



Human Factors and Ergonomics Society

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*Comments on "Ensuring American Leadership in Automated
Vehicle Technologies: Automated Vehicles 4.0"
Docket ID: DOT-OST-2019-0179*

Automated Vehicles (AV) 4.0 provides a broad overview of United States government-led efforts to support the development of automated vehicles. The Human Factors and Ergonomics Society applauds the adoption of AV Technology Principles for guiding development efforts, and in particular the leading principle to "*Prioritize Safety*." As a major shortcoming, however, insufficient emphasis in the document is placed on activities that will achieve this critical safety goal.

It is well established that automated technologies do not reduce human error, but instead create new types of human error as well as automation errors that can negatively affect current transportation accident rates.¹⁻³ Neglecting safety will lead to significant losses in consumer trust in AV⁴⁻⁷, as well as decreased adoption of AV and significant shortfalls in achieving many of the desired goals of the technology.^{8,9}

To achieve the desired increases in transportation safety with the implementation of AV technology, HFES recommends the following key actions be adopted as a key part of the government's plan.

- (1) **Future Research** — A significant emphasis on overcoming human error with automated systems is vital. Emphasizing increased attention to human-automation interaction in the development of AV technologies is needed in order to overcome this major barrier to its successful adoption. Specific research that should be funded includes:
 - a. Development of displays to provide automation transparency – including an accurate understanding of the state of the vehicle and the external driving environment, and transparency into the automation's state, settings, and modes, and what it is planning to do — in order to support both trust and situational awareness needed for performance;
 - b. Development of methods to achieve safe and rapid transition to manual control when needed;
 - c. Establishment of an understanding of changes in human roles with advanced AV (e.g. AV riders, pedestrians, other road users), and methods to support effective integration of AV with these agents;
 - d. Improved research on accident causality factors, allowing AV efforts to focus on critical needs for driver support technologies;
 - e. Development of effective methods for training drivers, users and other transportation system occupants on AV capabilities, limitations and the behaviors of automated and semi-automated systems so that drivers obtain the accurate mental model required for effective oversight and interaction with them, including methods for updating training as AV changes after purchase;

- f. Development of data collection systems for automatically collecting and analyzing AV accident and road usage data to support continued improvements in transportation safety.
- (2) **Regulations** — Updates to the current regulations to accommodate AV must emphasize the need to ensure the safety of users of AV technologies as well as other road users. Any modifications to regulations must recognize that AV technologies are not perfect and are susceptible to errors from sensors and algorithm bias as well as other shortcomings. To accommodate these shortcomings in the foreseeable future, the role of the human as a significant contributor to safety must be recognized and supported with interface technologies that allow them to take appropriate actions.
- (3) **Testing and Validation of AV Technologies** — Testing and validation of AV technologies is an important part of their development as well as any approval for their implementation on the national road system. Highly automated vehicle systems should be required to demonstrate equivalent or improved safety, across both situations in which the system is reliable and in automation failure conditions that involve resumption of control or over-ride by human drivers.
- (4) **Standards and Policies** – The government is promoting reliance on a loose set of voluntary consensus standards created by industry. It is critical that such bodies include experts in human factors to ensure that any standards and policies developed are sufficiently informed by the wide body of research that exists in this arena.

Increased emphasis on these critical issues for human interaction with AV technology will help the United States to achieve its stated goals of improved transportation safety.

HFES is a multidisciplinary professional association with over 4,500 individual members worldwide, comprised of scientists and practitioners, all with a common interest in enhancing the performance, effectiveness, and safety of systems with which humans interact through the design of those systems' user interfaces to optimally fit humans' physical and cognitive capabilities.

References

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