



December 3, 2018

Docket Management Facility
U.S. Department of Transportation
Room W12-140
1200 New Jersey Avenue SE
Washington, DC 20590-0001

Re: Docket no. NHTSA-2018-0092; ANPRM for Pilot Program for Collaborative Research on Motor Vehicles With High or Full Driving Automation

On behalf of Embark, we would like to offer the following comments as the National Highway Traffic Safety Administration (NHTSA) considers a proposed national pilot program to facilitate safe testing and deployment of Automated Driving Systems (ADS).

Introduction

Embark is a San Francisco Bay Area-based company developing the software that will allow commercial motor vehicles (CMVs), specifically Class 8 tractor-trailers, to operate safely on America's highways *without the presence of a human driver* through the use of *Level 4 highway-specific ADS*. We envision our ADS as functioning exclusively on long-haul freight routes along multi-lane, divided, limited access highways. Such automated trucks would be served on either end of a highway route by manually driven trucks and commercial drivers able to complete the off-highway portions of the journey.

Our technology leverages advanced sensors and state of the art machine intelligence to perceive the driving environment and control the vehicle beyond human capability to maximize operational safety and efficiency. In order to develop a Level 4 highway-specific ADS, we are currently testing a Level 2 automation system that requires a professional driver to be sitting at the wheel actively monitoring the road, supervising the system, and ready to take control at any time.

NHTSA Pilot Program

Embark's focus is exclusively on commercial vehicle automation. We acknowledge that the ANPRM states, "NHTSA is only considering a pilot program for light-duty vehicles; to the extent the Agency will consider establishing future pilot projects for other motor vehicles, such as truck tractors or buses, it will do so in coordination with the other relevant operating administrations within the Department." Nevertheless, as an ADS developer, we would like to offer the following general responses to the ANPRM.

Question 1: What potential factors should be considered in designing the structure of a pilot program that would enable the Agency to facilitate, monitor and learn from on-road research through the safe testing and eventual deployment of vehicles with high and full driving automation and associated equipment?

We wholeheartedly agree with NHTSA’s conclusion that “it is vital that the developers of vehicles with high and full driving automation have broad opportunities to gain practical, real world experience, in locations of their choosing, with different approaches to, and combinations of, hardware and software in order to learn which approaches and combinations offer the greatest levels of safety and reliability.”

Vehicle Agnostic Approach

The automated vehicle industry includes companies exploring a wide range of means to apply advanced technology to solve many of the intractable problems of traditional transportation systems, including human-caused crashes. These companies include incumbent vehicle manufacturers, established technology companies, and new startups developing ADS for everything from small package delivery vehicles to large CMVs. While NHTSA is currently focusing on a pilot program for light duty vehicles, we would encourage NHTSA to structure any program to be agnostic of vehicle type. By doing so, NHTSA would acknowledge the spectrum of both traditional and non-traditional players and vehicle concepts in the automated vehicle space.

We suggest pilot efforts focus on facilitating safe deployment of ADS in the context of existing FMVSS through both existing statutory provisions and any exceptions or exemptions that may be necessary, without expressly constraining such efforts to light vehicles.

Vehicle types such as heavy-duty commercial vehicles would still be required to address Federal Motor Carriers Safety Regulations and other relevant provisions that fall outside NHTSA authority, and pilot participation would presumably require coordination across USDOT operating administrations. However, on the issue of vehicle equipment safety and FMVSS, a NHTSA ADS pilot structure that allows for a range of vehicle types would provide industry with better regulatory certainty and avoid needing to “re-invent the wheel” for other vehicle types. Such an approach would also provide NHTSA with deeper insight into the degree to which future ADS regulation may need to be structured to account for different vehicle types.

Pilot Programs and Revenue Generation

We would note that ADS developers are considering a variety of business cases that may differ substantially from the traditional model of consumer sales. Such models include “vehicle as a service”, where the ADS developer, who may or may not be the vehicle manufacturer, provides a service with the automated vehicle to an end user without offering that vehicle directly for sale.

We encourage NHTSA to design any pilot program in a way that allows ADS developers to test both vehicle technology and business cases, including allowing for the generation of revenue through pilot activities.

For example, an ADS developer intending to use vehicles as a passenger rideshare or freight delivery service should not be restricted in testing all aspects of ADS deployment during a pilot, including charging for services that have commercial value. In our experience, the technology challenge of developing ADS and the business challenge of fitting ADS technology into the existing transportation ecosystem are inextricably linked. The full promise of ADS will only be realized if both the technology and business model can be tested and proven out. Prohibitions against charging fees or providing compensation during a pilot program do not impact safety and only serve to constrain the type of useful data generated by such efforts for the benefit of both government and industry. Furthermore, this would allow NHTSA to better understand how ADS

deployment will be structured from a business perspective and what changes, if any, may be needed to continue NHTSA's safety mission in an evolving market environment.

Question 7: What types of performance measures should be considered to ensure safety while allowing for innovation of emerging technology in vehicles with high and full driving automation participating in a pilot program?

We would encourage NHTSA to consider performance-based, non-prescriptive measures of safety that are specifically tailored to the vehicle's intended Operational Design Domain (ODD). For example, performance standards for vehicles never intended to leave an urban area or reach highway speeds would likely be different than vehicles intended to operate only on highway. While equipment regulations for traditional vehicles must anticipate all driving environments, ADS that are constrained to specific ODDs and incapable of operating outside them should only be measured against such ODDs. Testing the degree to which an ADS is actually constrained to its ODD by the developer would also be an important aspect of such an approach.

Question 8: How should the Operational Design Domains of individual vehicle models be defined and reinforced and how should Federal, State and local authorities work together to ensure that they are observed?

In these early days of vehicle automation, the ODD is highly unique to each ADS developer. System design, sensors, processors, software, and business case are but a few of the elements that end up determining a system's ODD. Furthermore, ODD can change as systems become more capable over time through updates. While there is a collective understanding of the broad categories that define ODD, such as weather, time of day, or road type, ODDs can be highly specific. For example, given two ADS that are intended for city driving under 40mph, both may be capable of operating in rain or at night, but only one may be capable of operating both in rain AND at night.

Given how unique ODDs can be to an ADS developer, we suggest NHTSA maintain the current approach of federal guidance 2.0 and 3.0, which requests that industry provide detailed ODD information through a safety assessment letter to the federal government. Such a document could also be shared with relevant state and local authorities, either by the developer or USDOT. Allowing ADS developers to define their own ODDs and detail how their systems are constrained to them is a common-sense approach to the diversity of approaches that currently exist in the market. As the industry develops, ODDs may begin to converge and allow for a more universal approach to ODD definition, however a developer-led definition is the right approach for the current state of the industry.

Conclusion

The ANPRM poses many specific questions, the answers to which will only come into focus for ADS developers as they get closer to commercialization. In general, we believe the current Federal Guidance 3.0 is sufficient to enable a broad range of safe testing activities of ADS on multiple vehicle types. We would see a pilot program with NHTSA and other USDOT agencies as a potential bridge between proprietary testing and commercial deployment of L4+ ADS that would allow data sharing between an ADS developer and USDOT. As such, the circumstances for a particular ADS developer's pilot participation would need to be highly specific to that developer's technology, use case, and deployment plans.

While an ANPRM is an important first step, we would encourage NHTSA to continue its excellent track record of facilitating workshops and direct dialogue with ADS developers as they move closer to being prepared for a pilot and eventual deployment. Many of the answers to the questions posed would be more suitably addressed in the context of a dialogue or workshop as opposed to one-way comment.

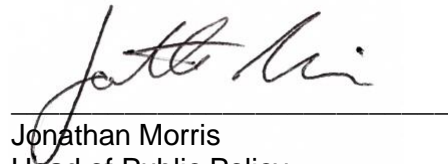
We commend NHTSA's leadership on automated vehicles and look forward to continued collaboration to improve the safety of America's transportation system through ADS technology.

Please direct any questions or communications regarding this comment to Jonny Morris (jonny@embarktrucks.com).

Sincerely,



Alex Rodrigues
CEO and Co-founder
Embark



Jonathan Morris
Head of Public Policy
Embark