April 1, 2020

Docket Management Facility, M-30,
U.S. Department of Transportation,
West Building, Ground Floor, Room W12-140,
1200 New Jersey Avenue SE,
Washington, DC 20590.

Re: Docket no. NHTSA-2020-0106 Framework for Automated Driving System Safety

On behalf of Embark, we would like to offer the following comments as the National Highway Safety Administration (NHTSA) considers how to begin developing a framework to support the safe introduction of Automated Driving Systems (ADS) onto the Nation's roadways.

Introduction

Embark is a San Francisco-based company developing automated driving technology 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. ADS-equipped CMVs have the potential to provide the American public with significant safety, mobility, and sustainability benefits on our nation's highways at a time when traffic fatalities remain tragically high and continue to increase.

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. As we develop a Level 4 highway-specific ADS, we are currently testing our system at Level 2, including requiring a professional driver to keep hands on the wheel, actively monitor the road, supervise the system, and take control at any time as needed.

Embark has been a strong advocate of developing technology through proactive engagement with the freight industry, based on the belief that our ADS technology must be tailored to the needs and demands of the broader freight ecosystem. Because of this, Embark has built freight partnerships with a number of Fortune 500 companies. During the course of system testing and development we move freight for these partners on a daily basis from an operations hub in Ontario, CA. By operating our Level 2 system in real-world freight trucking contexts and working with state and federal government partners, we are developing best practices for how a Level 4 ADS will eventually be deployed safely into the freight transportation ecosystem on long-haul interstate routes while ensuring compliance with all application Federal Motor Vehicle Safety Standards (FMVSS) and Federal Motor Carrier Safety Regulations (FMCSRs).

Since Embark's founding in 2016, our Public Policy Team has been engaged with government partners at the federal and state levels, including regulators, legislators, and law enforcement, to ensure the safe and timely deployment of ADS-equipped CMVs. In the course of our

engagement, we have appreciated the effort USDOT and its modal administrations have put in to solicit views from a wide range of stakeholders in developing existing guidance and regulatory actions to address ADS safety. USDOT's AV guidance issued to date, as well as voluntary initiatives such as AV TEST, has removed significant regulatory uncertainty for the industry and provided clear direction for ADS developers to move forward while complying with safety regulations and best practices. We appreciate that NHTSA is now exploring how to proactively develop a federal ADS safety framework in anticipation of the commercialization of ADS.

General Comments on AVs, ADSs, and the ANPRM

In general, we broadly agree with the nuanced and detailed comments on the status of the AV industry; the iterative process by which on-road, closed course, and simulation testing occurs during ADS development; and the benefits and limitations of NHTSA's various regulatory tools as they pertain to ADS that are presented in the ANPRM.

ADS & Novel Vehicle Design

As the ANPRM notes, NHTSA's previous regulatory notices "have focused more on the design of the vehicles that may be equipped with an ADS - not necessarily on the performance of the ADS itself." We support the ongoing DOT-wide efforts to interpret, update, or remove regulations that present barriers to AV testing and deployment and can be changed without adversely affecting safety. However, this raises an important distinction, acknowledged in this ANPRM but often conflated in many regulatory and policy discussions about AVs, that novel vehicle design is not a prerequisite for, nor inevitable result of, ADS deployment.

Embark is developing an ADS that can be integrated by OEMs into FMVSS-compliant Class 8 trucks. While the intent of our technology is to enable operation of SAE Level 4 ADS-equipped CMVs within a clearly-defined interstate ODD and without the presence of a human driver on board, we believe there are many operational and logistical benefits to retaining FMVSS-required controls and safety equipment should the truck need to be operated by a human driver under certain circumstances.Therefore, we support NHTSA's work to continue to remove regulatory barriers while also commencing the process of developing an ADS safety framework to support the broader commercial deployment of ADS. Given the range of approaches for how ADS will be deployed, including on FMVSS-compliant passenger vehicles and heavy trucks, as well as potentially a range of novel vehicle designs, we support future ADS regulatory approaches that modify existing FMVSS and, if needed, promulgate new regulations on an "if-equipped" basis, as opposed to developing an entire new set of ADS-equipped vehicle subclasses.

We would be supportive of research that would consider how a new set of vehicle subclasses could be implemented. However any such approach would need to acknowledge that many ADS will be deployed on otherwise FMVSS-compliant vehicles. Given the rapidly developing nature of ADS technology, we generally support a least-invasive approach to modifying the existing regulatory environment in order to remove barriers to deployment while maintaining safety.

Should Level 3 ADS be included in this framework?

Based on our perspective as a Level 4 developer, a one size fits all approach to SAE automation levels may not adequately address the unique safety considerations that exist at each level. The ANRPM currently aims to create a safety framework for ADS, which is defined in SAE J3016 as:

> *The hardware and software that are collectively capable of performing the entire [Dynamic Driving Task] on a sustained basis, regardless of whether it is limited to a specific operational design domain (ODD); this term is used specifically to describe a level 3, 4, or 5 driving automation system.*

J3016 creates a distinction between Automated Driving Systems – specifically meant to encompass Levels 3, 4, and 5 – and driving automation systems that can refer to any Level 1-5 system or feature. The bright line created by J3016 between Level 2, in which a driver is performing some of the Dynamic Driving Task (DDT), and the levels above, in which the ADS performs the entire DDT on a sustained basis in at least some circumstances and with or without also performing fallback, is certainly an important distinction from a technical perspective. However, this grouping often masks a perhaps even more important distinction from a regulatory and safety perspective of whether a human is in the loop as part of the safe operation of the vehicle.

At Level 3, a human driver is still required to serve as fallback in the event of a request to intervene by the ADS or any vehicle system failures that impact the performance of the DDT by the ADS. Thus, a human driver still represents a critical element in the overall safe operation of a Level 3 ADS-equipped vehicle, as is the case with Level 2 and below. In addition, the handoff between ADS and human user, as well as the level of receptiveness the human must maintain to takeover requests or malfunctions during the entirety of L3 ADS operation are critical to safety. Level 3 ADS operation poses safety questions similar to those of Level 2 driving automation systems (often referred to as Advanced Driver Assistance Systems, or “ADAS”), with the addition of system supervision added alongside questions of receptivity to takeover requests and handoff processes. None of these specific safety questions exist for Levels 4 and 5.

All this is to say that there is likely a set of safety considerations regarding the interaction between human drivers and driving automation systems at Level 3 and below that do not exist for Level 4 and 5, and the term "ADS" does not adequately capture this important distinction. While this ANPRM specifically addresses ADS, which comprise Levels 3-5, some safety considerations related to Level 3 ADS could also be relevant to any ADAS-related (Level 2 and below) actions NHTSA may consider taking in the future and would not be relevant to safety considerations of Level 4 and 5 ADS. The presence or absence of a human in the loop, whether as part of the DDT performance or as DDT fallback, is a critical differentiator in the safety validation and risk mitigation strategy of any driving automation system with significant implications for how NHTSA, as well as other modal and state regulatory agencies should approach their safe use. NHTSA should specifically consider these distinctions when determining whether or not to subject Level 3 ADS-equipped vehicles to safety frameworks targeting Levels 4 and 5, and vice versa.

ADS and Commercial Vehicles

While initial development of ADS focused on passenger vehicle applications, the AV industry's development over the last few years suggests the growing belief that commercial motor vehicles, specifically heavy trucks, could be the first viable commercial application of ADS. While Embark has been focused exclusively on developing an ADS for use in long-haul freight trucking since 2016, the intervening years have seen both additional truck-specific startups emerge, as well as well-established passenger-focused ADS programs pivot to freight trucking applications. The economic and safety impact of the trucking industry, as well as the relatively constrained environment of multi-lane, divided, limited access highways, make freight trucking an attractive and potentially nearer-term application of ADS than widespread passenger vehicle automation.

Embark strongly urges NHTSA to ensure any ADS safety framework is applicable to all vehicle types, including heavy trucks. We recognize this requires NHTSA and FMCSA to work closely on issues unique to the intersection of ADS and commercial vehicle operations. AV 3.0 provided critical guidance for ADS developers that, for the first time, specifically addressed commercial vehicle applications. We encourage the collaboration across modal agencies that resulted in AV 3.0 to continue and deepen.

Furthermore, to reflect the fact that Level 4 ADS-equipped CMVs could potentially be ready for deployment at scale sooner than passenger vehicles given both technical feasibility in an constrained ODD and well-defined business case, we strongly urge that any framework is developed in a way that does not advantage one vehicle type over another, or is developed in a serial manner with respect to vehicle type. At the state level, some regulatory frameworks that have been promulgated one vehicle type at a time have caused significant negative effects for the industry by creating unnecessary uncertainty, multi-year delays in rules, and an uneven playing field, all without any meaningful benefit to safety.

Safety Framework

Embark fully supports NHTSA's efforts to develop an ADS safety framework in anticipation of increasing deployments of ADS-equipped vehicles in the coming years. Specifically, we support a framework that considers both process and engineering measures across the spectrum of NHTSA authorities at appropriate points along the ADS development and deployment path.

General Framework Goals

We encourage NHTSA to develop a framework that is technology neutral, flexible, and responsive to the wide range of approaches being taken by ADS developers in order to avoid locking in certain approaches before a deep body of safety data on deployments is available. We agree with NHTSA that, based on past precedent, FMVSS promulgated too soon can have unintended and negative consequences on ADS innovation and deployment, potentially undermining safety.

NHTSA should also continue its important role as a convener of stakeholders to maintain its understanding of industry developments and how they affect safety. On this point, Embark plans to continue our longstanding dialogue with NHTSA, FHWA, FMCSA, and USDOT leadership to contribute to our shared goal of prioritizing the safe development and testing of ADS to improve roadway safety.

Testing Modalities

The ANPRM accurately describes the iterative and mutually-reinforcing process of ADS development using the essential tools of simulation, controlled closed-course, and public road testing. Embark believes any ADS safety framework should highlight the importance of each of these tools without prescribing the weight that each tool be given in contributing to an ADS safety validation. Given that each testing modality has its strengths and weaknesses, Embark generally rejects approaches that claim only one modality, be it massive public road mileage accumulation or exclusive reliance on sophisticated simulation, holds the key to "proving" safety. We do agree wholeheartedly with NHTSA's belief that "on-road testing is essential for the development of ADS-equipped vehicles that will be able to operate safely on public roads." To that end, we encourage NHTSA and the broader USDOT to engage with state government counterparts to ensure state-level laws do not prohibit ADS developers from on-road testing, especially when such testing is part of interstate commerce.

Use of NHTSA Authorities

Much like safety validation of an ADS will require the use of various testing modalities at the right times and in the right proportions during the development path, NHTSA should seek a regulatory approach that makes timely and effective use of its regulatory tools. As described in the ANRPM, NHTSA has a range of tools, such as voluntary information gathering, mandatory reporting requirements, guidance, and rulemaking authority. Each of these tools can be applied to both process and engineering measures related to ADS safety.

We agree with many statements made throughout the ANPRM that, given both the rapidly evolving nature of the technology and the current state of progress within the industry, regulatory mechanisms such as FMVSS related to either process or engineering measures are not currently feasible or advisable. On the other hand, voluntary mechanisms for monitoring and influencing the industry, such as the AV TEST initiative, should be continued and expanded upon. Such efforts can continue to standardize much of the ad-hoc voluntary information sharing that is already happening between industry and government stakeholders, as well as make the results of such information sharing easier for the public to access and search. Voluntary efforts such as AV TEST and Voluntary Safety Self-Assessments can also create important learning opportunities for both industry and NHTSA on what type of information is ultimately useful for assessing safety, creating a foundation for potential future mandatory reporting if a safety need for such reporting is justified.

Voluntary information gathering across a range of ADS stakeholders can also inform future guidance across both process and engineering dimensions. Guidance can play an important role in encouraging industry to take specific steps or look more closely at certain standards, while leaving room for innovation. As noted in the ANPRM, given initial deployments of ADS will

likely be small scale, NHTSA's existing defect investigation and remediation authority is the correct approach to addressing any unreasonable safety risks associated with ADS.

Process Measures

In the near term, given the status of ADS development broadly, Embark suggests NHTSA focus on voluntary information gathering on how ADS developers are utilizing existing and emerging process-based standards, which could eventually inform process guidance. Currently, Embark believes no standard exists that provides a single, comprehensive solution for evaluating safety. However, we do believe the use of process standards such as ISO 26262, ISO 21448, and UL 4600 by ADS developers may play an important role in building an overall safety case for an ADS by leveraging known and accepted approaches to the identification and mitigation of certain types of risks.

Engineering Measures

In considering engineering measures to assess ADS safety performance, we encourage the same approach of starting with voluntary information gathering and research that can then inform future guidance and subsequent regulatory action if needed. While the sensing, perception, planning, and control modular framework generally reflects Embark's approach to ADS development, we would encourage NHTSA to avoid anchoring a safety framework exclusively on this approach, as other pathways to ADS-development exist, such as end-to-end machine learning.

The variety of use cases being pursued for ADS, and the fact that some ADS-equipped vehicles may not ever face certain road types or driving scenarios depending on ODD, makes evaluating engineering measures a complex task. However, there are some common-sense and discrete safety functions that seem logical to apply to any ADS and include in any safety framework approach: such as redundancy, self-diagnostic capability, fallback capability (for L4 and L5), and first-responder response. NHTSA has already sought voluntary submissions for many of these issues through workshops, VSSAs, and other means. We encourage NHTSA to continue those efforts and use them to develop future guidance when a knowledge base of sufficient depth and breadth has been accumulated.

Finally, to the extent ADS safety performance becomes subject of NHTSA regulatory action, such as the promulgation of an additional FMVSS, we would not support a deviation from the well-established self-certification model in place for existing FMVSS.

Conclusion

We support NHTSA's efforts on developing a safety framework for ADS. The issues and thinking presented by NHTSA in the ANPRM reflect a clear understanding of the AV industry informed through the broad set of activities NHTSA has undertaken previously to build relationships, research, and understand this emerging technology.

While it is too early in the development and deployment of ADS-equipped vehicles to answer some of the questions posed in the ANPRM with a high degree of specificity, we look forward to

working with NHTSA, FMCSA, and USDOT leadership and staff to discover and refine answers in the coming years in a way that acknowledges the wide range of ADS use cases, provides space for innovation, and protects and improves safety.

Please direct any questions or communications regarding this comment to jonny@embarktrucks.com.

Sincerely,

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