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August 28, 2019

The Honorable Ray Martinez
Administrator, Federal Motor Carrier Safety Administration (FMCSA)
United States Department of Transportation
1200 New Jersey Avenue, SE
Washington, D.C., 20590

RE: Comments in Response to FMCSA's Advanced Notice of Proposed Rulemaking
(ANPRM) Docket No. FMCSA-2018-0037 – "Safe Integration of Automated Driving
Systems-Equipped Commercial Motor Vehicles."

I.   Introduction

Starsky Robotics is a San Francisco-based motor carrier developing and
operating automated commercial motor vehicles (ACMVs) designed to efficiently
move freight from distribution center to distribution center without a human driver
physically present in the cab of the truck. Starsky is taking a distinctly unique
approach to automation, designing ACMVs that employ a Level 4 automated driving
system (ADS) on-highway and a complimentary combination of remote driver inputs
and automation capability, referred to as teleoperation, for low-speed operations
between the off-ramp and the distribution center.

At Starsky, we believe functional safety is the most important design goal for a
successful ADS. For a detailed description of our approach to safety and
development, please see our Voluntary Safety Self-Assessment (VSSA), which is
referenced in our comments below.

We are pleased to provide our feedback in response to FMCSA's ANPRM
titled "Safe Integration of Automated Driving Systems-Equipped Commercial Motor
Vehicles." We welcome FMCSA's attention to the need to ensure Federal Motor
Carrier Safety Regulations (FMCSRs) do not pose unintended barriers to the
deployment of unmanned ACMVs. Starsky believes widespread ACMV deployment
has the potential to significantly improve highway safety, driver wellness, and freight

transportation mobility. In furtherance of those goals, we appreciate the Agency's thoughtful leadership and work to ensure ACMVs are safely integrated into the national highway network.

II.   Scope of the ANPRM and Taxonomy

We commend FMCSA's efforts to gather input from stakeholders to inform rulemaking proceedings facilitating the safe introduction of unmanned ACMVs into the U.S. freight ecosystem. The Agency's action to modernize regulations, decrease potential regulatory confusion, and enhance clarity in the applicability of existing FMCSRs is a critical step toward the development of a sound regulatory regime for ACMVs. We are supportive and appreciative of FMCSA's attention to this topic given the importance of ACMV deployment to the future of freight transportation. While many of the questions addressed in the ANPRM may not yet have definitive solutions and require additional research as ADS developers continue to test, build, and grow our fleets, we look forward to continuing to work with FMCSA as we seek to bring ACMVs to market. In considering changes to FMCSRs or the imposition of other requirements on ACMV operations, FMCSA should consult companies actively developing ADS technologies for Class 8 trucks to fully understand the implications of potential action on their respective business models. The emerging industry is evolving quickly and the Agency should ensure new ACMV-specific regulations do not inadvertently or artificially inhibit growth, innovation, or safety. Where necessary, the Agency should conduct robust, quantitative research on which to base regulatory action. Starsky has identified many of these areas in our comments below.

We agree with FMCSA's position that regulatory action should focus on ACMVs capable of unmanned operations. Critically, in the context of a rulemaking proceeding, it is important that FMCSA distinguish between higher levels of automation capable of operating at SAE Levels 4 and 5, Level 3 conditional automation systems, and Level 1 or 2 driver assistance technologies that rely on a human driver to supervise the performance of the system at all times. We do not believe regulatory action is necessary to accommodate lower levels of automation that require the physical presence of a human in the cab of a CMV.

Additionally, we appreciate FMCSA's attention to the role that remote drivers, defined below, may play in the testing and deployment of ACMVs. Equally critically, FMCSA should also clearly distinguish between Level 4 and 5 ADS-equipped vehicles

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and teleoperation systems that utilize remote drivers to perform certain aspects of the dynamic driving task (DDT). Inherently, Level 4 and 5 ADSs do not *require* any intervention or remote inputs to safely perform the DDT or achieve a minimal risk condition (MRC) if a vehicle experiences a performance-relevant failure.

Conversely, teleoperation may utilize a variety of levels of automation, including driving automation *features* – such as the ability to achieve a MRC or otherwise detect and avoid objects – in concert with remote inputs. The applicability of FMCSRs should be viewed differently – and clarified accordingly – for Level 4 and 5 systems, and teleoperation systems that involve individuals responsible for remotely performing part or all of the DDT for an unmanned vehicle. Starsky is designing a system that employs both approaches: Level 4 automation for on-highway operations and a complimentary blend of remote inputs and driving automation features for off-highway, low-speed operations. We believe driving automation features are a crucial component of a functionally safe teleoperation system and that unmanned remote driving should not be conducted absent such features.

Industry-wide, the range of responsibilities for remote individuals remains fluid and continues to evolve. The roles these individuals may play is likely to look different during testing and deployment and vary significantly between companies.

FMCSA should consider precisely the differences in these potential responsibilities, adopt consensus-based nomenclature, and apply regulations accordingly. Commonly, phrases for remote individuals are used colloquially, including remote "operator," "monitor," "driver," "dispatcher," and "supervisor" – each term has a unique connotation that implies different responsibilities, and should not be referenced interchangeably. Some of these terms are included in SAE's "Taxonomy and Definitions for Terms Related to On-Road Motor Vehicle Automated Driving Systems" (J3016).

It is important that FMCSA adopt appropriate definitions when considering, for example, regulatory action involving ADS-equipped CMVs or applying human-centric FMCSRs to remote individuals. In general, we support SAE's efforts to develop common definitions and recommend that the Agency stay abreast of updates in nomenclature as SAE approves revised versions of taxonomy. Notably, the most recent version of SAE's taxonomy document, J3016, is currently undergoing a revision process.

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We recommend the Agency use consistent terms when considering the applicability of FCMSRs to remote individuals and have offered suggestions for consideration. With the understanding that the industry will continue to evolve and may eventually adhere to updated taxonomy accordingly, if FMCSA were to proceed with regulatory action based on ADS-specific definitions, such as defining an "ADS driver" as referenced in Q 1.3, the following terms may serve as a broad, accurate set of definitions that could be included in section 390.5, Definitions. The following definitions are based primarily on J3016 taxonomy where possible and have been augmented as necessary in discussions among ADS-equipped CMV developers in an attempt to build as much consensus as possible:

- **Automated Driving System (ADS)**: The hardware and software that are collectively capable of performing the entire DDT 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, as defined in SAE J3016.

- **Highly Automated Driving System (H-ADS):** The hardware and software that are collectively capable of performing the entire DDT on a sustained basis, regardless of whether it is limited to a specific operational design domain (ODD), and capable of achieving a minimal risk condition without the input or presence of a human driver; this term is used specifically to describe a Level 4 or 5 driving automation system, as defined in SAE J3016.

- **Dynamic Driving Task:** All of the real-time operational and tactical functions required to operate in on-road traffic, excluding strategic functions such as trip scheduling and selection of destinations and waypoints.

- **Remote Driver:** A driver who is not seated in a position to manually exercise in-vehicle braking, accelerating, steering, and transmission gear selection input devices (if any) but is able to operate a commercial motor vehicle by performing part or all of the DDT and/or DDT fallback.

These terms may assist the Agency in accurately and appropriately augmenting FMCSRs to ensure human-specific provisions continue to apply to individuals who

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perform part of or all of the DDT remotely. Herein, the term ACMV is used to describe the entirety of Starsky's system, which includes both a highway-specific Level 4 ADS and a combination of remote inputs and automation capability (teleoperation) for off-highway, low-speed operations.

We support FMCSA's action to review and potentially augment or clarify relevant regulations to facilitate ACMV deployment. Where applicable, we support the maintenance of as many existing FMCSRs as possible. We believe these are well-established, effective frameworks designed to ensure the safety of the motoring public. In general, we seek to change current FMCSRs as little as is feasible and to fit within requirements as written wherever possible. As the industry matures and we consider widespread deployment at scale, we will continue to engage with the Agency to identify areas where flexibility may be required in the context of existing FMCSRs.

III.   Questions

1. – Do the FMCSRs Require a Human Driver?

1.1 – Should FMCSA establish a rule that would prohibit an ADS-equipped CMV from operating outside its designated ODD?

At this time, FMCSA should not attempt to prohibit an H-ADS-equipped vehicle from operating outside of its designated ODD. We share FMCSA's view that unmanned ACMVs should have a well-defined, well-understood ODD and should be operated within that ODD. Today, Starsky and other ACMV developers are still testing and improving our systems, including carefully monitoring, modifying, and expanding our ODDs.

Quantifying, understanding, and defining ODDs is critical to Starsky's deployment model. More information on our approach to ODD can be found in our VSSA.

ODDs are highly fluid and vary widely among different ADS developers. They can change rapidly and will evolve significantly overtime. ODDs include both fixed and variable components that are always subject to change, even within a given trip (such as weather conditions). J3016 offers the following definition:

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- **ODD:** Operating conditions under which a given *driving automation system* or *feature* thereof is specifically designed to function, including, but not limited to, environmental, geographical, and time-of-day restrictions, and/or the requisite presence or absence of certain traffic or roadway characteristics.

We design both our highway automation and teleoperation technologies to include diagnostics that are constantly interpreting the environment relative to ODD changes and responding accordingly. Any vehicle operated by an H-ADS or safely developed teleoperation system must be able to achieve an MRC in the event of an ODD exit or variable change. The ODD for our highway automation system and the ODD for our teleoperation capability differ, as these systems are not designed to operate in the same traffic conditions or on roadways with the same characteristics. Starsky currently provides ODD information to FMCSA and other modal administrations within U.S. DOT and are working on specific metrics to more precisely quantify and communicate our own ODD. We will continue to work with FMCSA as we develop these metrics.

Currently, we believe developers must maintain the discretion to define and operate within their ODDs. Starsky knows the limitations of our system best, and we operate within those limits. As our system evolves, we will be capable of tackling more difficult and complex ODDs.

At this stage it would be difficult, if not impossible, for FMCSA to define or quantify with precision different developers' ODDs and enforce a corresponding prohibition in real-time. In addition, premature action could result in unintended consequences, including impeding the expansion of our ODDs to include new environmental conditions.

Starsky and other ACMV developers take ODD constraints seriously, including by designing systems to detect and respond to ODD changes accordingly. Self-imposed ODD constraints will continue to be critical to ACMV testing and operations for the foreseeable future.

1.2 – What are manufacturers' and motor carriers' plans for when and in what way Level 4 and 5 ADS-equipped CMVs will be commercially available?

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Today, Starsky operates as a motor carrier. This includes the operation and management of a growing fleet of human-driven over the road (OTR) trucks in addition to our autonomous fleet. At this time, we do not have any future plans to make our vehicles commercially available for sale.

When considering regulatory proceedings for other business models, FMCSA should understand the delineation of roles and responsibilities between motor carriers and ADS developers. Such models may include the sale of ADS-equipped CMVs designed by a developer or OEM to motor carriers. Motor carriers who did not design these technologies may lack the expertise or in-depth understanding of these systems for the onus of software updates or hardware maintenance to be placed on the carrier. Starsky's comments should be considered from the perspective of both a developer and motor carrier that intends to operate our own trucks. As we have done to date, we will continue to keep the Agency and U.S. DOT updated on our plans for testing and scale over the next few years.

1.3 – Should FMCSA consider amending or augmenting the definition of "driver" and/or "operator" provided in 49 C.F.R. 390.5 or define a term such as "ADS driver" to reduce the potential for misinterpretation of the requirements?

We support and appreciate FMCSA's efforts to amend or augment definitions to better clarify the applicability of terms that as written are not particularly compatible with unmanned ACMV deployment, minimize the potential for confusion and misinterpretation, and enhance regulatory certainty relating to H-ADS-equipped CMVs.

As part of this effort, we would support the formal adoption of U.S. DOT's interpretation of the FMCSRs in the Department's most recent voluntary guidance for automated vehicles, "Preparing for the Future of Transportation" (AV 3.0). AV 3.0 provided that "FMCSA regulations will no longer assume that the CMV driver is always human or that a human is necessarily present on-board a commercial motor vehicle during its operation…in the case of vehicles that do not require a human operator, none of the human-specific FMCSRs (i.e. drug testing, hours-of-service, commercial driver's licenses, and physical qualification requirements) apply."

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As part of this formal adoption, FMCSA should also clarify that relevant human-specific FMCSRs would continue to apply to humans who are responsible for completing any parts of the DDT, whether they are remote or on-board.

Were FMCSA to adopt the proposed definitions offered above, the following approach could provide additional clarity regarding the applicability of FMCSRs to different operational models. For H-ADS-equipped CMVs, a human is not required to perform any aspect of the DDT, and these models could be explicitly exempt from provisions such as HOS, medical qualifications for drivers, etc.

395.1 Scope of rules in this part (HOS)
(y) Highly Automated Driving System. For a commercial vehicle equipped with a Highly Automated Driving System as defined in 390.5, and operating without the physical presence of a human on-board the vehicle,
> (1) the rules in this part shall not apply to the H-ADS.
> (2) the rules in this part shall continue to apply to any Remote Driver as defined in 390.5 that may be required to complete any aspect of the Dynamic Driving Task during the course of ADS operation.

We believe this amendment to Section 395.1, which defines the scope of the HOS regulations, would make clear that the HOS provisions do not apply to H-ADS equipped CMVs but do continue to apply to individuals performing aspects of the DDT remotely. We support augmentation approaches that require minimal changes to existing FMCSRs and believe this amendment could easily clarify the applicability of Part 395 to remote drivers, as defined above.

In addition, FMCSA could further clarify the non-applicability of other human-centric FMCSRs:

391.2 General exceptions.
(f) Highly Automated Driving Systems. The rules in this part do not apply to a Highly Automated Driving System as defined in 390.5 operating a commercial motor vehicle and capable of achieving a minimal risk condition without the input or presence of a human driver.

Similarly, this approach could be employed to provide that H-ADS-equipped CMVs are not considered subject to human-centric FMCSRs and would continue to apply to remote drivers performing aspects of the DDT.

2 – Commercial Driver's License (CDL) Endorsements

2.1 – Should a CDL endorsement be required of individuals operating an ADS-equipped CMV?

As stated above, we support FMCSA's efforts to clarify the non-applicability of certain FMCSRs to Level 4 or 5 vehicles that are capable of unmanned operations. Level 4 vehicles are capable of operating without a human driver physically present in the cab of the vehicle, and thus do not require an individual to be operating the vehicle. If there is no human driver, a CDL endorsement is not necessary.

We do not believe an ADS-specific CDL endorsement for H-ADS-equipped CMVs is necessary at this time, and we support FMCSA's preliminary position that a traditional CDL should continue to be required for individuals performing any aspect of the DDT on-board or remotely.

In the event business models emerge that envision a human in the cab of a Level 4 vehicle who would be responsible for disengaging the automation system and manually taking control to drive the "final mile" of a given route, that individual should be required to have a valid traditional CDL. In this instance, the vehicle would be operated manually and would not require additional skills or expertise on behalf of the human driver.

Starsky's remote drivers are well-trained, long-time CDL holders with significant experience as OTR truck drivers.

As much as possible, we design our remote command stations to replicate a traditional truck interface, including similar steering feedback, visual feed, and audio systems that a human driver would expect to have in the cab of a legacy CMV. We extensively train our remote drivers specifically on the Starsky system, and we benefit from the insight and experience of Starsky's remote drivers. We believe the maintenance of a traditional CDL requirement for these individuals is both critical and sufficient.

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2.2 – If so, what should be covered in the knowledge and/or skills test associated with an ADS endorsement?

Starsky does not believe ADS-specific endorsements are necessary. As noted above, any vehicle operating at Level 4 or 5 does not require a human driver to take control of a vehicle at any time. Any individuals manually or remotely operating an ACMV should be required to have a traditional CDL endorsement.

2.3 – What would be the impacts on SDLAs?

See response to Qs 2.1 and 2.2.

2.4 – Should a driver be required to have specialized training for ADS-equipped CMVs?

As described above, for ACMVs operating at Levels 4 and 5, a driver is not required. The vehicle can safely perform the DDT and achieve a MRC upon experiencing a performance-relevant failure.

2.5 – In an operational model that has an individual remotely monitoring multiple CMVs, should the Agency impose limitations on the number of vehicles a remote driver monitors?

Industry currently lacks a widely accepted definition for "remote monitoring." This term is not defined in J3016. The role played by remote monitors is not well-understood and could be considered to include a variety of different responsibilities. This term is often used casually, interchangeably, and without specificity. Without a clear understanding of the role in question and a corresponding definition, regulating such individuals remains premature and difficult and is likely to result in negative or unintended consequences. Importantly, H-ADS-equipped vehicles can safely perform the DDT and achieve a MRC without any input from a remote driver (or "monitor").

Starsky's remote drivers are never responsible for performing the DDT for more than one vehicle at a time. Our remote drivers do not watch or monitor multiple trucks in the same time frame and are never expected to do so. FMCSA should work with ACMV developers to understand the role of remote individuals and the responsibilities of those individuals in the context of ACMV operations.

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2.6 – Should a dedicated or stand-by remote operator be subject to existing driver qualifications?

Yes. Existing driver qualifications should continue to apply to any individuals who are expected to perform part or all of the DDT.

3 – *Driver's Hours of Service (HOS) Rules*

3.1 – Should HOS rule changes be considered if ADS technology performs all the driving tasks while a human is off-duty or in the sleeper berth, or physically remote from the CMV?

Starsky believes that any person responsible for any aspect of the DDT should be subject to HOS rules and considered to be on-duty, driving even if the person is physically remote from the ACMV. Starsky also believes that any person at the controls of a vehicle who may be called upon to perform the DDT for the vehicle should be considered on-duty, driving, even if the person is physically remote from the ACMV.

Starsky also supports FMCSA's position that any time a remote or onboard individual is not expected to perform part or all of the DDT for an ACMV because they are not present at the controls and are relieved completely from work-related responsibilities, should be considered off-duty. This could include, for example, a remote driver who is no longer present in a remote command station and is not expected to perform the DDT or other work-related duties (such as truck maintenance), but is taking a lunch break in the cafeteria at a Starsky facility.

3.2 – Should the HOS requirements apply to both onboard and remote operators?

Yes, Starsky supports applying HOS requirements to both onboard and remote drivers who may perform part or all of the DDT.

3.3. – If so, how should HOS be recorded when an individual is not physically in control of the vehicle?

As noted above, Starsky believes that any person should be considered on-duty driving, even if physically remote from the CMV, if they are responsible for any aspects of the DDT or they may be called upon to perform any aspects of the DDT.

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However, remote driving may require some modifications to the current approach to recording duty status under the Electronic Logging Device (ELD) requirements at Section 395. The current HOS and ELD regulations were drafted with the expectation the driver would be present in the vehicle and that ELDs would likely be installed in the CMV. As a result, ELDs generally synchronize with the vehicle engine to automatically record driving time.

For remote DDT performance, a remote driver's on-duty, driving time may not correspond with vehicle engine operating time. Instead, a more appropriate approach would be for an ELD to track the duty status of each remote driver, without regard to vehicle operations. Therefore, remote driving would benefit from using portable ELDs located at the remote station where the driver is located, rather than in the vehicle.

This would allow for more efficient recording of duty status for remote drivers, particularly if a single driver performs remote driving duties for multiple vehicles within a given work period, though never for more than one truck at any given time.

Absent the development of a comprehensive process for electronically recording HOS for remote drivers, FMCSA could consider the following approach:

395.8 Driver's record of duty status.
(a)(1)(iii)(A) A motor carrier may require a driver to record the driver's duty status manually in accordance with this section, rather than require the use of an ELD, if the driver is operating a commercial motor vehicle:
(5) as a Remote Driver as defined in 390.5 and not physically located in the commercial motor vehicle.

For future recording regimes, Starsky has identified current requirements under Part 395 related to the recording of duty status and the use of ELDs that may need to be revised to allow for remote electronic logging of duty status. These include:

Section 395.8(a)(1)(i): currently requires motor carriers to "install … an ELD to record the driver's duty status." Motor carriers with remote drivers should be allowed to use remote-from-vehicle ELDs to record remote drivers' duty status.

Section 395.8(c): currently requires the location of each change of duty status

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to be recorded. Remote operation raises multiple issues related to recording the location for each change of duty status. First, if the location information is based on the driver's location, the location information will remain the same for each change of duty status – the remote driving facility. Second, if the location information is based on the location of the vehicle, location information may be uninformative due to a remote driver's potential to perform remote driving duties for multiple vehicles within a given work period, though never for more than one vehicle at a time.

Appendix A to Subpart B of Part 395 at 4.8.1 and 4.9.1(c) currently requires an ELD to be able to generate a report either as a printout or on a display for use during a roadside inspection and provide that report to an enforcement official. FMCSA should consider allowing ELD data to be transferred via email or wireless web services, as provided in 4.9.1(b), to an authorized safety official during a roadside safety inspection in lieu of requiring a printout or display physically located in or on the ACMV for remote driving.

4 – Medical Qualifications for Human Operators

4.1 – Should some of the physical qualification rules be eliminated or made less stringent for humans remotely monitoring or potentially controlling ADS-equipped CMVs?

If FMCSA is to take action revising or eliminating rules relating to physical qualifications for remote drivers or those who may perform some aspect of the DDT on-board an ACMV, it should be based on statistically significant data justifying such a proceeding. In the absence of robust data indicating rules should be relaxed, existing driver qualifications should continue to apply to individuals performing part or all of the DDT, either remotely or on-board the vehicle. Today, Starsky's remote drivers continue to comply with existing physical qualification rules.

4.2 – If so, which of the requirements should be less restrictive for human operators who would take control of an ADS-equipped CMV remotely?

See response to Q 4.1. We recommend that FMCSA maintain all existing requirements unless the Agency determines changes are warranted based on data justifying any changes.

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4.3 – Should the Agency consider less restrictive rules for humans who have the benefit of ADS technology to assist them in controlling the vehicle (e.g. technologies that would enable individuals with limb impairments to operate at a level comparable to individuals without such impairments)?

See responses to Q 4.1 and 4.2. FMCSA should conduct additional research to explore the issue further and consider revisions to the requirements as such research merits.

5 – Distracted Driving and Monitoring

5.1 – How should the prohibition against distracted driving apply to onboard operators responsible for taking control of the CMV under certain situations, and to remote operators with similar responsibilities?

Increasingly, distracted driving is the cause of a growing number of automotive accidents and associated fatalities. We believe preserving distracted driving laws for individuals expected to perform part of the DDT while they are on-duty, driving is critical.

At Starsky, we take distractions for remote drivers seriously and take steps to prohibit the presence of distractions accordingly. We view remote driving stations as limited access facilities without unauthorized personnel present in a remote command room. This includes placing controls on remote command centers accordingly, similar to applicable restricted access protocols implemented by the Transportation Security Administration (TSA) for airport security. We are actively exploring the best mechanism to provide for authorized, badged entry into a remote driving center, as well as similar badging processes in order to ensure only an authorized individual engages a remote command station to perform the DDT for any trucks remotely.

In addition, we are actively exploring driver monitoring systems (DMS) for remote drivers to ensure they remain attentive whenever they are on-duty, driving. We also prohibit the presence of food, drinks, mobile devices, entertainment systems, and other non-essential objects in the room with a remote driver.

We view the elimination of accidents attributed to distracted driving as a critical benefit of ADS and remote driving technology. We support the continued application

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of these existing frameworks to individuals who are expected to take control of a vehicle, either remotely or present on-board, any time they are on-duty, driving.

Onboard operators for Level 4 and 5 vehicles should never be expected to be responsible for promptly taking control of the vehicle within a given trip while the system is engaged. If a driver is expected to take control of a vehicle, the driver should be subject to distracted driving laws while on-duty, driving.

6 – *Safe Driving*

6.1 – Should FMCSA consider revising its rules to ensure that (1) any human exercising control of an ADS-equipped vehicle must continue to comply with all the rules under Part 392, and (2) a CMV under the control of a Level 4 or 5 ADS must satisfy the operational rules?

In general, Starsky supports the continued application of Part 392 to any individuals exercising control over an ACMV, interpreted to mean performing aspects of or all of the DDT. FMCSA should consider augmenting or revising regulations in Part 392 to enhance clarity in the application of appropriate operational rules to remote drivers.

For example, FMCSA should clarify that Part 392.16 – Use of Seatbelts – would not be applicable to a remote driver performing aspects of the DDT for an ACMV. This could be accomplished by revising the section 392.16(a) requirement to include language from section 392.16(b) limiting the requirement to "occupants" of the vehicle. The provision as currently written assumes that the driver is an occupant, when a remote driver will not be physically present in the vehicle.

FMCSA should also clarify the applicability of non-driving related tasks under Part 392 to a "driver," ensuring that operational tasks required by these provisions may be completed by company personnel or using automated solutions (for example Part 392.7 – Equipment, Inspection and Use). As ADS developers identify technological solutions or non-driving personnel to satisfy these regulations, FMCSA should work closely with industry regarding the potential interplay between existing FMCSRs as written and future ACMV operations to allow for alternative mechanisms that safely meet the intent of these requirements.

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6.2 – For example, should FMCSA require that the ADS be capable of identifying highway-rail grade crossings and stopping the CMV prior to crossing railroad tracks to avoid collisions with trains, or going onto a highway-rail grade crossing without having sufficient space to travel completely through the crossing without stopping?

Yes. H-ADS-equipped vehicles or ACMVs that employ a remote driver to perform part or all of the DDT must be able to successfully and safely identify and navigate railroad crossings if routes containing such crossings are within a system's ODD.

6.3 – For scenarios in which the control of the ADS-equipped CMV alternates, or may alternate, between a human and the technology, should FMCSA require that both the human operator and ADS comply with the applicable operational rules?

Yes, though FMCSA should provide the flexibility to do so using company personnel or automated technological solutions where possible, rather than placing the strict onus of compliance on a human "driver."

<u>*7 – Inspection, Repair and Maintenance*</u>

7.1 – What qualifications should be required of the individual performing the pre-trip inspection?

For existing mechanical pre-trip inspection requirements, current FMCSRs should continue to apply. In addition to hardware and software diagnostics, Starsky performs the same pre-trip inspections required of any motor carrier in advance of ACMV operations.

With respect to individuals who will perform hardware and software inspections in the future, FMCSA should conduct extensive research regarding the development of qualifications for these individuals. Beyond automated system self-diagnostics, hardware and software inspections will be a specialized skill and likely specific to a particular company's sensor stack. Starsky performs regular complex (automated and physical) pre-trip hardware and software diagnostics, and these checks are displayed on screens available to a remote driver and to a safety driver in the cab of the truck. These checks include green or red lights indicating system status, and all relevant diagnostics must return positive in order for the vehicle to operate.

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The qualifications for individuals performing inspections will continue to evolve, and in the interim these tasks are likely to be conducted by a human employee. If individuals performing hardware and software checks are also responsible for mechanical pre-trip inspections, they should be subject to existing qualifications.

If these two tasks – performing ADS-specific diagnostics and conducting pre-trip inspections – are completed by separate individuals, companies should be responsible for training employees or contractors specific to their system requirements, while existing FMCSRs continue to apply to individuals performing mechanical pre-trip inspection tasks. As the industry matures, data is gathered, and FMCSA better understands the unique nature of these roles, longer-term requirements could be developed for system health-related pre-trip inspections based on robust research.

7.2 – What kind of routine or scheduled inspections should be performed and what types of ADS-related maintenance records should be required?

Starsky conducts regular maintenance specific to our sensor suite. Starsky's inspections of these systems are frequent and technical. We routinely inspect both our mechanical and technological system components and conduct maintenance accordingly. We document any changes or updates made to truck hardware.

Routine or scheduled inspections will be specific to the developer or manufacturer of a given ADS. Different companies use different technologies and techniques that vary in ruggedization standards and life-cycle. Today, Starsky performs ADS-related inspections and maintenance more frequently than mechanical inspections and maintenance required by FMCSA. In addition, an ADS should have built-in-test (BIT) capability that allows the system to "inspect" its own operation each time it is started or when it is driving. BIT capabilities should be expected to cover hardware component failures related to performance and prevent operation if any major sub-systems are not working properly.

7.3 – Should the inspection period be more or less frequent than annual for an ADS-equipped CMV?

FMCSA should continue to work closely with developers to understand the cadence of their hardware and software inspections. As described above, developers

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today conduct their own inspections based on the required lifecycle of their equipment. At this time, it would be difficult for FMCSA to mandate a specific, industry-wide inspection schedule. We recommend the Agency maintain inspection requirements that are currently applicable to legacy CMVs.

7.4 – Should inspections be mileage-based or time-based (e.g., 1,000 miles, 3 months or 1,000 hours of operation)?

At this stage, ADS developers know best the lifecycle and requirements of their systems and should set their own cadence for inspections accordingly.

7.5 – Should FMCSA impose general requirements for motor carrier personnel responsible for ADS-related inspection, repair, and maintenance tasks similar to the Agency's brake inspector qualification requirement?

Inspection, repair, and maintenance tasks specific to ADS-related equipment require specialized skills and training from an ADS developer. As mentioned above, the skills required for maintenance tasks for different ADSs vary among developers. Trained company personnel should continue to be responsible for these tasks until FMCSA has a quantitative data set indicating that qualification requirements would be necessary and can be applied to different fleets utilizing different hardware and software stacks.

7.6 – How could FMCSA ensure that motor carriers apply safety critical software updates?

The nature of the relationship between an ADS developer or OEM who intends to sell commercially available ACMVs to motor carriers remains unclear, and FMCSA should work with these entities closely to understand agreed upon responsibilities.

ADS developers should maintain the latitude to develop and deploy code to trucks at their discretion. Starsky's software updates are deployed to trucks after rigorous testing, verification, and validation. Code updates are not binary and may be deployed for a variety of reasons, including to add to an ODD, provide for a new feature capability, accommodate new hardware, etc. Developers operating their own fleets should maintain the ability to develop, test, and deploy new code branches as

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necessary. As a developer and motor carrier, Starsky can always ensure that the proper software is deployed to our fleet.

FMCSA should continue to monitor and understand the nuances surrounding the operation and software-related responsibilities between a motor carrier and an ADS developer or OEM before establishing requirements. FMCSA could consider the Federal Aviation Administration's (FAA's) Airworthiness Directives process as a mechanism that has been successfully implemented in aviation for deploying safety-critical software updates.

8 – Roadside Inspections

8.1 – Should motor carriers be required to notify FMCSA that they are operating Level 4 or 5 ADS-equipped vehicles?

Starsky currently keeps U.S. DOT informed of our ACMV operations and will continue to do so. We do not oppose requirements that motor carriers notify FMCSA if they are operating H-ADS-equipped vehicles.

8.2 – If so, how should the carrier notify FMCSA?

FMCSA can look to existing registration processes, such as the Motor Carrier Identification Report (MCS-150), which would serve as an effective reporting method and allow carriers to easily notify FMCSA they are operating H-ADS-equipped vehicles.

8.3 – Should FMCSA require markings identifying the ADS Level of a vehicle?

We believe assisting law enforcement in identifying an ACMV is critically important. We work closely with law enforcement partners everywhere we operate, as well as entities like the Commercial Vehicle Safety Alliance (CVSA), as part of that philosophy. Starsky will continue working with these partners to facilitate the development of a seamless interface for widespread deployment that allows law enforcement personnel to identify a Starsky truck prior to ever approaching it. In the context of a pull-over event or roadside enforcement inspection, this interface should include mechanisms to affirmatively assure officers that a truck's automation system is disengaged and the truck will not move, provide the ability to communicate with

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relevant Starsky personnel, and allow for the exchange of required information. Starsky is working actively with public partners to advance these goals and will continue keeping FMCSA apprised accordingly.

While this identification process for law enforcement is a necessity, when considering whether to require easily identifiable external markings on ADS-equipped vehicles, FMCSA must also consider other implications. The Agency should conduct robust study to ensure that external markings clearly identifying a vehicle as an ADS do not negatively impact road safety or increase the likelihood of unsafe driving behavior around ACMVs or attacks against ACMVs. Even in the testing phase, developers have seen ADS-equipped vehicles physically attacked. In addition, Starsky is cognizant of the potential for surrounding motorists to be distracted by unmanned ACMVs in initial deployment phases, causing unsafe driving behavior such as taking photos of ACMVs while operating a vehicle.

FMCSA should conduct research to explore and fully understand the potential negative ramifications of on-vehicle ADS markings to roadway safety. Based on this data, the Agency should develop requirements accordingly.

8.4 – Should the Agency require motor carriers to utilize ADS-equipped CMVs that have a malfunction indicator?

Level 4 and 5 vehicles can achieve a MRC without a malfunction indicator light (MIL) upon experiencing a performance-relevant failure. Starsky's system is constantly conducting diagnostics to detect system malfunctions within milliseconds and adequately characterize and respond to failure modes accordingly. Binary in-vehicle MILs may not be easily viewed by or convey sufficiently useful information to law enforcement officials (such as the nature, severity, or type of a malfunction). FMCSA should study the issue to determine the potential use cases for MILs, what benefits they might provide, and if there may be negative implications associated with such a requirement.

8.5 – Should the Agency require that motor carriers deploying ADS-equipped CMVs ensure the vehicle can pull over in response to Federal and State officials or move out of the way of first-responders?

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Yes. ACMVs should be capable of adequately responding to law enforcement and first responders. These requirements should continue to apply.

8.6 – How might that be achieved, and at what cost?

Before an unmanned vehicle is deployed, it should be incumbent on ADS-developers to have the capability to respond to law enforcement and first responders. Starsky is currently capable of recognizing emergency lights and responding accordingly. We are continuing to develop and improve our system to best facilitate these interactions, including training our law enforcement partners how to interact with an unmanned Starsky truck, and developing our law enforcement and first-responder interfaces with the input of these communities.

8.7 – How would roadside enforcement personnel know that a vehicle can no longer operate safely?

Any Level 4 or 5 ACMV or functionally safe teleoperation system should be capable of achieving an MRC in the event it experiences a performance relevant failure that prevents the safe operation of the vehicle. The Starsky system includes on-board diagnostics that are constantly evaluating system health and performance. In any event where an unmanned Starsky truck achieved a MRC, a Starsky employee would be alerted to this situation immediately and can communicate information to law enforcement as appropriate. Any performance-relevant failure should prevent the vehicle from operating, which can also be communicated to law enforcement accordingly.

Starsky's diagnostics system includes indicators on-board the vehicle that inform a safety driver in the cab that all sub-systems are performing as intended. In the future, the results of these diagnostics could be wirelessly communicated to roadside enforcement personnel to affirmatively confirm that hardware and software health is adequate for safe operation. As mentioned above, we have worked with CVSA and other state partners regarding this issue and recommend FMCSA continue to engage with these stakeholders to consider approaches with widespread support.

8.8 – Absent an FMVSS, how could standard indications be provided to law enforcement personnel?

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Developing standard indicators for law enforcement remains an active area of discussion among developers and the law enforcement community. Today, Starsky works closely with law enforcement everywhere we operate and greatly values the insight these partners provide as we iterate and improve our system. As these discussions continue, FMCSA should consult ADS developers, industry organizations like the American Trucking Association's (ATA) Technology and Maintenance Council (TMC), and groups like CVSA to develop standards based on widespread consensus from stakeholders.

9 – Cybersecurity

9.1 – What types of safety and cargo security risks may be introduced with the integration of ADS-equipped CMVs?

Legacy CMVs are subject to increasingly sophisticated cargo hijacking techniques and face an ever-evolving threat environment. Starsky will be subject to these same threats and is constantly evaluating risks to cargo and our truck assets as part of our broad security umbrella.

9.2 – What types of rules should FMCSA consider to ensure that motor carriers' safety management practices adequately address cybersecurity?

Cybersecurity is a crucial component Starsky's security portfolio. Cyber vulnerabilities are relevant to any modern automotive technology and ADSs are no exception. We appreciate FMCSA's attention to the importance of cybersecurity hygiene and recommend the Agency work with other government agencies, including the National Institute of Standards and Technology (NIST), the Federal Bureau of Investigation (FBI), and Department of Homeland Security (DHS) in addition to industry groups developing best cyber practices, such as ATA's TMC / Fleet CyWatch and the Automotive Information Sharing & Analysis Center (Auto-ISAC) when considering potential cyber-related vulnerabilities for ADSs.

As described in our VSSA, Starsky's cyber-management practices include taking steps to adopt applicable best-practices from a variety of different industries and NIST's Cybersecurity Risk Management Framework to isolate access points and mitigate potential risks. We will continue to engage with the Agency as FMCSA seeks to ensure carriers are adequately addressing cybersecurity threats.

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<u>*10 – Confidentiality of Shared Information*</u>

10.1 – As the development of ADS technology continues, the Agency believes that there is a need to learn about the performance limitations of these systems. FMCSA draws a distinction between information about performance limitations (e.g. how well does the ADS keep the vehicle in its lane and under what environmental conditions, etc.) and details about the system designed (e.g., the specific types of sensors, or the array of sensors and cameras used for input to the central processing unit for the ADS). To what extent do ADS developers believe performance data should be considered proprietary and withheld from the public?

Currently, several developers and industry groups are working to establish and define common performance metrics for ADSs. In the absence of consensus-based metrics, FMCSA should continue to work closely with developers to understand the proprietary nature of their performance data. Today, commonly considered performance metrics may provide an imperfect or inaccurate picture of a vehicle's capabilities. At Starsky, we consider a suite of data to build a comprehensive matrix comparing our vehicle performance to human driven CMVs.

As part of our efforts to build public confidence in ADS technologies, we believe that openly demonstrating that our vehicles are *as safe or safer than* human drivers and do not pose *unreasonable risk*, as defined in ISO 26262, is a critical component of widescale deployment. However, while developers are continuing to actively test our systems, certain performance or ODD data may remain highly proprietary and should be protected when provided to FMCSA.

10.2 – Are the Agency's current processes under 49 C.F.R. 389.9 for submission and protection of confidential business information in the context of a rulemaking sufficient to allow ADS developers and motor carriers to communicate essential information to the Agency regarding the operation of ADS?

At this time, we do not specific have reason to believe these processes are insufficient and will continue to work with the Agency regarding the best mechanisms to protect confidential information.

10.3 – If not, how should those processes be modified?

See response to Q 10.2.

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IV.   <u>Conclusion</u>

Thank you again for the opportunity to submit feedback in response to this proceeding. Please do not hesitate to contact us with any questions at Kam@starskyrobotics.com.

Sincerely,

Kameron Simmons
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Starsky Robotics

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