



2022 Forum on the Impact
of Vehicle Technologies
and Automation on Users:
A Summary Report

October 2022

Title

2022 Forum on the Impact of Vehicle Technologies and Automation on Users: A Summary Report

(October 2022)

Foreword

As the world contends with impacts stemming from the global pandemic, vehicle technology continues to advance and evolve at a rapid pace. Understanding its impact on travel behavior and road safety remains a pressing area of need. This year, 2022, has been a watermark year for the return of in-person events, including the Forum on the Impact of Vehicle Technologies and Automation on Users. This year's event, held on campus at the Arizona State University, brought together many stakeholders to engage in conversations surrounding pressing questions and research needs.

This report summarizes panel discussions, presentations, and discussion from the 2022 Forum, including active participants from academia, industry, government, and other domains. This report should be of interest to researchers and practitioners who are involved with work related to vehicle technologies and automation.

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About the Sponsor

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Introduction

On April 5–6, 2022, the AAA Foundation for Traffic Safety (AAAFTS) and the Arizona State University hosted a forum to discuss issues and identify future research needs on the impact of vehicle technologies and automation on users. This forum, the fifth in the series, focused on the current state of vehicle automation technology deployment and the progression to higher levels of automation.

Consistent with past forums, the main objective was to gather representatives and experts from the research community, government, industry, and other stakeholders to discuss issues and to identify research needs and critical considerations regarding the implementation and safety of vehicle technologies and automation. A list of registered organizations can be found in Appendix A.

On Day 1, three expert panels were convened to discuss a variety of topics related to vehicle technology, automation, and their interaction with transportation system users. On Day 2, forum attendees engaged in a world café exercise, a structured conversational process in which small groups discuss and share knowledge on specific questions. The panel presentations and discussions, world café exercise, and outcomes are described in the sections below. The forum agenda can be found in Appendix B.



Panel 1: State of Vehicle Automation Development & Deployment

(Panelists: Dr. Peter Burns, *Transport Canada* (virtually); Mr. Chan D. Lieu, *Aurora*; Dr. Steven Shladover, *University of California–Berkeley*. Facilitator: Dr. Ram Pendyala, *Arizona State University*.)

Dr. Peter Burns discussed the current state and importance of a human-centered system design in meeting human needs and driver interaction with automation, while pointing to a number of notable deficits in some emerging vehicle (shuttle) designs and interfaces. He outlined a number of efforts and initiatives to advance discussions, guidance, and recommendations concerning human–machine interfaces (HMI). He also described the quantification of virtual testing tools.

Mr. Chan Lieu provided an overview of a Safety Case Framework (see figure), which he described as being grounded in structured arguments supported by evidence to justify that a given system is acceptably safe. He noted that there are currently no Federal Motor Vehicle Safety Standards but that it is possible to leverage approaches used in other safety-critical domains. The five broad principles in the Safety Case Framework are: (i) Proficiency, (ii) Fail-Safe, (iii) Continuous Improvement, (iv) Resilience, and (v) Trustworthiness.



Dr. Steven Shladover described many of the challenges associated with the deployment of new technology, especially considering that human drivers (baseline) have already set a very high bar in terms of safety. He provided a conceptual framework with safety assurance as the center piece and acceptance, regulations, and technology safety as influencing factors. He further provided some insights into the segments or applications where the technology is likely to emerge the quickest (or at all).

The ensuing discussion covered a gamut of topics including the state of progress on automated/autonomous vehicles (AV) development, realistic expectations about safety levels and the selection of minimum acceptable levels, infrastructure needs and priorities, and the role of standards and regulations, education/training, driver monitoring, and remote operators, among other topics.

Panel 2: Moving toward Higher Levels of Automation: Lessons Learned & Challenges

(Presenters: Dr. Natasha Merat, *University of Leeds* (virtually); Dr. Jeffrey Wishart, *Institute of Automated Mobility*; and Dr. Larry Head, *University of Arizona*; Facilitator: Mr. Brian Tefft, *AAA Foundation for Traffic Safety*.)

Dr. Natasha Merat offered some perspectives on why moving towards higher levels of automation is so difficult, underscoring the significance and the wide range of unexpected possibilities and other unintended consequences. She emphasized that the field of human factors, relevant literatures, and guidance can be leveraged, especially concerning the limitations of human operators in automation environments leading to confusion, boredom, and reduced monitoring. She discussed the importance of keeping drivers in the loop through good design and driver monitoring, but also considered the perceptions and safety of other road users when interacting with automated vehicles.

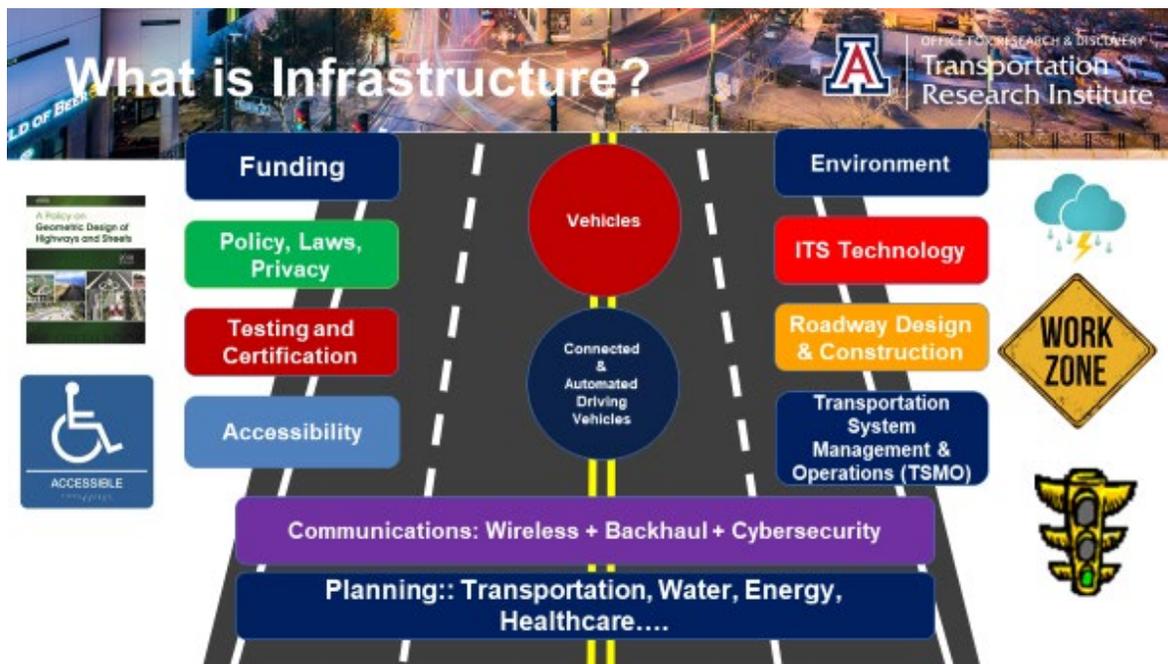
Dr. Jeffrey Wishart discussed best practices leading to standards and regulations, while considering many technical issues related to operational performance and safety evaluation. He provided a regulatory framework, which can feed into a safety case (see figure). With respect to testing and validation, he described methods, metrics and their interpretation, and thresholds. He also referenced some ongoing international efforts regarding metrics, including work by the Society for Automotive Engineers (SAE) On-Road Automated Driving (ORAD) Committee.

Regulatory Framework

- FMVSS-like regulatory scheme not likely to evaluate AV safety – Safety Case?
- Test and Validation Methods
 - Metrics and metrics interpretation
 - Test methods, including fidelity
 - Scenario comprehensiveness
 - Single evaluation?
 - Evaluation criteria (“how safe is safe enough?”)

Design and Development Methods	Test and Validation Methods
Systematic Process	Simulation Testing
Safety Principles	SIL/MIL/HIL Testing
Safe By Design Architectures	Closed Course Testing
Formal Proof	Public Road Testing
Robustness Analysis	
Safety Management System	
Training	Test & Development Procedures
Change Management	Operations Procedures

Dr. Larry Head focused his comments on the role of infrastructure in order to support the advancement of automation to higher levels. Infrastructure, in his view, is not just the road, but incorporates other elements as well, including funding, policy and laws, accessibility considerations, planning, and communications, among others (see figure). In discussing the levels of vehicle automation against tenets of infrastructure automation, he touted the potential merits of a “moon shot” as a cooperative driving automation effort. He also noted the importance of trust as a foundational piece upon which other things can progress (e.g., funding, adoption, etc.).



In the discussion following the panelist remarks, questions related to prominent lessons learned (and similarly lessons remaining to be learned) were posed, along with topics such as how to advance infrastructure needs in an effective manner (including bandwidth and approaches to communication), considerations for accessibility and affordability, standards or unified guidance, and the need for provisions for testing and validation.

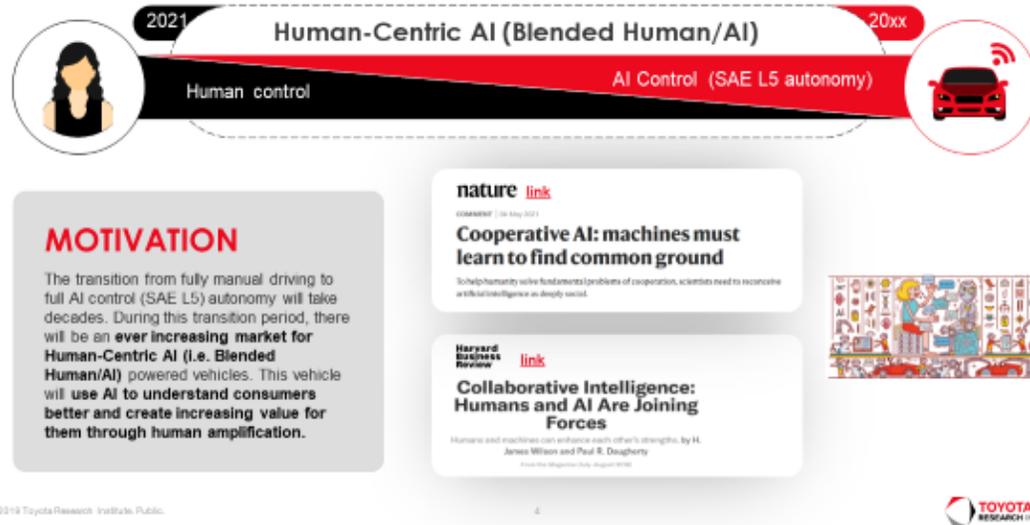
Panel 3: Moving toward Higher Levels of Automation: Opportunities & Next Steps

(Panelists: Dr. John D. Lee, *University of Wisconsin–Madison*; Dr. Avinash Balachandran, *Toyota Research Institute*; Dr. Hani S. Mahmassani, *Northwestern University*. Facilitator: Dr. William Horrey, *AAA Foundation for Traffic Safety*.)

Dr. John Lee, in discussing the future of automated vehicles, implicated the importance of peoples’ mental models in shaping predictions of the future, noting that they allow us “to see what we want to see and disregard the rest.” He further noted that people are not good at assimilating new information and updating their predictions, using the transition from fountain pens to ballpoint pens as a useful analogy when considering technological innovations, user mindsets, and “fleet” turnover. Reframing thinking about self-driving cars could be a means of nudging end users and other stakeholder towards the technology.

Dr. Avinash Balachandran discussed some of the approaches being undertaken at Toyota to bring research into production. One the overarching principles being espoused is a human-centric approach wherein automation amplifies rather than replaces humans (see figure). He noted many of the challenges fall between technology as it currently exists and the future state of “full autonomy” and in trying to add value right now (through what he referred to as blended human-AI systems). He touched upon a variety of approaches that could enhance driver experiences and safety, including using AI to train drivers to improve their skills, or providing more personalized interventions to enhance safety.

Human Centric Intelligent Driving (HCID)



Dr. Hani Mahmassani noted many pressing questions concerning connected and automated vehicles and touted a gap analysis approach to identify key travel-demand components needed to forecast the public uptake or adoption of automated vehicles. He discussed automated vehicles from the perspective of household activities and travel, citing vehicle ownership (versus shared fleets), “chauffeur features”, time use and savings, and spatial flexibility (e.g., leave car in one place and pick up in another) as important dimensions. He also noted some of the challenges in study travel behavior with the advent of automation.

The subsequent discussion covered a multitude of topics including approaches to reframing our collective thinking about vehicle automation, and trust and reconciliation of the levels of automation. Issues concerning the business models for automated vehicles (e.g., AV as a service), likely target end users, and implications for design were also entertained.

Breakout Discussions and Outcomes

Following a similar model as in previous years, Day 2 involved breakout group discussions in order to gather input and feedback from all attendees. A World Café approach was used, which is a structured conversational process for sharing knowledge in small groups. Groups discuss a topic at a table and, after 15-minutes, they rotate to a new table and topic. A table “host” provides an overview of what previous groups have discussed and the group aims to build upon the previous groups’ discussions. In the current exercise, six small groups were exposed to 3 different question sets (all group were exposed to each question set two times):

1. What are the most challenging problems that remain to be solved to enable widespread deployment of Automated Driving Systems (e.g., technology, public acceptance, regulations, ...) and why?
2. What are the key safety measures in the context of higher levels of vehicle automation (consider both pre-deployment and post-deployment)? What are some examples of appropriate targets or thresholds for these measures?
3. What are the most pressing research needs concerning user interactions with Automated Driving Systems, especially considering the move towards higher levels of automation? How should we address these research needs?

After each group had rotated through all of the questions, the six table hosts each presented a summary of key themes that emerged throughout the discussions at their respective tables. Information from those presentations, the notes from group interactions, and the feedback gleaned from individuals have been distilled and synthesized in the sections below. While this captures many of the main themes, it does not do justice to the rich, dynamic, and interconnected threads comprising the group discussions. Further, there was some overlap in the scope of the questions as well as in the ensuing discussion. This is reflected in the sections below.



What are the most challenging problems that remain to be solved to enable widespread deployment of Automated Driving Systems (e.g., technology, public acceptance, regulations)? Why?

Many important problems, challenges, or barriers were discussed during the World Café exercise, many of which fell into the categories of technology, policy/regulations, and public acceptance. Additionally, an emergent topic that concerned many commenters related to access or equity issues. Many of the discussion threads are grouped in sections below. Interestingly, from a higher level, there were some disagreements about how different types of barriers may interact with or stem from one another. One perspective was that issues related to technology should be addressed before barriers related to policy and public acceptance could be tackled. Others believed that progress on different fronts was not necessarily orthogonal and that addressing barriers was likely to occur in cyclical fashion as opposed to a defined sequence.

Technology

Technological barriers tended to relate to design philosophies, technological capabilities, and system-level considerations. Expressed as needs, these included the following:

- Develop/refine/focus on safety critical software
- Identify model or ideal behaviors for automated vehicles. That is, whether AVs should replicate the “best” human drivers or if different driving profiles should be considered.
- Focus resources to advance deployment in one specific application area, given many areas, challenges, and limited resources
- Resolve different approaches to deep learning, e.g., whether “training” AVs will leverage shared (fleet-level) experiences or different AV “personalities”?
- Consider that challenges will vary and evolve as technology progresses
- Ensure that technology will work across all environments and conditions. For example, the operational design domain (ODD) will need to include rural roads, in snow, other conditions, in order to facilitate widespread adoption.
- Consider many infrastructure needs, e.g., specialized lanes, changes to speed limits
- Identify and mitigate safety issues, enhancing prediction and detection of environmental objects, including bikes and pedestrians as well as non-AV fleet vehicles
- Determine best approaches to interact and communicate with other road users as well as with law enforcement, first responders, etc.
- Identify potential misuse of technology and mitigation strategies

Policy and Regulations

A number of challenges related to policy, regulations, or adjacent topics. These included the following:

- Increasing the clarity around technology for policy makers
- Enhancing the level of transparency for regulation (although the mechanism for such is unclear)
- Managing role of and interactions between different jurisdictions concerning regulations and deployment
- Timing and scope of regulations, such that they are sufficiently broad to allow for innovation, while not being misguided by being implemented too early in the process
- Articulating the relationship between AV and public transit, eco-issues (carbon footprint), and societal benefits
- Safeguarding against illicit or illegal activities carried out in (or implicating) AVs
- Resolving liability issues, including responsibility in crash situations, the decision authority, etc.
- Increase transparency, such that companies are more open with their current development status
- Render decisions regarding the best or most appropriate business model (e.g., goods/services, monetization of individual data, advertisement with captive audience). Different use cases will call for different costs, time, insurance approaches, etc.
- Facilitate sharing of safety advances for the benefit of all road users. (Many participants stated in various ways that safety should not be proprietary.)

Regulation was also described as an aspirational process as well as a spiral or iterative process that requires partnerships and collaboration, especially as technology and other developments evolve over time. It was also noted that, while regulations can help guide development processes, they may not guide performance standards.

Public Acceptance

Many challenges were noted regarding public acceptance and adoption as well as issues concerning driver interactions with AV technology. These included the following needs:

- Improve the clarity surrounding technology for public consumption, including how to effectively communicate limitations to the public, along with other critical information
- Create and support positive and clear information to address negative public opinion
- Understand and consider real public response (both positive and negative) as inputs to improve systems
- Alignment of stakeholder expectations (need to be realistic; understanding that expectations will evolve over time)
- Understand perspectives and needs of different users, given heterogeneity in driving or user population
- Determine what types of information resonates best with consumers in terms of acceptance, adoption, and use. Reducing fatalities is too “remote” a concept to many

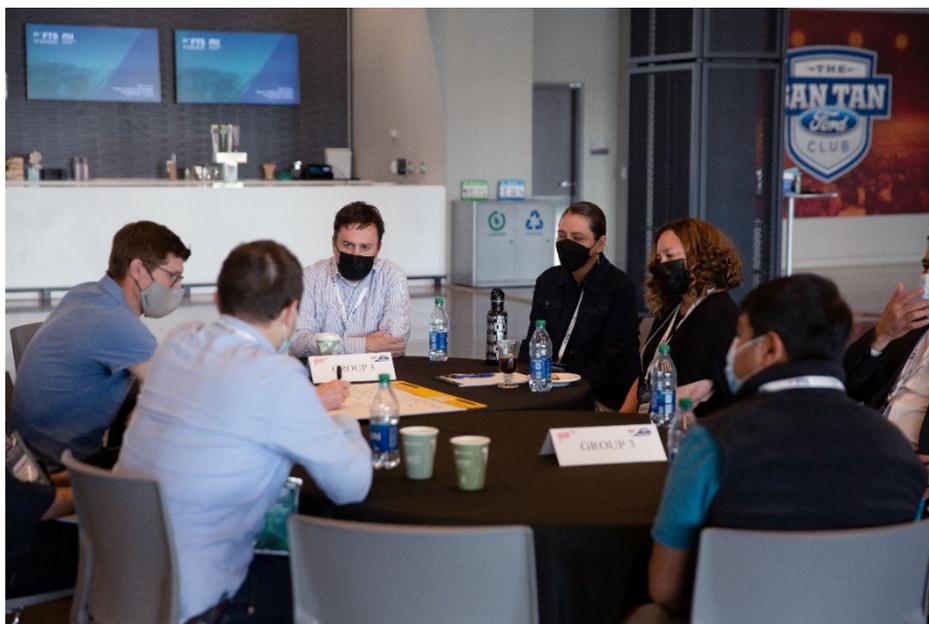
users; focusing on financial aspects, quality of life (mobility, commute time), or other dimensions may be more useful.

- Differentiate AV from other mobility services, such as ridesharing
- Identify the critical skills needed in the transition for drivers from today's vehicles to AV
- Facilitate exposure to AV technology, including initial as well as subsequent use case scenarios, in different roles (driver/passenger/other road user) and examine the impact on user perceptions and acceptance of technology

Access and Equity

Although not independent from the categories above, access and equity issues were integral features in many of the discussions. Access and equity-related issues raised by participants included the following:

- Affordability, cost of vehicle and insurance
- No entity charged with ensuring equity: what is the role of governments, for profit businesses, other stakeholders/entities?
- Deployment/business models remain uncertain, although they will have different implications for equity (public service/transit, shared versus ownership models)
- Understanding of needs of different user groups/communities, including those with disabilities, mobility needs, etc.
- Measuring equity and goal setting and how to prioritize these in relation to other milestones/targets
- Capabilities and ODD of technology, which will impact equity. That is, the technology will need to operate or provide service in all areas where need exists.
- Understanding aging of technology and the implications for the used vehicle market
- Understanding and mitigating unintended consequences for non-users of automated systems (e.g., will proliferation of owned or shared AVs lead to reduction in investment and thus service for transit?)



What are the key safety measures in the context of higher levels of vehicle automation (consider both pre-deployment and post-deployment)? What are some examples of appropriate targets or thresholds for these measures?

Measures

Many different measures were brought up in group discussions, including safety metrics, vehicle performance and behavior, traffic system performance, and others. With respect to safety, crashes were paramount and encompassed all levels of severity: fatal, injury, property damage only. Other correlated surrogate safety measures were also called out, especially as an expansion of onboard sensors and data can help improve the fidelity of such surrogates. Where possible, identifying crashes that the technology helped to prevent was thought to be beneficial, along with information about causality in cases where crashes do occur (i.e., who was responsible or who originated a crash).

New vehicle technology also affords more data regarding the behavior and performance of the vehicle, including its speed, acceleration, trajectory, safety envelope, headway, time to collision, etc. The capacity to measure such elements was likened to onboard tracking devices employed by insurance companies. Other system performance variables were noted, such as system disengagements, including the number of voluntary takeovers, forced takeovers, and safety critical events. It follows that an understanding of what caused these issues or events is of critical importance. Relaying such metrics in terms of exposure is essential, not just in terms of per mile traveled but also in relation to the vehicle's ODD (e.g., billions of miles driven on highway will not generalize to urban environments). The groups also suggested that redundancy reliability (i.e., agreement between independent on-board systems) could be a useful metric as well as the ODD itself (when applied in conjunction with other measures).

Groups also noted system-level (macro) indicators to be used for establishing operational domains based on traffic throughput and mobility. Environmental considerations were also noted, including net pollutants and numbers of/miles driven by empty vehicles). Lastly, public perceptions (and related factors) were raised as important metrics as they impact other issues such as adoption and use.

Benchmarking & Thresholds

There was much discussion and debate regarding the appropriate targets or benchmarks for the post-deployment safety performance of AVs. Some participants contended that zero fatalities and serious injuries was the only acceptable goal. Others, however, debated whether this was realistic, and expressed that while AV developers, manufacturers, and stakeholders should continually strive to reduce risk and improve safety, the existence of a non-zero number of fatalities or injuries should not preclude AV deployment provided the rate of such negative outcomes associated with AVs remained lower than the corresponding rate in human-operated vehicles by some agreed-upon margin.

Although not independent of these crash benchmarks, groups also discussed the behavior of AVs. For example, if they should aim to behave and perform as the average

driver or as the “best” drivers. Such an approach might elicit more natural behaviors (in relation to the expectations of other road users); however, some believed that human drivers might not be good benchmarks for technology. This sparked lively discussions and debates over whether AVs should follow precisely any relevant laws or if more normative behaviors should be considered. In the case of travel speed, for example: should an AV strictly comply with the posted speed limit at all times, or should it match the prevailing speed of traffic to reduce the theoretical risk of being rear-ended by a human-driven vehicle travelling at a higher speed?

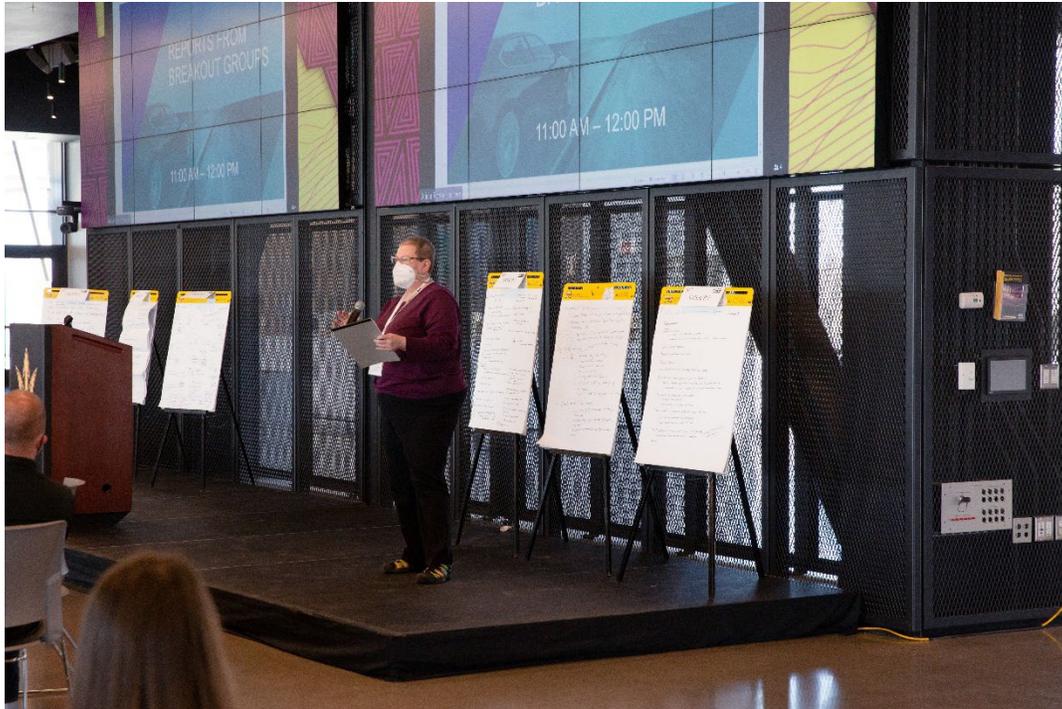
For all metrics, discussants agreed that the right data (and access to the data) were critical, along with the need to verify and validate measures. Prior to deployment, simulation models need to be improved and validated (and, in doing so, consider the proprietary nature of systems). Thresholds cannot be established in a vacuum and need to be decided jointly between different stakeholders. Moreover, the thresholds may vary according to the environment or operational domain (e.g., it is conceivable that relevant stakeholders may deem it acceptable to exceed the speed limit under certain conditions on a limited-access highway but never in an urban environment).

Other Related Topics

The discussion of critical metrics and thresholds led to other topics, including the need to establish under what conditions measures should be gleaned, how to reconcile efforts from different countries or states, and issues concerning accreditation. Given that many measures are situational, the groups noted the need to define what and how many scenarios are implemented for testing or evaluation. This could include different operating conditions, locations and road geometries, speeds, etc. It was noted that AVs can be highly adaptable to the environment and circumstances and can change behaviors as necessary to enhance cooperation and safety (one example was that AVs could become “pace cars” when approaching a previous crash or disabled vehicle).

The groups also noted the need for greater standardization in metrics and reporting. Measures need to be validated but also drawn from different regions and jurisdictions, making standardization an important consideration. Reporting and access to data are equally imperative, including a determination of what information is required and what (proprietary) information is less relevant.

Lastly, the groups also discussed the prospects of future vehicle licensing; that is, accreditation of vehicle technology through a form of driver’s license for vehicles (or, alternatively, through star ratings). Naturally, this would merit a deeper consideration of the different levels of technology and use cases.



What are the most pressing research needs concerning user interactions with Automated Driving Systems, especially considering the move towards higher levels of automation? How should we address these research needs?

The World Café exercise yielded numerous research needs covering a variety of topics. In general, a wide range of methodological approaches were espoused, depending on the nature of the research question. These including but are not limited to ethnography, lab/benchmarking, simulation, field studies (mapping to actual experiences), modeling, and persuasion research (e.g., to promote public acceptance of AVs), among others. Gathering information from actual users' experiences was often cited as a general need, along with more data on broader segments of population. Moreover, many encouraged cross-sectional or multidisciplinary research efforts. The following research needs or questions were distilled from group discussions and notes and have been grouped into broader categories.

Consumer Education and System Understanding

- What are the most effective ways of conveying information about automated systems, including their capabilities and limitations (e.g., immersive training, feedback approaches, scenario-based, etc.)?
- How can consumer education be tailored to the specific vehicle or technology and the needs of the individual driver/user?
- What is the most effective way to convey critical information to drivers of rental, borrowed, or used vehicles (i.e., drivers who obtain the vehicle elsewhere than from a new car dealer)?
- What is the quality of dealer knowledge concerning vehicle technology and how is it translated to prospective buyers? How can this be improved?

- What are the system affordances that contribute to (or detract from) appropriate use? What do users know and expect concerning system–driver handoffs?
- How do perceptions of emerging automation technologies differ between users and non-users?
- What are the best approaches to communicate with the general public about system benefits, capabilities, and limitations? What approaches should be considered for different segments of driving population (e.g., early adopters/believers, skeptics, etc.)?
- How to integrate best practices and lessons learned from past studies and other domains as a benchmark for future research?
- How to account for new road users that now have access to transportation because of AV technology? What are the needs related to disabilities, multilingual barriers, etc. that must be considered?
- What are the best approaches to facilitate the development of calibrated trust (e.g., practice, exposure, information)?
- Can lessons from recent vaccine experience be used inform public trust and acceptance of AVs (i.e., role of social media, external factors that influence trust in AV, misinformation campaigns)?
- How to consider acceptance of technology in the context of many different levels of automation and many different iterations at each level?

System and HMI Design

- What are the implications of personalization, customization, or tailoring of automated systems in terms of interfaces as well as system behaviors?
- What are the best approaches to promote accurate mode awareness on the part of drivers, as well as clear means to exit or change modes?
- How can data concerning driver state be incorporated into allowable functions (e.g., activating or deactivating dependent on driver state)?
- Should automation provide different modes for different roads or conditions?
- What elements should be included in the HMI to promote system transparency, comprehension, and ease of learning?
- How does user experience (UX) influence safety? How does UX change as the role of driver moves more towards that of a passenger?
- How can researchers efficiently execute studies that are representative of real-world systems?
- How can systems assist or enhance driver takeovers from automation? When can and when should control be taken back from automation?
- With respect to Level 2 automation, how to keep driver engaged while using automated system? Similarly, how can mode confusion be avoided or mitigated?
- How will driver types (e.g., skilled, nervous) and driving styles interact with system use and safety? How do these factors influence understanding, trust, acceptance of systems?
- How can the HMI be leveraged to provide critical driving and system information and, for higher levels of automation, non-driving related content?
- For Level 4 technology, how to mitigate pickup location confusion and enhance or allow for interaction with remote person? How to convey key information to riders (e.g., travel/motion plan, other behaviors)?

- What is the role of remote operators in AV rides?
- What is the experience of motion sickness in AVs and how to mitigate?
- Should riders be allowed to select types of driving styles?
- What strategies can be implemented to keep riders more aware or in the loop concerning driving conditions? For example, limiting types of driving and trip length or duration of automated support with Level 3.
- How to improve interface designs that are more intuitive and how to leverage learnability and consumer education?
- How to enhance communication between AV and other road users including human drivers, pedestrians, cyclists, etc.?
- How can we encourage good “roadmanship” (by AVs as well as others using the same roads)?
- How to ensure adequate occupant protection in the event of a crash in an AV designed to accommodate various seating positions and orientations (e.g., non-forward-facing, sleeping)?
- To what extent do or will other road users test AV capabilities (e.g., cutting off AV or stepping out in front of)? What are the safety impacts?

Non-Driving-Specific Issues

- For shared AVs, what is the willingness among users to share the vehicle and with whom?
- What lessons can be learned from previous accessibility research (e.g., system usability research for visual-impaired persons)?
- How to increase and enhance accessibility to automation technology, considering needs of different age groups, populations, and cultures, including multilingual?
- Special considerations associated with unaccompanied minors traveling in AVs (especially in the context of shared rides in driverless vehicles)?
- How can AVs fulfill non-driving tasks typically done by drivers (e.g., taxi drivers help riders with luggage; help elderly passengers enter/exit the vehicle)?
- How do we give people agency as automation replaces types of human roles?
- How to maintain vehicle cleanliness (for AVs used in shared mobility services)?
- What kinds of data will be shared with AVs and what are the barriers to information sharing?

Policy Considerations

Key legislative and policy considerations for safe implementation and deployment of vehicle automation technologies were discussed at the forum. Such considerations are relevant for federal, state, and local jurisdictions. Detailed information can be found throughout this report, but a summarized list can be found below:

- **Infrastructure investments and upgrades are necessary for greater deployment.** Lawmakers should work with automation stakeholders to determine priorities and roadmap for investments in the near-term and long-term.

- **Until more federal vehicle safety standards are established for advanced automation technologies, regulators should embrace a robust testing and development regime.** Using a variety of testing and development methods, including virtual tools and prototypes on public roads, requires balancing current safety needs with anticipated benefits. However, regulators should weigh how to approach each technology’s testing and development trajectory while ensuring all road users remain safe during on-road testing.
- **Policymakers should be prepared to address new opportunities and challenges presented as deployment increases.** There are still a number of unknowns regarding consumer use cases and adoption patterns for advanced automation vehicle technologies. As deployment increases, regulators will be expected to intervene to mitigate potential harms from advanced automation — such as increased vehicle emissions — or seizing opportunities like reducing congestion.
- **The road to public acceptance for advanced automation technologies will be paved by good educational milestones.** Safe use of advanced automation technologies requires enhanced public understanding of the range of capabilities and limitations of new technologies. Regulators should work alongside stakeholders to guide public education efforts. New skills and learning needs should be identified that will help transition today’s drivers and passengers into tomorrow’s occupants.
- **Access and equity considerations should be top-of-mind for policymakers.** If not, they may not be included during design and development of advanced automation technologies. However, the public will hold regulators accountable for advancing technologies unsuitable for all, delaying or forgoing the potential societal benefits from increased deployment.

Closing Remarks

While the global pandemic had great impacts on work, travel, and in-person events, 2022 marked the beginning (or a beginning) of the return to normalcy. The process continues, but attendees of the 2022 Forum expressed appreciation and, in some cases, relief to share the same space as colleagues. In following its legacy, the aim of the meeting remains modest: to promote engagement and discussion amongst key stakeholders. The breadth of topics described in this report are testimony not only to the quality of interactions, but of the importance of research and information to address pressing needs and overcome significant barriers. Echoing past reports: it is our sincere wish that many of the questions listed in this report can spark imagination, interest, and pursuit—whether by students and faculty, research organizations, other practitioners, or even the system developers themselves.



Appendix A: List of Organizations Registered for the 2022 Forum

AAA National	Science Foundation of AZ
AAA Oregon/Idaho	State Farm
AAAFTS	Toyota CSRC
AECOM	Toyota Research Institute
Arizona Commerce Authority	Transport Canada
Arizona Department of Transportation	UNC Highway Safety Research Center
Arizona State University	University of Arizona
Aurora	University of California PATH Program
Automobile Club of Southern California (AAA)	University of Iowa
Exponent	University of Kansas
Google	University of Leeds
HDR	University of Massachusetts–Amherst
Hyundai Motor America	University of Utah
Institute of Automated Mobility	University of Virginia
Maricopa Association of Governments	University of Windsor
Mobile Video Computing solutions	University of Wisconsin–Madison
Northwestern University	Virginia Tech Transportation Institute
Red Scientific Inc.	Westat
School of Sustainability–ASU	

AGENDA

Wednesday, April 6, 2022

8:00 AM – 9:00 AM

Registration and Breakfast

9:00 AM – 9:15 AM

Breakout Group Assignment & Instructions

9:15 AM – 10:45 AM

Breakout Group Discussion – *World Café Style*

10:45 AM – 11:00 PM

Coffee Break

11:00 AM – 12:00 PM

Reports from Breakout Groups

12:00 PM – 1:00 PM

Conclusion of 2022 Forum & Boxed Lunch

1:00 PM – 5:00 PM

Waymo Tour (Maximal Number of Participants: 15)

Advance Registration is required. Shuttle service will depart at 1:00 PM from the Sun Tan Ford Club and will return to the Hyatt House Tempe at the conclusion of the technical tour.

AV Shuttle Demo (Maximal Number of Participants: 30)

Advance Registration is required. Shuttle service will depart at 1:00 PM from the Sun Tan Ford Club and will return to the Hyatt House Tempe at the conclusion of the technical tour.