demand. When a street is enlarged, congestion is eliminated temporarily. In time, the number of drivers increases to meet the increased capacity. Congestion returns. And, historically, we build more capacity to meet the demand and create more induced demand.

This building of more road capacity costs money. Where will this money come from? State gas taxes range from a high of $0.582 per gallon in Pennsylvania to $0.1225 per gallon in Alaska. The average is $0.3104 per gallon. The federal gas tax is $0.184 per gallon. These taxes along with tolls and motor vehicle license fees covered 41.4 percent of state and local road spending in 2013. The remaining funds come from general federal, state, and local revenues. Depending

on where one lives, the mix of user fees/taxes and general funds with more rural states tending to subsidize transportation spending from general revenues.

What does this mean for AVs and transportation policy? Pervasive AV use will create more traffic and congestion, even with expanding road systems. The footprint of 200 people in 177 cars is much larger than 200 people on three buses or on one light rail train. When the Brooklyn Bridge was converted from part rail to all cars in 1948, it went from carrying 400,000 people per day to carrying only 170,000 people per day. In congested places, AVs are not a solution to transit.

In addition, there are other policy implications with AVs, particularly in the development of communities. AVs serve to heighten suburban-style development. Such development is a function of many factors, particularly highways. AVs will serve to use of cars and, serve to expand our cities horizontally. This creates the need for more infrastructure to build and maintain. The tax revenue from low-density places is not enough to repair/replace the roads and pipes once they fail. AVs serve to induce more suburban development much as car ownership does.

Another policy implication is associated with safety. By increasing support of AVs and cars in general, we implicitly decrease support from what makes our communities livable. More car lanes mean narrower sidewalks, thus decreasing use due to proximity to traffic and difficulty to navigate. Narrower sidewalks lead to fewer merchants along those streets as people will not be walking to them. Fewer walkers will serve to increase our nation's obesity rate and lead people into more sedentary lifestyles.

With all this said, I do not want to write off AVs. The unfortunate thing is the focus is on how we can make cars safer and autonomous. In that way people with disabilities can get to where they want to go. I suggest we look at how we can provide cost-effective transportation options (including AVs – such as Ford's AV bus initiative) to people so that we have strong communities for all.

**Subject Matter Expert Comments**

- No clear policy proposal here.
- "While this is an important issue, I'm not sure that this is not beyond this particular activity. Autonomous vehicles that can be linked together in high traffic density areas may effectively become high capacity and linked public

transit fixed route systems, with break off individual modes in lower traffic areas. This is a whole separate, though important, issue outside this activity."

**2. Disadvantaged Populations in Rural Areas**

*Received 5 votes and 3 comments during the dialogue*

There is a lack of research and no clear vision for self-driving vehicles in rural areas. The transportation needs of tribal nations must be considered.

**Subject Matter Expert Comment**

- Important for the disability community, but needs more detail.

**3. Achieving Wheelchair Accessible On-demand Transportation**

*Received 16 votes and 19 comments during the dialogue*

As someone who's been exploring the idea of equal on-demand transportation for people with disabilities, I feel we need to first solve the lack of wheelchair-accessible vehicles (WAV) on the networks of major TNCs like Uber and Lyft.

In most U.S. cities, simply getting a human-driven on-demand WAV ride through Uber or Lyft is nearly impossible.

I believe solving this problem first will bring us much closer and move us much quicker towards accessible autonomous vehicles. It will provide opportunities to gradually test automated systems that allow wheelchair users to safely load, unload, and secure their wheelchairs independently.

Essentially, by focusing on achieving accessible on-demand transportation through TNCs today, we will in return solve the autonomous vehicle accessibility issues of tomorrow.

**Subject Matter Expert Comments**

- "We need to find a strategy to make TNC-like service available to people with disabilities, but the answer is make sure such a system is in place locally, versus making every TNC company responsible. Make this a system, not a company requirement. Also, while this is an important issue, it is not really an autonomous vehicle issue."
- "The goal is very important, but it is not clear how this would be accomplished, so I am not sure that this idea is ripe for review. I would note that the obligation of TNCs to provide WAVs is currently the subject of intense litigation."
- "There are currently almost no regulatory levers that federal agencies have with respect to TNCs."

- "The idea needs more specific actions rather than a goal. I agree with the goal, but it is not clear how to go about it."

**4. Autonomous Vehicle Interface for Visually Impaired Users**

*Received 7 votes and 10 comments during the dialogue*

At the University of Florida, I am currently conducting research designed to make autonomous vehicles accessible for users with disabilities. Currently, we are developing a system designed to help individuals with visual impairments control and interact with a fully autonomous vehicle. The system will enable users to enter their desired destination and route using touch or speech input. The system also uses a number of different technologies to 1) help users verify that they are going in the desired direction, 2) adjust the behavior of the autonomous vehicle to improve user comfort (e.g. speed and braking), 3) receive information in real time to support situational awareness (location of pedestrians, emergency vehicles, etc.) 4) and verify their arrival at the desired location (e.g., did I arrive at the grocery store or did the vehicle take me to a field somewhere?).

The system is nearly complete, and we anticipate conducting on the road testing in Florida December through January of this year.

**Subject Matter Expert Comments**

- "The two safety reports released by Waymo and GM suggest that this is being done."
- "This strategy can be considered by designers as part of the options to make vehicles fully available to people with disabilities."

**5. Grant Programs**

*Received 4 votes and 5 comments during the dialogue*

The government should issue Request for Proposals that would encourage developers to design, manufacture, and promote the use of autonomous vehicles. Additionally, the cost of leasing (purchasing??) such vehicles should be an allowable cost in any employment and training program targeting individuals with disabilities who are seeking job training and/or employment.

**Subject Matter Expert Comments**

- "The design parameters for people with disabilities should be a federal requirement, perhaps an expanse on the ADA. Incentive grants for training programs are appropriate."
- "I am not sure it is the right role for the government to directly requisition a vehicle."

- "I am concerned that this could become expensive and not deliver commensurate benefit."
- Should be a requirement for DOL and its partner agency (or agencies) to implement this idea.

**6. Privately Owned AVs in Rural Areas**

*Received 4 votes and 11 comments during the dialogue*

Is there a reason we are not considering these for private ownership by individuals with disabilities? For individuals in more rural areas, or that have a commute that exceeds the boundaries of the public transit system, these vehicles could make a big difference on their ability to interact with the community. [ODEP note: Ownership could include individuals, cooperatives of people, local and regional governments, and employers/groups of employers.]

One option is to improve rural transit. It's very expensive per ride now, and a lot of the cost is for the drivers. If you can supplement that service with driverless shuttles, which have a lower cost to operate, then you can increase the frequency of service. Or a community could set up a co-op system and purchase vehicles that everyone could share.

**Subject Matter Expert Comments**

- "It is true that paratransit services are less usable in rural areas. However, I think the issue raised here is better addressed through a program dealing specifically with rural mobility, rather than a disabilities program."

**7. Accessibility for the Deaf/Hard-of-Hearing Community**

*Received 12 votes and 8 comments during the dialogue*

As a health care provider for the Deaf/Hard-of-hearing community, I believe it is vital that autonomous vehicles include universal design features. Individuals with disabilities miss many days of work due to limited access to transportation and it is important that autonomous vehicles include design features that benefit those in the disability community. For individuals who are Deaf/Hard of hearing, that may look like visual screens with keyboards so that the individual can interact with the vehicle and tell it where to go. It may also include visual pictures of the mapped route to that location and written or pictorial output of turn by turn moves the autonomous vehicle is making along the route.

**Subject Matter Expert Comments**

- "This is fairly easy. Interestingly, deaf people do not encounter the same issues driving a car that blind people or wheelchair users do. The HMI will be accessible to this population; it is already being developed by a couple of companies."
- "This recommendation is targeted towards a subsection of the community."

- "It seems like a heavy lift for federal agencies to be get involved in very specific aspects of app design. This guidance is better offered at a higher level of generality."

**8. National Performance Standard**

*Received 0 votes and 0 comments during the dialogue*

Create a national performance standard and design regulations and leave oversight of insurance, licensing, and other issues to the states.

## Appendix B – AV Twitter Chat Recap

### Topic Summary

On October 20, 2017, ePolicyWorks co-hosted a Twitter Chat with Securing America's Future Energy (SAFE). Participants joined a real-time, interactive discussion on how autonomous vehicles (AVs) can be leveraged to expand access to competitive, integrated jobs for people with disabilities and what issues policymakers should consider when developing legislation, regulations, or other policies that govern autonomous vehicles.

The chat featured special guests including Amitai Bin-Nun, Vice President of Autonomous Vehicles and Mobility Innovation at SAFE; Kent Keyser, Policy Fellow at United Spinal; Dylan Hedtler-Gaudette, Government Affairs Specialist at the National Federation of the Blind (NFB); Anil Lewis, Executive Director at the NFB Jernigan Institute; and Sachin Pavithran, Presidential appointee to the U.S. Access Board.

The chat built upon the ongoing ePolicyWorks online dialogue, "Autonomous Vehicles: Driving Employment for People with Disabilities," hosted by the U.S. Department of Labor's Office of Disability Employment Policy (ODEP) and SAFE. Participants were invited to continue the conversation by engaging in the online dialogue.

Questions Asked During Chat

- (Poll) What community are you representing during this chat?
    - disability community
    - transportation industry
    - technology industry
    - government
    - other
- How does a lack of access to transportation impact the disability community?
- How can developers of autonomous vehicles (self-driving cars) ensure accessibility for people with disabilities?
- How would widespread use of autonomous vehicles impact employment opportunities for people with disabilities?
- What impact do you think self-driving cars would have on employment opportunities for people with disabilities?

- What are some of the challenges to making widespread use of self-driving cars a reality for people with disabilities?
- How can we ensure self-driving cars are an affordable option for people with disabilities?
- Participants, if you identify as having a disability, what concerns do you have about using self-driving vehicles?
- What can policymakers do to support the development of autonomous vehicles for widespread use?

## By the Numbers

- Number of Tweets posted with the #ePWChat during chat: (including tweets from ePolicyWorks): **178**
- Number of asked questions: **10**
- Number of Retweets for @ePolicyWorks during chat: **81**
- Number of Tweet "likes": **150**
- Number of Tweet impressions (times a user is served a Tweet in timeline or search results) during chat: **14,581**
- Number of active Tweeters (participants who posted at least once) during chat: **25**
- Number of new Twitter followers: **40** as of initial chat promotions

## Key Topics Discussed by Participants

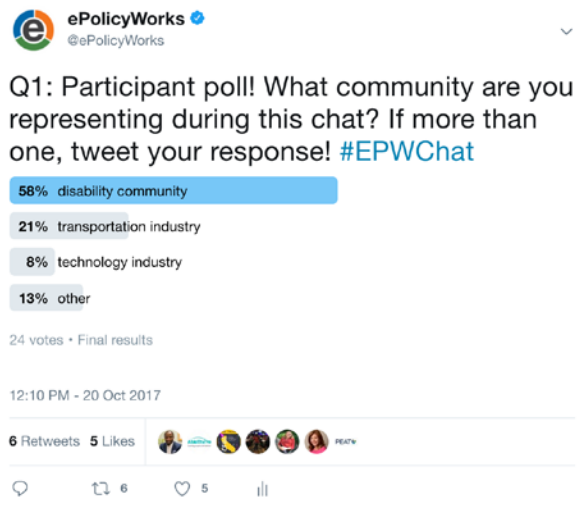
- Benefits of self-driving cars for people with disabilities
- Lack of access to accessible transportation options
- Importance of collaborating with disability community to develop autonomous vehicle technology
- Working with policymakers to further legislation regarding autonomous vehicles
- Design and usage concerns people with disabilities have regarding autonomous vehicles
- Expenses of accessible transportation/autonomous vehicles

## Notable Participating Twitter Accounts

- National Council on Disability – @NatCounDis
- Consumer Technology Association Foundation (CTAF) – @CTAFoundation
- Gary Shapiro (CEO of CTAF) – @GaryShapiro
- Autistic Self Advocacy Network – @autselfadvocacy
- Easter Seals Thrive @ability2thrive

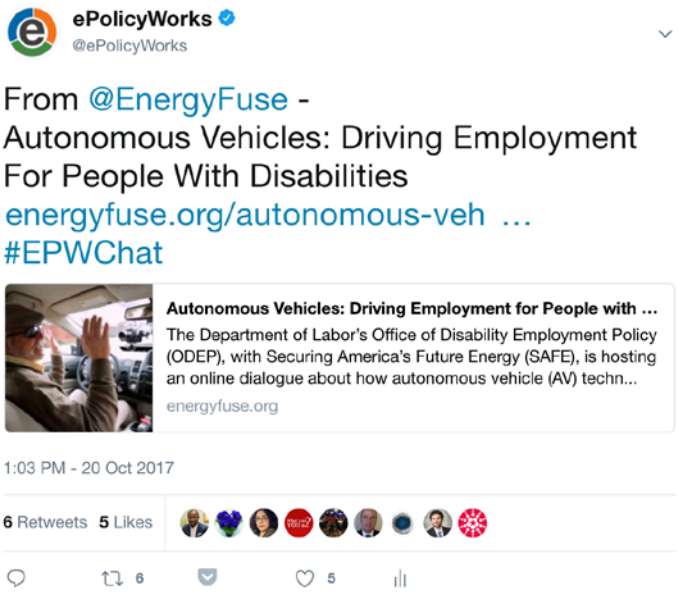
## Top 3 Tweets from @ePolicyWorks with the Most Retweets

### 1. Impressions: 525



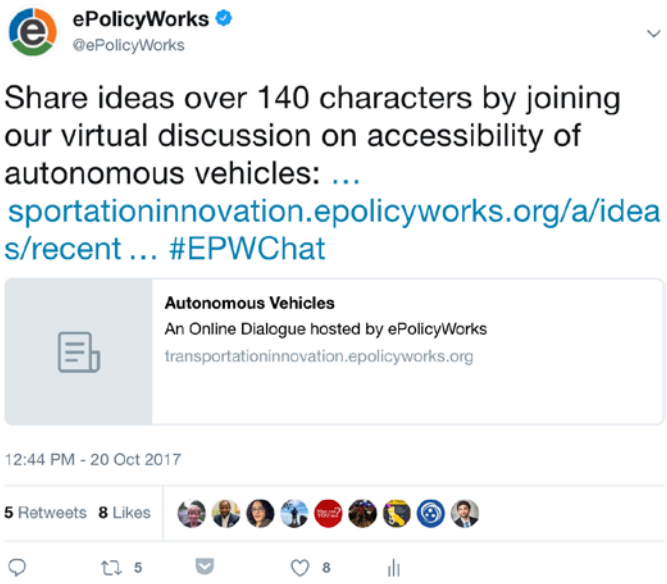

[Image Description: Tweet from ePolicyWorks that reads “Question 1: Participant poll! What community are you representing during this chat? If more than one, tweet your response! #EPWChat.” Four choices are listed and then the percentage of votes they received. Disability Community 58%; Transportation Industry 21%; Technology Industry 8%; Other 13%. There were a total of 24 overall votes. The tweet has 6 Retweets and 5 Likes. Link to Tweet.]

**2. Impressions: 978**




[Image Description: Tweet from ePolicyWorks that reads "From @EnergyFuse - Autonomous Vehicles: Driving Employment For People With Disabilities http://energyfuse.org/autonomous-vehicles-driving-employment-people-disabilities/ #EPWChat." Tweet has 6 Retweets and 5 Likes. Link to Tweet.]

**3. Impressions: 555**




[Image Description: Tweet from ePolicyWorks that reads "Share ideas over 140 characters by joining our virtual discussion on accessibility of autonomous vehicles: https://transportationinnovation.epolicyworks.org/a/ideas/recent/campaigns/52785 #ePWChat."