



April 1, 2021

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

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

Robotic Research, LLC. (“RR”) is a leading developer of ADS for commercial and defense customers. We appreciate the opportunity to comment offer the following comments for consideration as the NHTSA explores development of a Framework for ADS safety.

Our company has been a leader in autonomy for nearly 20 years providing ADS systems to both defense and commercial customers. Since 2002, we have deployed our ADS technology on over 40 platforms including trucks, buses, drones, and specialized vehicles. We were the first company to be approved to operate autonomously around pedestrians by the Department of Defense, first to deploy wartime deployments of unmanned autonomous ground systems, first to equip 75+ unmanned autonomous trucks delivered for Army logistics applications, the first to equip a SAE Level-4 transit bus, and first to equip an automated SAE Level-4 electric heavy-duty mass transit bus to be used in revenue service.

On December 3, 2020, the National Highway Traffic Safety Administration (NHTSA) requested comment on the development of a framework for Automated Driving System (ADS) safety which would “objectively define, assess, and manage the safety of ADS performance while ensuring the needed flexibility to enable further innovation.” We thank NHTSA for addressing the safety framework now as ADS are becoming more prolific and regulatory certainty is critical for higher level ADS testing and deployment. The benefits of ADS are clear: enhanced safety, reduced emissions, and greater mobility for all Americans.

The following comments contain general comments and some specific answers to NHTSA’s questions. We believe it is important for NHTSA to regulate in a holistic manner. To this end, we believe the core tenants of any ADS framework should be to remain technology neutral, base ADS systems on performance, and remain flexible in testing and deployment within established regulatory parameters that underpin NHTSA’s mission of safety.

Current Status of ADS Development

RR has created proprietary ADS software and hardware that is integrated either into a vehicle at the time of production or added aftermarket. Any ADS is the sum total of not one technology, but multiple technologies from multiple vendors coming together to perform driving tasks.

RR is actively testing and deploying its technology. Our technology has undergone the U.S. Army Test and Evaluation Command (ATEC) review and certification. RR has operated and tested in some of the most adverse weather and extreme terrain (off road). We have also undertaken commercial testing and review. We have actively deployed our technology on four continents with the Local Motors Olli Shuttle and are testing the New Flyer Xcelsior SAE L-4 AV bus to be used in revenue service on the CTDOT Fastrak.

Safety Strategy

Standards and Best Practices

We support and implement best practices in development, testing, functional safety, and validation, such as ISO26262 Road Vehicles – Functional Safety which serves as a basis for a more comprehensive safety strategy. There are other standards for best practice under development, including ISO/PAS 21448 Safety of the Intended Function (SOTIF) and UL 4600 Standard for Safety for the Evaluation of Autonomous Products which we are closely monitoring for their applicability. The RR team is tailoring and extending Functional Safety processes for autonomous trucks.

Industry developed standards with significant NHTSA involvement is the way forward, within the larger self-certification framework that currently exists for automotive safety. Standards must be succinct to be effective for system designers. A consortium or alliance of consortia are essential to come to a common definition of minimum capabilities of an ADS. This can serve to prevent “bad actors” in testing and deploying systems that present unacceptable risks.

Responsible Approach to ADS Upgrades After Product Release

After release, it is likely that developers will incrementally upgrade their ADS to improve performance. Performing such upgrades must be done via a rigorous process, implementing industry best practices. Robotic Research approaches upgrades by taking a holistic view of the change and its effect on the system. The same best practices and rigor that is applied to the initial ADS system is also applied to upgrade from design through verification and validation. We recommend this type of approach be used broadly and that NHTSA address best practices in ADS upgrades in future Guidance.

Alignment of State Traffic Laws

NHTSA should work with states to align state traffic laws regarding AV allowance and operations. We support the Alliance for Automotive Innovation’s suggestion that “a federal grant program could be established to provide funding to states that agree to work together to

harmonize policies that govern the testing and deployment of AVs. In addition, a unified approach to AV licensing and registration should be encouraged.”¹

Bringing Roadway Infrastructure Up To Standards

Our ADS operates at a high level of performance on today’s roads. To increase safety performance further, NHTSA, along with FHWA, should take a leadership role in stimulating/funding states to upgrade roadway physical infrastructure in a manner supportive to ADS. This would also enhance the operation of existing ADAS. Examples are lane markings, signage, and traffic control devices. It is not essential for states to take action for initial deployment to occur, but upgraded infrastructure reduces technical challenges and therefore risk.

Robotic Research supports the efforts spearheaded by FHWA to update the *Manual on Uniform Traffic Control Devices* to address aspects specific to automated vehicles.

Safe and Effective Interactions with Emergency Responders and Enforcement Personnel

Any Federal regulation or guidance regarding interaction with emergency responders and/or enforcement personnel should be performance-based, allowing AV developers/manufacturers the flexibility to develop design requirements and work with industry standards that facilitate such capabilities.

For commercial trucks, interactions with state inspection protocols must be carefully worked out.

Creation of a New Regulatory Class of Vehicles for ADS

Robotic Research believes the implications of this type of structural change must be fully understood. Creating a new “ADS Vehicle” class deserves significant study and consultation with industry. In particular, we are concerned that the creation of this new Class would pose a hurdle to actually getting down to the core business of adapting regulations to best support ADS deployment.

NHTSA Approach to Safety Case

NHTSA defines safety case as “a structured argument, supported by a body of evidence that provides a compelling, comprehensible, and valid case that a system is safe for a given application in a given operating environment.” Per the ANPRM, “valid,” as used in this context, means “verifiable.”

We support NHTSA’s use of an administrative mechanism, (e.g. Guidance), both in creating a verifiable “safety case” and publishing this safety case. NHTSA should recognize that in this or any future regulatory proceedings on this topic, an ADS developer’s approach to system safety validation could be a core aspect of their intellectual property. A solid safety case can be

¹ “Policy Roadmap to Advance Automated Vehicle Innovation,” Alliance for Automotive Innovation, December 2020.

published at a high level, but pressure to disclose key Intellectual Property must be avoided. The focus should instead be on providing fundamental safety metrics of system performance. We stress that a proper safety case must address both incidental and systematic faults, i.e. failure modes affecting an entire fleet.

Role of FMVSS Going Forward

While the philosophy behind FMVSS properly addresses objectivity, the task of ADS safety assurance is fundamentally different. New methods are essential which do not rely solely on the deterministic approaches NHTSA has employed in the past. Robotic Research advocates an approach in which professional judgement and expertise is applied to the performance evaluation approach of any particular ADS.

Points of Agreement

We agree with NHTSA on many of the points made in the ANPRM. Specifically:

- “NHTSA envisions that a framework approach to safety for ADS developers would use performance-oriented approaches and metrics that would accommodate the design flexibility needed to ensure that manufacturers can pursue safety innovations and novel designs in these new technologies.”²
- “The Agency anticipates that the safety framework would include both process and engineering measures to manage risks. The process measures (*e.g.*, general practices for analyzing, classifying by severity level and frequency, and reducing potential sources of risks during the vehicle design process) would likely include robust safety assurance and functional safety programs. The engineering measures (*e.g.*, performance metrics, thresholds, and test procedures) would seek to provide ways of demonstrating that ADS perform their sensing, perception, planning, and control (*i.e.*, execution) of intended functions with a high level of proficiency.”³
- “NHTSA has broad investigatory and enforcement authority relating to motor vehicle safety. While NHTSA can order a recall for FMVSS non-compliance, it can also order a recall when it learns of a defect in the design, construction, or performance of a vehicle or item of equipment that poses an unreasonable risk to motor vehicle safety that increases the likelihood of a crash occurring or increases the likelihood of injury or death should a crash occur. In fact, the vast majority of recalls are issued for safety related defects that having nothing to do with FMVSS.”⁴ Robotic Research is confident that NHTSA current authority is sufficient to deal with testers and deployers who may pose a safety risk. We would emphasize that NHTSA needs tools and sufficient budget to identify bad actors and take appropriate measures. We responsible actors depend on NHTSA taking a strong role in this respect.

² Framework for Automated Driving System Safety, 85 Fed. Reg. 78058,78059 (December 3, 2020)

³ *Id.* at 78060.

⁴ *Id.* at 78068 (citing footnote 63).

- “NHTSA believes that on-road testing is essential for the development of ADS-equipped vehicles that will be able to operate safely on public roads.”⁵
- “Premature establishment of an FMVSS without the appropriate knowledge base could result in unintended consequences. For example, a premature standard might focus on the wrong metric, potentially placing constraints on the wrong performance factors, while missing other critical safety factors. Such a standard could inadvertently provide an unreliable sense of security, potentially lead to negative safety results, or potentially hinder the development of new ADS technology.”⁶
- “The FMVSS established by NHTSA must: Meet the need for motor vehicle safety; be practicable, both technologically and economically; and be stated in objective terms. The final requirement means that they are capable of producing identical results when test conditions are exactly duplicated and determinations of compliance must be based on scientific measurements, not subjective opinion.”⁷
- “A new generation of FMVSS should give manufacturers of vehicles, sensors, software, and other technologies needed for ADS sufficient flexibility to change and improve without the need for frequent modifications to the regulations. Such an approach may also benefit the safety of future vehicles through more flexible standards that focus more on the safety outcome, rather the performance of any specific technology.”⁸

Responses to Section V Questions

Within the ADS space there are many approaches. We speak from our perspective in developing and deploying supervised Level 4 and unsupervised Level 4 truck ADS. We understand that some aspects of our comments may not apply to all ADS.

A. Questions about a Safety Framework

RR follows existing guidance established by ISO 26262 and UL 4600 among others. We view these standards as the core underbelly for NHTSA to establish regulations and guidance that incorporate these principles. Proper system engineering and functional safety processes must be implemented in system development, and rigorous testing should be validated through data

To avoid hampering innovation at this early stage in ADS rollout, NHTSA should incorporate existing standards and framework by reference from bodies such as the Society of Automotive Engineers (“SAE”), International Standards Organization (“ISO”), the American Trucking Associations’ Technology and Maintenance Council (“ATA TMC”) and other groups. All standards should be viewed as guide, framework, and best practice towards the ultimate goal of demonstrating performance.

⁵ Id. at 78061.

⁶ Id. at 78059.

⁷ Id. at 78062.

⁸ Id. at 78071.

As ADS advance, it should be the responsibility for each ADS manufacturer to demonstrate that they meet or exceed NHTSA's regulatory standard based on performance and validated through data. As systems improve, NHTSA should revise regulation accordingly to meet the improvement of technology.

Robotic Research would not support NHTSA developing standards at this time as it has no appropriate baseline to measure and would likely hamper innovation. Again, we feel there are others, like SAE, ATA's TMC, etc. that are involved in this process and can establish standards, which NHTSA can incorporate by reference, for an ADS-equipped vehicle relevant to the ODDs our vehicles operate in is widely available.

ADS developers should provide a high level of transparency to NHTSA regarding system performance, that when combined with establish incorporated framework and standards by reference, will lead to a solid safety case being put forward by an ADS companies resulting in public confidence that such systems are safe.

Test track testing tailored to the ADS's ODD, with methodology and metrics defined by experienced test engineers, must occur.

Examples of Regulatory Approaches

NHTSA posited three candidate approaches in the ANPRM. They are:

- A. FMVSS Requiring Obstacle Course-Based Validation In Variable Scenarios And Conditions
- B. FMVSS Requiring Vehicles To Be Programmed To Drive Defensively In A Risk-Minimizing Manner In Any Scenario Within Their ODD
- C. FMVSS Drafted In A Highly Performance-Oriented Manner

Regarding Approach A, Robotic Research advocates an approach in which professional judgement and expertise is applied to the performance evaluation approach of any particular ADS. Respected industry bodies (SAE, ATA's TMC, etc.) are vital in defining best practices in metrics and setting performance thresholds. Robotic Research believes it is too early to define FMVSS in general, which includes item A.

Approach B represents a basic engineering requirement for any responsible ADS developer. To define "driving defensively" in regulation, with any specificity, could be challenging. This concept would benefit from further study. At this time, Robotic Research believes it is too early to define FMVSS in general, which includes item B.

Item C focusing on performance-oriented metrics is a valid approach in concept. Robotic Research agrees with the approach espoused in AV 3.0, which is quoted in the ANPRM in NHTSA's discussion of this approach:

“Future motor vehicle safety standards will need to be more flexible and responsive, technology-neutral, and performance-oriented to accommodate rapid technological innovation. They may incorporate simpler and more general requirements designed to validate that an ADS can safely navigate the real-world roadway environment, including unpredictable hazards, obstacles, and interactions with other vehicles and pedestrians who may not always adhere to the traffic laws or follow expected patterns of behavior. Existing standards assume that a vehicle may be driven anywhere, but future standards will need to take into account that the operational design domain (ODD) for a particular ADS within a vehicle is likely to be limited in some ways that may be unique to that system.”

As previously stated, we believe it is too early to define FMVSS in general, which includes item C.

C. Questions About Administrative Mechanisms

Robotic Research supports NHTSA’s use of an administrative mechanism, (i.e. Guidance) both in creating a verifiable “safety case” and publishing this safety case. NHTSA should recognize that in this or any future regulatory proceedings on this topic, an ADS developer’s approach to system safety validation could be a core aspect of their intellectual property. A solid safety case can be published at a high level, but any pressure to disclose key intellectual property must be avoided. The focus should instead be on providing fundamental safety metrics of system performance. We stress that a proper safety case must address both incidental and systematic faults (i.e. failure modes) affecting an entire fleet.

At this time, we do not believe consideration of an “alternative regulatory path” is necessary, as it is premature to proceed with regulations at this early stage in ADS development and deployment.

D. Questions About Statutory Authority

We believe that NHTSA’s past performance and statutory authority provide an existing model that allows for ADS development. As it states in this ANPRM,

“NHTSA has typically used its FMVSS authority either to mandate the installation of a proven technology by way of performance standards to address a safety need and subject the technology to minimum performance requirements, or to regulate voluntarily installed technology by subjecting the technology to minimum performance safety requirements. In most instances, when NHTSA has mandated the installation of a technology by way of

performance standards, it has not done so until the technology is fully developed and mature, so that all buyers of new vehicles have the protection of that technology.”⁹

While we recognize current regulations allow for ADS development and adoption, we also recognize that there will be unforeseen future instances, which turn on a specific set of facts, where NHTSA’s legal and regulatory authority may need to be amended. Without specifically knowing what such a situation may be, we would urge the agency to remain nimble and engaged to handle such situations.

Conclusion

Robotic Research appreciates the opportunity to provide comments. We believe ADS hold great promise to benefit highway safety. We urge NHTSA to be performance oriented while not stifling innovation as this innovation can improve and enhance NHTSA’s mission.

Sincerely,

Alberto Lacaze,
CEO

⁹ Id. at 78070.