Kodiak

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The Honorable Raymond P. Martinez
Administrator
Federal Motor Carrier Safety Administration
U.S. Department of Transportation
1200 New Jersey Avenue SE
Washington, DC 20590

Re: Docket No. FMCSA-2018-0037, "Safe Integration of Automated Driving Systems-Equipped Commercial Motor Vehicles"

Kodiak Robotics, a leading developer of Automated Driving Systems (ADSs) for Class 8 semi trucks, is pleased to present this response to the Federal Motor Carrier Safety Administration's (FMCSA's) Advanced Notice of Proposed Rulemaking on the Safe Integration of Automated Driving Systems-Equipped Commercial Motor Vehicles.

Kodiak is thrilled that FMCSA has chosen to focus its attention on how ADSs can best be integrated into the nation's trucking fleet, making the country's roads safer and address a critical economic need. We believe that in the coming years, ADS-equipped Commercial Motor Vehicles (CMVs) will play a key role in driving economic growth and improving safety on America's roadways. As such, we applaud FMCSA for beginning to update its regulatory structure to account for ADSs, and support FMCSA's efforts to formalize its existing interpretative guidance regarding ADSs into promulgated rules.

Please see below our answers to the questions laid out in the Advanced Notice of Proposed Rulemaking.

Question 1.1 *- How should FMCSA ensure that an ADS-equipped CMV only operates consistent with the ODD for the ADS equipped on the vehicle?*

> Kodiak Robotics' ADS is designed to only operate consistent with its ODD, and immediately assume a minimal risk condition should the CMVs reach the limits of their ODDs. Given that these ODDs will change significantly over time, we strongly support USDOT's decision to allow ADS developers to define the ODDs for their own systems.

Question 1.2 *- What are manufacturers' and motor carriers' plans for when and how Levels 4 and 5 ADS-equipped CMVs will become commercially available?*

> Kodiak believes that ADS technology is developing rapidly, and that deployment on specific lanes in specific ODDs may be feasible over the next several years. Critically, we believe CMV deployment will precede passenger vehicles, given the more structured nature of highway deployments and more straightforward technological requirements which underpin it. We therefore strongly support FMCSA's decision to move forward with this rulemaking, as it is critical to begin to develop a regulatory structure for ADS-equipped CMVs in the coming years.

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

Yes. We believe that FMCSA should amend its definitions to clarify the roles that may exist once ADS-equipped CMVs become widespread. FMCSA should partner with SAE International to ensure consistency between federal regulation and SAE taxonomy.

Kodiak believes that, broadly, the following definitions will be necessary:

- Automated Driving System - the combination of hardware and software capable of driving a CMV
- Automated Driving Provider - An entity responsible for the operation of an ADS. An Automated Driving Provider would therefore be either an ADS developer, an Original Equipment Manufacturer, or another entity that has proven the technical ability to own and operate an ADS.
- Automated Driving System Technician - a person qualified to conduct all the key non-driving responsibilities of a CDL-holder, including the pre-trip inspection and the cargo securement inspection, without the licensed ability to drive the vehicle.
- Conventional Human Driver - a traditional human driver of a motor vehicle.
- Remote Driver - a person capable of driving a CMV without being physically located inside the vehicle. In some configurations, remote drivers will be dedicated to operating a specific vehicle for an entire trip, whereas in other configurations remote drivers may operate in stand-by mode, and operate a vehicle during a specific period of need. In either case, a remote driver should only be able to operate one vehicle at a time, but should be able to give control of a CMV to an ADS, or to another remote driver.
- Remote Monitor - a person who remotely monitors the performance of an Automated Driving System and can issue commands to the Automated Driving System, without having a safety-critical or time-sensitive role in the operation of the ADS-equipped CMV.

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

We do not believe that a CDL endorsement should be required for individuals operating an ADS-equipped CMV. Operators of ADS-equipped CMVs will have similar or lessened responsibilities to current CDLs. To the extent that the roles differ, those differences will be driven by variations between ADSs. Given the lack of uniformity across ADSs, each ADS developer is best positioned to train operators on its unique system, without a specific CDL endorsement.

Additionally, FMCSA typically requires endorsements for more difficult driving tasks: e.g. hazmat endorsements are necessary because driving hazardous materials is more difficult and dangerous than traditional cargo. Driving an ADS-equipped CMV should be an easier task for a driver, reducing the need for an endorsement.

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

See our response to 2.1 - we do not believe that a CDL endorsement should be required of individuals operating an ADS-equipped CMV.

Additionally, technology in this area continues to progress and evolve at a rapid pace making it very difficult, if not impossible, to create a curriculum that captures both the breadth and depth of technology and one which remains up to date. Each ADS will require fairly specialized training, which developers are well-positioned and strongly motivated to provide.

Question 2.3 *- What would be the impacts on SDLAs (state-level driving licensing agencies)?*

Creating an ADS endorsement would be extremely burdensome for states. In many cases, they may lack the requisite technical expertise and experience to create and administer curricula and exams.

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

Like users of any other complex piece of technology, drivers of ADS-equipped CMVs will need specialized training to ensure that they have the skills required to operate an ADS-equipped CMV, and to ensure they understand the specific ODDs and behaviors of specific ADSs. This training can be best administered by ADS developers and, when applicable, their motor carrier partners, who are using the ADS-equipped CMVs on a daily basis. As an example, Kodiak provides specialized training to, and develop specialized skills in, our experienced and hardworking team of drivers.

Depending on the ADS developer, the specialized training required to operate an ADS may also be fairly simple: most ADSs will presumably be designed to operate primary on their own without interaction with, or even the presence of a human driver.

Question 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?*

By the SAE J3016 definition, a Level 4 or 5 ADS can perform “the entire Dynamic Driving Task (DDT) and DDT fallback, without any expectation that a user will respond to a request to intervene”. A human monitoring a Level 4 ADS-equipped CMV, therefore, is definitionally non-safety critical, and there is no compelling reason for the FMCSA to impose limitations on the number of vehicles a single remote monitor monitors at a given point in time.

ADS developers whose models depend on using remote drivers should only permit those drivers to operate a single vehicle at a time, since they presumably will be conducting all or some portion of the DDT during operation. A stand-by remote driver should therefore only be responsible for a single vehicle until they have handed complete control of the DDT to the ADS or to another remote driver.

Additionally, different business models for ADS-equipped CMVs may have different configurations and monitoring options, from human drivers on-board to remote drivers to individual monitors monitoring several trucks.

Question 2.6 *- Is there any reason why a dedicated or stand-by remote operator should not be subject to existing driver qualifications?*

No. Any human responsible for any safety-critical or time-sensitive driving task, either in the cab of the vehicle or remotely, should be required to hold a CDL. This will help ensure safe deployment of this technology and broad acceptance of ADS-technology. Motorists will want to know that the people behind the wheel of a CMV hold CDLs, regardless of where that wheel may happen to be physically located.

Remote monitors, however, who have the ability to instruct a Level 4 or 5 ADS-equipped CMV to perform the very limited driving task of requesting the CMV to pull over when the ADS pull over when it independently verifies it can safely perform the action but do not have a safety-critical role in the dynamic driving task, need not be subject to existing driver qualifications.

Question 3.1 *- Should HOS rule changes be considered if ADS technology performs all the driving tasks while a human is on-duty, not driving; off-duty or in the sleeper berth; or physically remote from the CMV?*

HOS regulations should apply to any individual who could be called upon to assume control of an ADS-equipped CMV in a time-sensitive fashion. This includes both “remote drivers” and any driver in the driver’s seat of a truck. Whether or not these drivers are physically in control of a vehicle, they are subject to the same stresses as drivers performing the dynamic driving task and should be well-rested and in control.

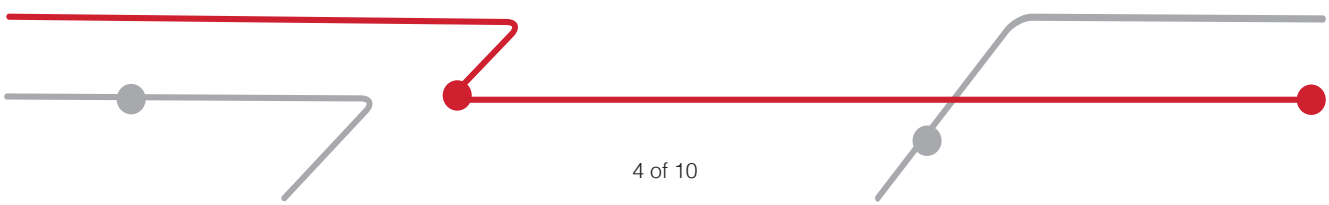
Drivers who are in a truck but could not be called upon to assume control of an ADS-equipped CMV should be considered ON-duty, but not driving. This should apply to drivers in the passenger seat of a vehicle or performing remote monitoring tasks, but not drivers in the sleeper berth and off-duty performing no work-related function.

Question 3.2 *- Should the HOS requirements apply to both onboard and remote operators?*

Yes, HOS requirements should apply to both onboard and remote operators: they are subject to the same stresses and should be treated identically by the FMCSRs. It is worth noting, however, that motor carriers will have little incentive to have remote operators drive long hours, due to existing overtime regulations and the relative ease of switching between operators as compared to in-cab drivers.

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

Individuals who are not in control of a vehicle, but may be called upon to assume control in a time-sensitive fashion, should be considered on-duty and driving and an ELD should be utilized.



Questions 4.1 - 4.3 *- Should some of the physical qualification rules be eliminated or made less stringent for humans remotely monitoring or potentially controlling ADS-equipped CMVs?*

Yes. Physical qualification rules should reflect the physical attributes required to complete all relevant tasks. Monitoring an ADS-equipped CMV will likely be significantly less physically taxing than driving a traditional CMV, and it would therefore be appropriate to loosen or eliminate physical qualifications for such monitors. This would allow for a wide range of people with disabilities, including truck drivers who no longer meet physical qualification standards, to work in such roles.

While it may eventually be possible to loosen physical requirements for humans controlling ADS-equipped CMVs from inside the truck, more study is needed before FMCSA makes any changes.

Question 5.1 *- How should the prohibition against distracted driving (i.e., texting, hand-held cell phone) apply to onboard operators responsible for taking control of the CMV under certain situations, and to remote operators with similar responsibilities?*

Any driver or remote driver who may be called upon to assume control of a vehicle in a time-sensitive fashion should be held to the same standards as currently exist in the FMCSRs. This requirement should apply to any driver in the driver's seat of a vehicle, as well as to remote drivers and remote operators, but should not apply to on-duty drivers that are not behind the wheel of an ADS-equipped CMV.

ADS-equipped CMVs may, however, be equipped with screens that are necessary to operate the ADS. FMCSA should consider rules that allow drivers to consult with these screens during operation, as well as rules to prevent these screens from serving as a distraction. For example, these screens should not be able to function as entertainment devices, or present information not directly related to the operation of the ADS.

Question 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 Level 5 ADS must satisfy the operational rules?*

Except as set forth below with respect to tasks that would require physical presence (such as placing warning devices near a CMV when pulled to the side of the road), we believe that FMCSA should require compliance with Part 392 for any human who may be able to exercise control over a CMV. Similarly, an ADS-equipped CMV under the control of a Level 4 or Level 5 ADS must be able to satisfy all operational rules - depending on the ADS-equipped CMV to switch to human control for narrow operational conditions creates a significant risk of violating an ADS-equipped CMV's ODDs.

Question 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?*

As described in 6.1, we believe ADS-equipped CMVs must be able to comply with all the rules of the road that do not require a physical presence, without switching to a human driver, whether that driver is remote or in the vehicle. Situations like railroad crossings are both safety critical and sufficiently common that ADSs must be able to appropriately navigate the situation. FMCSA should not allow humans to be necessary for routine parts of the DDT.

There are a few rules of the road, however, that are impossible for CMVs without a human driver to undertake. For example, an ADS driver would not be able to place warning devices near a CMV that has pulled to the side of the road, or to conduct a Cargo Securement inspection. We believe further study is needed to determine the proper solution to these issues.

Question 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?*

We believe that both human and ADS drivers should be capable of complying with the applicable operational rules in any situation where either a human or ADS driver are called upon to take control of a vehicle.

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

As described above, we believe that FMCSA should create an ADS Technician role, who is qualified to perform the pre-trip inspection and cargo inspection, but is not qualified to actually drive a CMV. These individuals performing the pre-trip inspection should have qualifications consistent with the current FMCSRs. Additionally, they should be trained to conduct an ADS self-diagnostic test by that ADS's developer. Since those self-diagnostic tests will likely remain inconsistent between ADS developers for the foreseeable future, FMCSA should not require any specific training or expertise on self-diagnostics.

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

FMCSA should maintain its current requirement that ADS-equipped CMVs receive an annual inspection by a DOT-qualified inspector. Operators of ADS-equipped CMVs should be able to self-certify to ADS functionality during the routine maintenance process, with records created in real-time and maintained permanently.

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

FMCSA should maintain its current annual inspection period for ADS-equipped CMVs for the foreseeable future. As discussed above, self-diagnostic tests may make scheduled inspections less critical, as CMVs may be able to self-report on critical vehicle maintenance issues, but FMCSA will need to collect significantly more data before it can determine whether self-diagnostics should be considered sufficient.

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

We believe FMCSA should maintain its current inspection regulations for ADS-equipped CMVs, with inspections occurring every 12 months.

Question 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 requirements?*

Given the substantial differences between the range of ADSs available, it would be impractical for FMCSA to impose requirements on ADS-related inspection, repair, and maintenance. Instead, we believe a self-certification approach will be most effective in ensuring that inspectors have the skills required to maintain developer-specific ADSs.

Question 7.6 *- How could FMCSA ensure that motor carriers apply safety-critical software updates?*

It's critical that freight carriers and ADS developers ensure that every ADS operates safely, including through the installation of critical safety and security updates. That being said, forcing updates on an ADS without the knowledge of its user can, in certain circumstances, be counterproductive or dangerous. ADS operators may not understand subtle changes between different software versions and any operational considerations required by such software updates. Carriers should therefore have discretion around when they install system updates to ensure ongoing safe operation of the vehicles.

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

We believe that motor carriers should notify FMCSA if they are operating Level 4 or 5 ADS-equipped CMVs, to ensure FMCSA and USDOT at large are well informed as to automated vehicles on America's roadways.

Question 8.2 *- If so, how should the carrier notify FMCSA?*

FMCSA should update the MCS 150 form to allow motor carriers to declare if they plan on operating ADS-equipped CMVs.

Question 8.3 *- Should FMCSA require markings identifying the ADS Level of a vehicle?*

We believe further research is needed to understand the need for specific markings for ADS-equipped CMVs. From the point of view of other motorists, ADS-equipped CMVs should behave similarly to, or more safely than, traditional CMVs. Requiring special markings would suggest to motorists that ADS-equipped CMVs require additional care, concern, or distance, which could lead to erratic or irrational driver behavior. Potential markings, therefore, should go hand-in-hand with further public education.

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

No. ADS-equipped CMVs should be able to communicate malfunctions directly to their monitors, without an internal or external malfunction indicator. In case that malfunction would make continued operation dangerous, an ADS-equipped CMV should automatically assume a minimal risk condition (e.g. pulling to the side of the road and engaging its hazard lights).

Question 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?*

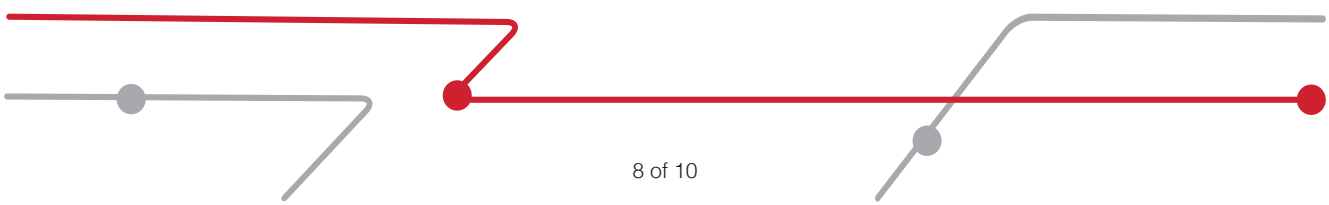
Yes. Pulling over in response to Federal and State officials is critical for compliance and moving out of the way for first-responders is a safety-critical function. ADS-equipped CMVs should be able to do both.

Question 8.6 *- How might that be achieved, and at what cost?*

ADS developers are continuing to develop solutions that will allow them to respond appropriately to first responders and other Federal and State law-enforcement officials. We look forward to partnering with the law enforcement community and the ADS industry to solve this issue, but believe a technology-neutral approach is critical so long as such technological approach (be it audio or visual detection systems or vehicle-to-vehicle communication or another approach) is able to address this critical requirement.

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

ADS-equipped CMVs will have access to a number of tools to determine safe operation beyond what human drivers are capable of. This includes numerous self-diagnostic systems, and the ability to remotely contact its operator in case of safety issue. Additionally, ADSs will be better equipped than humans to make safety decisions, since systems will ge designed to pull over or assume another fail-safe condition and be rendered inoperable when the vehicle can no longer operate safely. Irrespectively, roadside enforcement personnel will be able to make their own determinations of vehicle safety by monitoring erratic behavior, much as they do for human drivers, and ground the vehicle via communication with the operator or direct physical means.



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

ADS-equipped CMVs should offer a higher level of safety than traditional CMVs - Kodiak Robotics does not plan on utilizing our ADS-equipped CMVs without a safety driver until we can demonstrate that our ADS is safer than a human. ADS-equipped CMVs do, however, create some novel safety risks, including cybersecurity risks and "spoofing" risks.

Kodiak takes cybersecurity extremely seriously and is in the process of developing and integrating industry best-practices to ensure the safety of its vehicles and the public at large. Given the continued evolution of strategy and tactics that bad actors utilize with respect to hacking and other behavior it is critical that cybersecurity solutions continue to evolve to address these threats.

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

FMCSA should require ADS developers to implement cybersecurity fail-safe mechanisms that would ground the trucks should the ADS be hacked. Additionally, FMCSA should required ADS developers to subject their systems to extensive cybersecurity testing.

Question 10.1 *- As the development of ADS technology continues, the Agency believes 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 design (e.g., the specific types of sensors, or the arrays 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?*

While we believe information sharing can have a positive impact on both ADS development and public acceptance of ADS technology, overly broad or complex data-sharing requirements could have a chilling effect on ADS development. At this time, more research is necessary to determine how ADS developers and regulators should define performance data and put an appropriate scope in place, and what information will assist with public outreach and safety validation.

Some states have requested overly broad datasets from ADS developers looking to test their solutions, which have both been burdensome to collect and provided little real value to regulators and the public. We believe that any data-sharing that FMCSA require from ADS developers should be narrowly-tailored to ensure that it provides regulators with the data they need which can be productively used as well as what data leads to greater public acceptance and understanding of ADS technology.

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Question 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?*

We believe that the current process is sufficient with respect to protecting confidential business information but not with respect to proprietary technical information.

Question 10.3 *- If not, how should those processes be modified?*

We believe additional study and guidance is required to determine, what, if any, proprietary technical information may be required by FMCSA. Such study and guidance will help inform how the process may need to be modified.

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