UNIVERSITY OF MIAMI SCHOOL OF LAW
RESEARCH PAPER

# LIABILITY RULES FOR AUTOMATED VEHICLES:

## DEFINITIONS & DETAILS

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*This paper explains how the law ought to attribute and allocate liability for accidents involving automated vehicles. We advocate for the creation of the legal fiction of a "Computer Driver" and allow a court or jury to attribute ordinary negligence liability to the Computer Driver anytime a court or jury determines that the Computer Driver's behavior failed to imitate or exceed the level of care we would expect of an attentive and unimpaired Human Driver in similar circumstances. Further, we explain how to determine contributory negligence for the interactions between Computer Drivers and Human Drivers when control of a vehicle is transferred from a Computer Driver to a Human Driver by specifying a portion of time during the take-over transition period in which the Human Driver cannot have contributory negligence as a matter of law. We have proposed and defended these views in contemporaneous traditional law review articles.*

*We make our case in this paper by presenting proposed legal definitions and explanatory legislative history to show additional details in our recommended structure. We use this non-traditional presentation because we believe this complexity can only be fully conveyed by providing the details in a precise way with technical definitions and wording which should be familiar to engineers and safety specialists.*

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## INTRODUCTION

THIS paper explains how the law ought to attribute and allocate liability for accidents involving automated vehicles by providing detailed definitions and explanations suitable for use in a new statute. We advocate for a new statute that establishes the legal fiction of a "Computer Driver" which owes a duty of care to other road users.[1] This would allow a court or jury to attribute ordinary negligence liability to the Computer Driver if a court or jury determines that the Computer Driver's behavior failed to imitate or exceed the level of care the law demands of an attentive and unimpaired Human Driver in similar circumstances. [2] In this statutory scheme, the manufacturer of the Computer Driver has financial responsibility for losses proximately caused by Negligent Computer Drivers it produced.

The paper also explains how to determine contributory negligence for the interactions between Computer Drivers and Human Drivers when control of an automated vehicle is transferred from a Computer Driver to a Human Driver. It specifies an amount of time during the take-over period in which the Human Driver cannot have contributory negligence as a matter of law. We recommend a minimum 10-second window. Thereafter, contributory negligence is determined based on the specific facts and circumstances of the case as it is for human to human interactions.

The law needs a minimum takeover grace period within which the Human Driver is not at fault because of the realities of human nature and reaction time. The takeover of control is a process. It does not occur at an instant in time. The Human Driver simply cannot have liability from the instant that the Computer Driver sounds the alarm for the Human Driver to take over control. The Human Driver

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[1] *See Nilsson v. General Motors LLC*. In *Nilsson*, the plaintiff relied solely on a theory of general negligence (and not defective design or failure to warn), claiming that the AV manufacturer had breached its duty of care because the vehicle itself—and not the backup driver—drove in a negligent manner that caused the plaintiff's injury (Compl. ¶¶ 15-16, Nilsson v. Gen. Motors LLC, No. 18-471 (N.D. Cal. Jan. 22, 2018), ECF No. 1). The case settled before trial.

[2] In its answer to the *Nilsson* complaint, GM admitted that the *vehicle itself* was required to use reasonable care in driving (Answer ¶ 15, Nilsson v. Gen. Motors LLC, No. 18-471 (N.D. Cal. Mar. 30, 2018), ECF No. 18 (stating that "GM admits that the Bolt was required to use reasonable care in driving"). The issue that remained was who had financial responsibility if the vehicle were found negligent.

can have negligence liability or contributory negligence only after a fair opportunity to assume responsibility for safe operation to of the vehicle. We have proposed and defended these views in contemporaneous traditional law review articles.[3] This paper makes those proposals concrete.

We make our case in this paper by presenting proposed legal definitions and explanatory legislative history to show how to attribute and allocate liability in our recommended structure. We use this non-traditional presentation because the intersection of driving automation technology and safety is particularly complex. We believe this complexity can only be fully conveyed by providing the details in a precise way which reflects technical definitions and wording which should be familiar to engineers and safety specialists.

This third piece supplements the prior two articles by adding an additional level of precision. The definitions begin in part A.) with general defined terms useful to implement the legal fiction of a "Computer Driver" which may have ordinary negligence liability just like Human Driver.

We further provide definitions and explanatory descriptions as a starting point for a statute which uses operating modes to attribute and allocate liability to determine contributory negligence. These details appear in parts B.) through E.).

## *A. Defining a Computer Driver*

A statute providing an architecture for state law liability rules attributing and allocating responsibility for losses should be based on the concept of synthetic negligence for a fictitious entity called a "Computer Driver." This fictitious entity is considered equivalent in roles and responsibilities to a Human Driver with the exception that the Manufacturer, rather than the equipment comprising the Computer Driver, is the Responsible Party. The concept of a Negligent

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[3] William H. Widen & Philip Koopman, *Winning the Imitation Game: Setting Safety Expectations for Automated Vehicles*, UNIVERSITY OF MIAMI SCHOOL OF LAW LEGAL STUDIES RESEARCH PAPER SERIES (April 25, 2023), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4429695; William H. Widen & Philip Koopman, *The Awkward Midddle for Automated Vehicles: Liability Attribution Rules When Humans and Computers Share Driving Responsibilities*, UNIVERSITY OF MIAMI SCHOOL OF LAW LEGAL STUDIES RESEARCH PAPER SERIES (May 10, 2023), available at SSRN: [to come].

Computer Driver can be based on the following definitions or their equivalents:[4]

**"Automated Vehicle"** means a motor vehicle equipped with a Computer Driver. The presence or use of a Driver Assistance Feature other than automated Steering, and momentary control functions that do not provide sustained directional control of the vehicle are not relevant to determining whether a vehicle is an Automated Vehicle. Notwithstanding technical characteristics, any statement by a manufacturer, distributor, or dealer to the effect that a vehicle can drive itself or that it contains self-driving or automated driving technology shall result in classification of that vehicle as an Automated Vehicle.

Comment: An automated vehicle might or might not have steering control active at any given time, depending on its operating mode. An automated vehicle might or might not require Human Driver supervision at any given time, depending on its operating mode.

**"Breach of the Duty of Care"** means, with respect to a Computer Driver, the deficient and unsafe operation of an Automated Vehicle as described below under "Duty of Care."

**"Computer Driver"** means a set of computer hardware, software, sensor, and actuator equipment that is collectively capable of Steering a vehicle on a sustained basis without continual directional input from a Human Driver.[5]

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[4] It is commonplace for laws in the United States to use tort law to influence product design. *See, e.g.*, Harry Surden & MaryAnne Williams, *Technological Opacity, Predictability, and Self‐Driving Cars*, 38 Cardozo L. Rev., 178 (2016) (describing indirect regulation through the tort system).

[5] This has a larger scope than the term Automated Driving System (ADS) defined by SAE J3016 for defined levels 3, 4, and 5. It also includes a driving automation system that performs at least lateral vehicle motion control via steering on a sustained basis regardless of J3016 Level. While in practice most such capabilities are limited to a particular Operational Design Domain (ODD), liability is assigned without regard to whether the Computer Driver is inside or outside its ODD. The Computer Driver does, however, have the option of refusing to engage outside its ODD and requesting a transfer of control to a Human Driver and/or terminating its mission via a Failure Mitigation Strategy if it finds itself about to exit its ODD. *See* SAE INT'L, TAXONOMY AND DEFINITIONS FOR TERMS RELATED TO DRIVING AUTOMATION SYSTEMS FOR ON-ROAD MOTOR VEHICLES J3016_202104 (2021) [hereinafter J3016], https://www.sae.org/standards/content/j3016_202104/.

Comment: The definition of Computer Driver is a superset of the concept of an Automated Driving System as defined in SAE J3016.[6] The Computer Driver on SAE Level 3, 4, and 5 features is called the Automated Driving System (ADS). The Computer Driver on SAE Level 1 and 2 systems does not have a name defined by J3016 beyond being vehicle automation equipment capable of performing sustained steering.

**"Driver Assistance Features"** means a vehicle automation feature that does not automate Steering on a sustained basis.[7] Such features include, but are not limited to, electronic blind spot assistance, automated emergency braking systems, adaptive cruise control, lane keep assist, lane departure warning, traffic jam speed assist, electronic stability control, or other similar systems that enhance safety or provide driver assistance, but are not capable, collectively or singularly, of vehicle control without sustained directional control being provided by a Human Driver who performs the task of Steering.[8]

**"Driving"** means the holistic task of operating a vehicle on public roads in conformity with applicable laws, regulations, and statutes, without creating Undue Risk for vehicle occupants and other road users.[9] "Drive" has the correlative meaning.

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[6] *See* J3016, note 5.

[7] This has a different scope than the term Driver Support Feature defined in SAE J3016. A Driver Support Feature is a generic term for Level 1 and Level 2 automation features which might in some cases included sustained automated steering, but excludes momentary intervention active safety features such as automated emergency braking. It should be noted that Level 2, which combines both automated steering and automated speed control, is not defined in SAE J3016 as a driver assistance feature, even though it is common to see an incorrect designation of Level 2 features as "driver assistance" rather than "driver support" features.

[8] This term is largely compatible with an intuitive notion of Advanced Driver Assistance Systems (ADAS), but not quite the same. It includes all momentary intervention and alert active safety functions, as does the typical usage of ADAS. It excludes SAE Level 2 features that automate both steering and speed control, which is also said to be "automation" rather than "assistance" by SAE J3016. However, while SAE J3016 would say that a steering-only automation feature that did not concurrently automate speed control would be a Level 1 "driver assistance" feature, by the definition in this paper such an automated steering Level 1 feature would still be said to have a Computer Driver.

[9] This includes, but has a significantly broader scope than the term Dynamic Driving Task defined in SAE J3016, which deals only with tactical vehicle motion considerations. A liability approach must consider the holistic driving task, which includes aspects such as route planning, post-crash driver responsibilities,

**"Duty of Care"** means, with respect to a Computer Driver, the operation of an Autonomous Vehicle without Undue Risk. The Duty of Care of a Computer Driver is owed to Automated Vehicle occupants, other motorists, bystanders, cyclists and pedestrians; the Duty of Care extends to any person (including, without limitation, the property of a person) who may reasonably be expected to be affected by the operation of the Automated Vehicle and who is injured by failure of the Automated Vehicle to operate without Undue Risk. A breach of the Duty of Care includes, without limitation, (i) the failure of the Automated Vehicle to operate in compliance with applicable motor vehicle laws, rules and regulations – including without limitation, prohibitions against speeding, running a red light, failure to stop for pedestrians in a crosswalk, failure to respond to signals from a traffic officer (unless in exigent circumstances a deviation from compliance is reasonable) and (ii) the failure to implement defensive driving maneuvers for operation without Undue Risk and reasonably expected to be performed by an attentive and unimpaired Human Driver in similar circumstances. The Duty of Care of a Computer Driver is the same as that expected of a Human Driver in identical circumstances.

**"Human Driver"** means a natural person with a valid driver's license applicable to the class of vehicle being operated who is Driving a motor vehicle.

Comment: This includes a driver (SAE J3016 Levels 0-2), a fallback ready user (SAE J3016 Level 3), and a human occupant who might potentially assume operation of a vehicle with suitable controls (SAE J3016 Levels 4-5).[10]

**"Manufacturer"** means the last entity in the development and supply chain who has substantive ability to mitigate the potential for Computer Driver negligence via technical means. This might be a developer, manufacturer, upfitter, programmer for, or any developer or supplier of, a Computer Driver or components for Computer Drivers. A "Manufacturer" is the legal entity who (a) is the vehicle

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ensuring proper vehicle maintenance, law enforcement interactions, and other responsibilities customarily required of human drivers but disclaimed by the scope of J3016 and therefore not required of a J3016-defined ADS.

[10] It is sometimes, incorrectly, said that SAE Level 5 vehicles are ones that do not have human driver controls. Vehicles with Level 4 or Level 5 features might or might not have human-accessible controls. For the purposes of the approach presented in this paper, vehicle controls are optional for a fully autonomous vehicle, and the implications of having such controls apply only if they are present.

manufacturer for a vehicle provided with a Computer Driver as factory equipment, (b) the system integrator of an aftermarket hardware device primarily intended to provide a Computer Driver, (c) the software provider for an aftermarket Computer Driver that does not involve use of an aftermarket hardware device primarily intended to provide a Computer Driver or create Computer Driver functionality, or (d) solely for a test vehicle, the supplier performing testing if not otherwise the manufacturer of a Computer Driver end product. Every Computer Driver has exactly one Manufacturer for the purpose of asserting a case for liability by a Plaintiff who has suffered harm from a Negligent Computer Driver.

Comment: The salient attribute of the manufacturer is that the manufacturer is the legal person furthest along the development cycle and supply chain who can substantively affect the behavior of the Computer Driver and its associated driving safety. Any questions as to division of contributions to negligence within the design cycle and supply chain by multiple suppliers, partners, and system integrators should properly be resolved by the Manufacturer, and not become an additional burden on a Plaintiff.

**"Negligent Computer Driver"** means a Computer Driver which operates in a deficient or unsafe manner which operation, if performed by a Human Driver, would constitute negligence. A Computer Driver is also negligent if, when it requests that a Human Driver take over control of an Automated Vehicle, it places a Human Driver in a situation in which it is unreasonable to expect the Human Driver had a reasonable opportunity to take over control of the Automated Vehicle and operate in a safe manner and without Undue Risk.

**Operating Mode:** the current operating situation which determines the Human Driver's responsibility for controlling the vehicle.[11] The four Operating Modes are: *Conventional* (Human Driver is driving), *Supervisory* (Human Driver is supervising the operation of a Computer Driver), *Autonomou*s (the Human Driver has no responsibility for driving), and *Testing* (the Human Driver is tasked with mitigating risk from public road testing of a potentially defective or incompletely implemented Computer Driver that is not yet released for series production, including without limitation so-called "beta" test versions of a Computer Driver).

[11] The Operating Modes guide attribution and allocation of responsibility for accidents, collisions and other incidents based on contributory negligence and comparative fault to human drivers and occupants of automated vehicles.

Comment: The Operating Mode is used for determining contributory negligence and comparative fault of the Human Driver. As a general rule, in our formulation the Computer Driver has liability during operation during testing mode and in other cases when it is engaged (and for a period after disengagement to allow for a proper Human Driver takeover). A J3018 test driver also may have liability for dereliction of duty, but test driver fault does not absolve a manufacturer of liability by using the test driver as a scapegoat. The Computer Driver in an Automated Vehicle operating in autonomous mode generally has responsibility because such systems allow for human occupant disengagement with the driving task—for example, by taking a nap or reading a book. Supervisory mode is the most complex and is a type of "collaborative driving."[12] In supervisory mode, the Human Driver can have responsibility for accidents when she unreasonably ignores prompts to stay attentive or take over performance of the driving task.

**"Responsible Person"** means the Manufacturer.

Comment: The Manufacturer is the legal entity who has civil, criminal, and financial responsibility for ensuring Driving conformance to applicable laws, regulations, rules, and statutes, without creating Undue Risk for vehicle occupants and other road users and persons to whom a Duty of Care is owed. For the avoidance of doubt, the Computer Driver as a physical system is not a Responsible Person under any circumstances because the Computer Driver is not a legal person, even though the Computer Driver performs the task of Steering and potentially other control functions.

**"Steering"** means actively providing sustained directional control for a motor vehicle. "Steers" has the correlative meaning.

Comment: Automated control of steering is the threshold decision criterion for transferring negligence liability between a Human Driver and a Computer Driver, and may be used by a state as a basis for subjecting a motor vehicle to regulation as an Automated Vehicle.[13]

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[12] *See* Gary Witzenburg, *"Collaborative" Driving: Sharing Is Caring*, KELLEY BLUE BOOK, Jan. 1, 2019, at https://www.kbb.com/car‐news/collaborative‐driving‐sharing‐is‐caring/ (defining "collaborative driving" as a system that "lets the car drive itself under ideal conditions but will warn and return control to the human driver on demand and when it senses it should" and falls "somewhere between Levels 2 and 3," on the SAE taxonomy).

[13] As a practical matter it will be common for Computer Drivers to perform not only steering, but also speed control and other aspects of the Dynamic Driving

**"Undue Risk"** means an overall risk of harm greater than that presented by attentive and unimpaired Human Drivers of vehicles equipped with comparable active and passive safety features, operating in similar environments, operating under otherwise similar conditions.

## *A. Testing Mode.*

*1. Testing Mode Defined.* "**Testing Mode**" is the operation of a Test Vehicle, regardless of whether the Computer Driver is activated at the time.[14]

"**Test Vehicle**" means an Automated Vehicle:

> (i) that has a non-series-production Computer Driver,
> (ii) is driven by a Computer Driver under the immediate supervision of, or at the direction of, a Computer Driver developer, Manufacturer, upfitter, programmer or any developer or supplier of components for Computer Drivers, or
> (iii) the operation of a motor vehicle by a Computer Driver in which
> (A) the motor vehicle is a prototype, or
> (B) is being operated for performance evaluation, engineering testing, or beta testing or
> (C) that has been installed in fewer than 2,500 motor vehicles.[15]

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Task (DDT) as defined in SAE J3016 as well as safety-relevant functions beyond the DDT such as law enforcement interaction. Thus, the term Computer Driver is not intended to limit functionality only to steering, but rather uses the question of whether a feature provides sustained steering as the threshold decision criterion for whether it is a Computer Driver or a driver assistance capability.

[14] One possible defect in a vehicle being tested is that a Computer Driver either activates without having been commanded to do so, or interferes with vehicle controls during what should be conventional operation even when supposedly inactive. Defining testing mode to cover all use of a test vehicle incentivizes manufactures to ensure that test driver controls have an appropriate level of safety even in the presences of potential Computer Driver software and hardware design defects.

[15] By way of comparison, Federal Motor Vehicle Safety Standards (FMVSS) Part 555 specifies a limit of 2,500 exempt sold vehicles per year for some types of exemption, suggesting a precedent that this is a "small" number of vehicles. *See* CODE OF FE. REG., PART 555—Temporary Exemption From Motor Vehicle

Any statement by a Manufacturer, dealer or distributor that a vehicle is a "test" vehicle or the use of the word "beta" or other terminology reasonably interpreted as describing a feature related to automated Steering not ready for series production shall result in classification of that vehicle as a Test Vehicle.

*2. Liability for Testing Mode Operation*. Subject to limited exceptions, a Manufacturer has strict liability for losses sustained by persons or property in any accident or collision involving a vehicle operating in Test Mode. For this purpose, liability attaches if a plaintiff can prove damages and physical causation (i.e., that the Manufacturer's test vehicle hit the plaintiff or the plaintiff's property or otherwise initiated an incident proximately causing loss or harm). A plaintiff is not required to allege or prove a product or design defect, negligence, recklessness, or culpability to state a claim or prevail in an action. Liability attaches regardless of whether the Computer Driver or a human test driver was steering or otherwise in nominal control of the vehicle at or immediately before the time of the accident or collision.

*3. Exceptions to Liability*. A Manufacturer may overcome the presumption of liability by proof that the plaintiff deliberately engaged in malicious behavior intended to cause or result in harm. A Manufacturer may not overcome the presumption of liability by proof that its human test driver failed properly to perform the duties of a testing safety driver.[16]

*4. Safety Driver Qualifications*. A Manufacturer may only operate a vehicle in Testing Mode using its own employee drivers or drivers hired by it to conduct testing activities. Such drivers must be properly licensed for the class of vehicle being tested, regardless of the role assigned to them by the Manufacturer.[17]

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Safety and Bumper Standards, § 555.6 (c)(5), available at https://www.ecfr.gov/current/title-49/subtitle-B/chapter-V/part-555.

[16] Failures to perform the duties of a safety driver would include, without limitation, supervising the operation of a vehicle while intoxicated, texting, or playing video games, supervising testing for more than 40 hours per week, or more than 2 hours without a rest break, or without the class of license needed to operate the vehicle (such as failing to have a current driver's license for vehicles over 10,000 pounds while supervising testing of a Computer Driver for a semi-truck).

[17] For example, a remote safety supervisor for a heavy truck test vehicle must have an appropriate driver license for that class of truck, even if the manufacturer insists that the truck is able to completely ensure safety, with the remote safety supervisor is just there as an extra measure of protection. Note that this

A Manufacturer may only operate a vehicle in Testing Mode in full compliance with SAE J3018.[18] A Manufacturer may only operate a vehicle in accordance with a written Safety Management System plan.[19]

States may wish to add additional requirements for insurance, safety driver background checks, and other considerations related to public road testing safety that are not directly linked to the technology.[20]

*5. Rationale for Structure of Testing Mode*. Testing immature technology puts public road users at risk for the benefit of the Manufacturer. Manufacturers should be held to a high standard of safety in return for the privilege of using public roads for this purpose, and

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requirement might be relaxed when monitoring a series production non-test vehicle that is no longer conducting public road testing, and therefore not operating in testing mode.

[18] SAE J3018 is guidance for on-road AV testing. *See* SAE INT'L, GUIDELINES FOR SAFE ON-ROAD TESTING OF SAE LEVEL 3, 4, AND 5 PROTOTYPE AUTOMATED DRIVING SYSTEMS (ADS) J3018_201503J3018 (2015) [hereinafter J3018] , https://www.sae.org/standards/content/j3018_201503/ (available for purchase; on file with the authors). It is required for testing automated vehicles in New York City. *See* New York City Department of Transportation, Notice of Adoption, Title 34, ch. 4, s. 4-17, Rules of the City of New York, https://www.nyc.gov/html/dot/downloads/pdf/noa-autonomous-vehicle-technology-on-public-highways.pdf Conformance to the currently issued version of J3018 implicitly requires a qualified human test driver to be used for all public road testing. Manufactures of driverless vehicles such as delivery trucks might refit test vehicles with driver compartments until safety-relevant testing has been completed and the vehicles are ready to deploy. The industry, through its professional society SAE, might also update SAE J3018 to encompass the use of remote safety drivers if the industry deems it essential to operate test vehicles without on-board safety drivers. One of the authors is on the voting committee for SAE J3018, and believes that such a standard can be updated if needed quickly enough to not be a substantive bottleneck if the industry is sufficiently motivated to do so.

[19] The details of the Safety Management System might be defined by a state Department of Transportation or similar agency, or might be left at the discretion of the Manufacturer. Industry guidelines exist for creating safety management plans, such as AUTOMATED VEHICLE SAFETY CONSORTIUM, A PROGRAM OF SAE ITC, AUTOMATED VEHICLE SAFETY CONSORTIUM™ BEST PRACTICE, AVSC00007202107 (Issued 2021-07-16), https://www.sae.org/standards/content/avsc00007202107/

[20] *See, e.g.*, AM. ASSOC. OF MOTOR VEH. ADMIN., SAFE TESTING AND DEPLOYMENT OF VEHICLES EQUIPPED WITH AUTOMATED DRIVING SYSTEMS GUIDELINES (3d ed. July 2022),https://www.aamva.org/getmedia/66190412-ce9d-4a3d-8b6e-28c1b80e3c10/Safe-Testing-and-Deployment-of-Vehicles-Equipped-with-ADS-Guidelines_Final.pdf.

incentivized to use professional test drivers following industry-written best practices for testing safety, such as the SAE J3018 testing safety standard.

### *B. Autonomous Mode*

*1. Autonomous Mode Defined*. "**Autonomous Mode**" is operation of a Vehicle with an Autonomy Feature which is engaged. An "**Autonomy Feature**" allows safe operation of the vehicle, with the Computer Driver being completely responsible for Driving when a vehicle is operating in Autonomous Mode. In Autonomous Mode, any person eligible to be a Human Driver that might be a passenger or monitoring the vehicle remotely has no duty or obligation to assume responsibility for Driving (even if available to do so), and the failure to assume responsibility does not constitute contributory negligence or a basis for comparative fault. A Human Driver might not be available to assume responsibility for Driving at all, whether due to design features of the vehicle such as absence of a steering wheel, the vehicle being empty, loss of a remote monitoring communications connection, or otherwise.

*2. Liability for Autonomous Mode Operation*. Subject to limited exceptions, a Manufacturer has liability for losses or harm sustained by persons or property in any accident or collision involving negligent operation of vehicle in Autonomous Mode. For this purpose, liability attaches if a plaintiff can prove a Negligent Computer Driver and proximate causation of damages (e.g., that the automated vehicle hit the plaintiff or the plaintiff's property[21]) when operating in Autonomous Mode. A plaintiff is not required to allege or prove a design or product defect, recklessness, or culpability other than a Negligent Computer Driver to state a claim or prevail in an action. Liability attaches regardless of whether a natural person had an opportunity to take over control of the vehicle at the time of the accident or collision. The Computer Driver of a vehicle operating in Autonomous Mode may request a natural person, if one is available, to initiate a transition to another operational mode. However, no potential Human Driver or other natural person has a duty or obligation to take any action in response to such a request, and the failure to do

[21] There might be other loss scenarios that do not involve a physical collision with Plaintiff's property, such as an AV crashing into a building that causes injuries from flying glass or structural collapse without victims actually having been struck directly by the vehicle.

so does not constitute contributory negligence or provide a basis for a comparative fault calculation. A vehicle in Autonomous Mode may exit that mode by transitioning to a powered-down or standby overall vehicle state when in a stable, stopped condition if doing so will not present Undue Risk.

A vehicle operated in Autonomous Mode may contain a feature which allows for a permissive Driver Intervention. "Driver Intervention" means an overt act of asserting vehicle control by a Human Driver when not in Conventional Mode.[22] This may consist of the Driver assuming responsibility for Steering, or may be a momentary intervention of some or all vehicle motion controls, depending on the design of the Computer Driver. In Autonomous Mode, a Driver Intervention can only be permissive.

Each Automated Vehicle may have urgent egress or demand stop features available for use during operation in Autonomous Mode regardless of whether it allows for permissive Driver Intervention.[23] Neither an occupant, a Human Driver, nor an external natural person shall have any liability for initiating or failing to initiate an urgent egress or demand stop feature when operating in Autonomous Mode.

*3. Exceptions to Liability*. A Manufacturer may overcome the presumption of liability by proof that the plaintiff made a Malicious Intervention or maliciously activated an urgent egress or demand stop feature. A "Malicious Intervention" is a permissive Driver Intervention performed in bad faith or which constitutes malfeasance; provided however, malfeasance may not be shown based on failure to comply with a traffic law, rule, regulation or statute during exigent circumstances or as part of an effort to avoid an accident, collision or other loss event. The Human Driver may have civil, criminal or

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[22] In some situations the Human Driver might be connected remotely. It is our position that someone providing traffic direction such as a police officer is doing just that, and should not be considered to be intervening in the role of a Human Driver. In the case of dangerous traffic directions being associated with an accident or a failure to follow traffic directions, the Computer Driver would have the same liability posture as a Human Driver put in an identical situation.

[23] An urgent egress feature is a passenger request for an expedited stop of the vehicle to permit debarkation for any reason. A demand stop feature that inhibits vehicle motion might be made available to emergency responders outside the vehicle to hold the vehicle in place if it threatens to disrupt on-scene operations with further motion, or for other specific purposes. In any event liability is not transferred to a person making a request to stop or failing to make a request to stop unless such actions are made maliciously.

financial liability for performing a Malicious Intervention. Malicious urgent egress and demand stop activations have the correlative definitions.

Any negligence of the Computer Driver should be judged by the same standards as would be used for a Human Driver, except with the Manufacturer held to be the responsible party. [24] This means liability might be assigned to another road user in any specific crash, using the same negligence rules that would be used if Human Driver had been operating the vehicle instead.

*4. Rationale for Structure of Autonomous Mode*.

A primary objective of having an autonomous vehicle is to relieve people of the burden of driving. Manufacturers especially emphasize the capability to remove drivers entirely, transport people who are not qualified to drive, transport people who are not fit to drive, let passengers sleep during driving, and so on. It is inappropriate to place a liability burden on people who have been told they are not responsible for driving, or who are not in a position to directly affect driving safety.[25]

It is also inappropriate to burden remote safety monitoring personnel with liability if the vehicle is supposed to be driving itself.[26]

## *C. Supervisory Mode*

*1. Supervisory Mode Defined*. "**Supervisory Mode**" means operation of a Vehicle in which the Computer Driver performs Steering and potentially controls other aspects of vehicle motion as may be

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[24] See Winning the Imitation Game, supra note 1.

[25] For example, consider a state law which holds vehicle owners responsible for the driving behavior of an autonomous vehicle. Suppose that a private investor purchases a robotaxi and places it in operation to generate income as an uncrewed publicly available taxi. Even if the investor ensures that maintenance is performed properly, she would have no credible way to evaluate, much less ensure, non-negligent driving behavior, and should not be held accountable for that in place of the Manufacturer who does have a substantive ability to evaluate and mitigate potential driving negligence.

[26] If remote personnel are actively and continuously involved in the driving task to ensure safety, such as might be done in a tele-operated hybrid Computer/Human driver scheme, the vehicle can and should instead be considered to be in Supervisory Mode rather than Autonomous mode.

required to avoid Undue Risk.[27] In Supervisory Mode, the Human Driver has limited obligations to perform a Driver Intervention, which may include, without limitation, assuming active control of Steering or a transition to Conventional mode. Supervisory Mode operation may involve activation of both an effective Driver Monitoring Feature and an Intervention Request Feature.[28] A Manufacturer may include these features, in combination, to provide a reasonable expectation that the Automated Vehicle may be operated without Undue Risk when operating in Supervisory Mode.

*2. Liability for Operation in Supervisory Mode*. Liability is immediately transferred to the Computer Driver whenever it accepts a request to engage from a Human Driver or otherwise engages for any reason.[29]

Once the Computer Driver feature is engaged, liability for operation in Supervisory Mode only transfers from the Computer Driver to the Human Driver following certain alarms and requests by the driving automation system. The liability of the Manufacturer commences in Supervisory Mode once the autonomy feature engages and it ceases to be the only party[30] who may be at fault: (i) ten (10) seconds after the Driver Monitoring Feature sounds an alarm designed to reestablish the Human Driver's attention if the driving automation system determines that the Human Driver is inattentive,

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[27] The Human Driver might be assigned other aspects of safety, such as monitoring cargo safety and passenger behavior. However, assigning a person these responsibilities does not turn Autonomous mode operation into Supervisory mode operation unless an obligation to perform Interventions is also present as described in this mode.

[28] The mode description provides significant incentive for Manufacturers to implement these features. However, this is not an equipment regulation, and the features are not explicitly required. Manufacturers who have an operational concept that they determine makes either feature unnecessary might omit them if they are comfortable also foregoing the potential benefit of liability transfer to the Human Driver that might be associated with use of such features. Safety regulators, such as NHTSA, might independently require such features and set minimum performance standards for them, but those activities are beyond the scope of this example statute.

[29] Among other things, this should motivate Manufacturers to only permit their Computer Driver to be engaged when it is operating inside its Operational Design Domain. Note that because active safety features such as Automated Emergency Braking do not qualify as a Computer Driver due to lack of ability to provide sustained steering control, this liability shift does not inhibit such features from being activated even when a crash is imminent.

[30] We note that a Computer Driver is not a legal person, but rather a fictitious "party" for which the Manufacturer is responsible.

or (ii) ten (10) seconds after the Intervention Request Feature makes a request for the Human Driver to take over control of active Steering and other driving tasks on a sustained basis due to a system fault, limitation, or other reason for which the Computer Driver predicts it will be unable to continue driving without Undue Risk, or (iii) ten (10) seconds after a hazard has become readily apparent, with a longer time possible if necessary to provide an attentive Human Driver with a reasonable time to detect and react to the hazard to mitigate any risk presented by that hazard according to the specifics of the situation.

A "**Driver Monitoring Feature**" is a feature that (1) continuously monitors the availability of the Human Driver to perform an effective and timely Driver Intervention, (2) if the feature detects that the Human Driver is not available, issues multiple warnings and alerts reasonably expected to re-establish the availability of the Human Driver, and (3) initiates and executes a reasonable and effective Failure Mitigation Strategy to protect the occupants of the vehicle and other road users until the availability of the Human Driver is re-established. To be fully effective, the Driver Monitoring Feature should function under all vehicle operational environmental conditions (including, without limitation, lighting conditions and use of sunglasses). A Manufacturer determines the technical specifications of a Driver Monitoring Feature but, regardless of its proficiency, its proper functioning on a given occasion is required to transfer liability from a Computer Driver to a Human Driver in designated circumstances.

A law or regulation may require the inclusion of a Driver Monitoring Feature as a condition to testing, permitting, and licensing. The presence, absence or effectiveness of a Driver Monitoring Feature may be relevant to a determination of product liability or a design defect, but it is not a direct factor in determination of negligence liability for driving behavior.[31]

An "**Intervention Request Feature**" is a feature that (1) detects an imminent or current operational condition which the Computer Driver is not designed to handle or will be unable to handle without Undue Risk, (2) alerts the Human Driver of the need for the Human

[31] Lack of an effective driver monitor precludes a Manufacturer's use of the corresponding transfer of liability to the Human Driver. A driver monitor that fails to alarm does not initiate the transfer. A driver monitor that has too high a false alarm rate or is continuously activated as a liability-shedding strategy would likely be deemed ineffective due to humans have a well-known propensity to ignore nuisance alarms.

Driver to assume the task of Steering and potentially other vehicle control tasks, (3) issues as many warnings and alerts as are reasonably expected to be necessary to prompt the Human Driver to perform a timely Driver Intervention, which might include assuming sustained vehicle control including Steering.[32] To be fully effective, until the Human Driver performs a Driver Intervention and assumes active control of Steering, the Intervention Request Feature should initiate and execute a reasonable and effective Failure Mitigation Strategy. A Manufacturer determines the technical specifications of an Intervention Request Feature but, regardless of its proficiency, its proper functioning on a given occasion is required to transfer liability from a Computer Driver to a Human Driver in designated circumstances.

Comments:

In Supervisory Mode, a Driver Intervention may be required or permissive.

A law or regulation may require the inclusion of an Intervention Request Feature as a condition to testing, permitting, and licensing. The presence, absence or effectiveness of an Intervention Request Feature may be relevant to a determination of product liability or a design defect, but it is not a factor in determination of negligence liability for driving behavior. [33]

A "**Failure Mitigation Strategy**" means execution of vehicle behaviors and maneuvers by the Computer Driver reasonably expected to protect the occupants of the vehicle and other road users from Undue Risk posed by operation of the vehicle during any period in which the Human Driver is unavailable to perform or has not yet performed a requested Driver Intervention. For determination of negligence liability, a Manufacturer determines whether to include

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[32] Alerts and warning conspicuity will depend upon the level of attentiveness enforced by the driver monitoring feature. Consideration must be made of potential sensory impairments of otherwise qualified and licensed drivers.

[33] One purpose for including an Intervention Request Feature is to provide a mechanism to transfer control from the Computer Driver to a Human Driver upon exiting the AV's ODD as defined by SAE J3016. Another is to prompt a transfer of control in response to a Computer Driver equipment failure. While including an Intervention Request Feature is optional, omitting such a feature does not absolve the Manufacturer from liability if there is a Computer Driver limitation or failure that results in a hazard not readily apparent to the Human Driver. Rather, the Intervention Request Feature functions solely as a legitimate means, if activated, for the Computer Driver to transfer liability onto the Human Driver in an acceptable manner.

a Failure Mitigation Strategy, and if included, determine its specifications. A law or regulation may require the inclusion of a Failure Mitigation Strategy as a condition to testing, permitting, and licensing. The presence, absence or effectiveness of a Failure Mitigation Strategy feature may be relevant to a determination of product liability or a design defect. The continued operation a reasonable "best effort" Failure Mitigation Strategy is required to transfer liability to a Human Driver after 10 seconds have elapsed from the time of an intervention request or a driver monitoring alert.

A hazard is "**readily apparent**" if a typical Human Driver with the level of attentiveness enforced by the Driver Monitoring Feature would appreciate that the hazard would require a Driver Intervention, whether required or permissive.[34]

A Human Driver has "**reasonable time to detect and react**" if, considering perception, cognition, and reaction times of a competent Human Driver, there was enough time for that Human Driver to effectively assume control of the vehicle to avoid or mitigate the consequence stemming from the hazard to an acceptably low level. Hazards might be due to external causes (e.g., an overturned truck on a highway) or internal causes[35] (e.g., the Computer Driver swerves suddenly toward a tree or oncoming vehicle with no input command from the Human Driver, with no warning and insufficient time for even an attentive Human Driver to react).

The customary behavior of the Computer Driver is also relevant to determining whether and when a hazard is readily apparent. For example, a Computer Driver that habitually drives full speed up to a red traffic light and brakes forcefully at the last moment will quickly accustom the Human Driver to such behavior. It is unreasonable to expect that Human Driver to notice a Computer Driver lack of hazard mitigation until the normal point at time it would have

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[34] A Computer Driver might increase the conspicuity of a hazard via some combination of a making an intervention request, use of a heads-up display to highlight an area of concern in the driver's field of view, audio alerts, and so on at the discretion of the Manufacture. From a liability point of view the relevant question is whether it was reasonable to expect the Human Driver in that situation and with the enforced attention posture to appreciate the threat presented by the hazard, along with any alerts provided by the Computer Driver to enhance the conspicuity of the hazard, and the need to react.

[35] This feature of including internal causes is a key approach to avoiding complex and expensive product liability proceedings if a Computer Driver clearly behaved in a way that was both obviously dangerous and that left the Human Driver insufficient time to react to avoid a crash.

started any hazard mitigation behavior such as braking (plus a cognitive processing delay). In this example, routine last second braking behavior by the Computer Driver might mean it is already be too late for the Human Driver to avoid the vehicle entering an intersection through a red light – even with the quickest human reflexes – when responding to an unexpected failure of the Computer Driver to brake at the expected last-second time/distance from the red light.

The effectiveness of a Driver Monitoring Feature might indirectly affect negligence liability in that the determination of whether a Human Driver had enough time to react to a readily apparent hazard will be relative based on the state of enforced Human Driver attentiveness. A Driver Monitoring Feature that permits drivers to look away from the roadway for long intervals without an alert might be in keeping with the AV's operational concept, but carries with it the implication that hazards that can only be detected by watching the road might not be readily apparent to the Human Driver (instead requiring an Intervention Request from the Computer Driver), and an eyes-off-road set of circumstances will make a longer reaction time a reasonable expectation.[36]

Intentionally missing from the liability transfer criteria is a statement regarding departing the Operational Design Domain (ODD). The ODD is an engineering construct that is a model of the operational environments the Computer Driver is designed to handle properly. Whether the AV is inside or outside the ODD at any given time is a relevant concern for engineering, but is not a direct consideration for transfer of liability. The ODD can affect Computer Driver behaviors by informing decisions to issue an Intervention Request to the Human Driver associated with an ODD departure. Unenforced aspects of the ODD might result in a Human Driver permissive interventions when the conditions are clearly too dangerous for the Computer Driver to handle safely (e.g., the AV is about to drive into a flooded roadway, and it is reasonable to expect the Human Driver

[36] As an example, a Driver Monitoring Feature might not be defective if the AV designers purposefully designed it to permit the driver to watch a movie during vehicle operation, as might be the case with a vehicle advertised to have an SAE Level 3 feature. However, such an approach might set an extremely high bar for whether a road hazard is readily apparent without the Computer Driver issuing an explicit Intervention Request. It would also set an expectation of a longer permissible time to intervene due to the need to regain situational awareness, compared to a Driver Monitoring Feature that is purposefully designed with gaze tracking to ensure the driver continually scans the road for upcoming hazards.

to know this is unsafe for this particular vehicle, as well as notice that the roadway is flooded).[37]

Asking the Human Driver to memorize a set of ODD limitations and enforce them without support from the Computer Driver will in most cases involve placing an unreasonable burden on the Human Driver. For example, an AV owner manual might say that the Computer Driver should not be operated in heavy rain. But how should a Human Driver judge the heaviness of rain in a practical sense to know when a particular rain is "heavy?"[38] It is better to incentivize Manufacturers to build-in enforcement of ODD limitations that are more restrictive than a competent "reasonable man" Human Driver would find acceptable for vehicle operation.[39]

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[37] It is important to emphasize that the "clearly too dangerous" situation must be apparent to an ordinary "reasonable man" driver with no specialized skills or training beyond having an appropriate-class driver license. As a practical matter this is likely to restrict "clearly too dangerous" to situations which a human driver would appreciate presented undue risk in Conventional Mode if mitigating actions were not taken. However, if that Human Driver had been taught (e.g., via experience) that the Computer Driver could be expected to handle a situation, it is unreasonable to fault that Human Driver for permitting the Computer Driver to handle a similar situation once again without intervention.

[38] Instrumentation on the vehicle might well be able to estimate the number of raindrops per cubic meter of air volume. Typical Human Drivers will likely not have specialized skills sufficient to determine when a specific density of raindrops relevant to camera and lidar capabilities has been exceeded in non-extreme cases without prompting from the Computer Driver. Similar problems occur with other attempts to impose a responsibility for policing ODD limitations on Human Drivers. For example, exactly how degraded might lane markings be for a lane yet still be considered "well marked" enough for a Computer Driver to function safely? And which types and presentations of overturned or parked trucks, animal-powered vehicles, or locally customized signage on a roadway might be detectable vs. not detectable by a Computer Driver?

[39] It has become obvious that Human Drivers will misuse or abuse automation if the automation lets them do so. As an example, lane keeping assistance features that are supposed to be used only on expressways can be expected to be activated anywhere by drivers if the feature will let them do that, whether within the ODD or not, with an arguably reasonable Human Driver expectation that if they activate successfully, they must actually be within the Manufacturer's intended ODD. Therefore, the approach taken in this framework is that if any Supervisory or Autonomous mode feature permits itself to be activated, liability transfers to the Computer Driver, and arguing about whether such a feature was activated inside or outside the ODD simply does not enter into the discussion. Cases in which a situation is obviously hazardous to a Human Driver (such as entering a fire or flood) can still form the basis of liability transfer if the Human Driver has an alertness posture that would reasonably lead to the Human Driver having

### *D. Conventional Mode*

*1. Conventional Mode Defined*. "**Conventional Mode**" means operation of a vehicle in which the Human Driver both performs Steering and is responsible for other aspects of Driving. This includes, without limitation, operation of vehicles equipped with Driver Assistance Features that do not provide sustained control of Steering.

*2. Liability for Operation in Conventional Mode.* Liability attaches to the Human Driver when operating in Conventional Mode as under current law (except to the extent liability remains with the Computer Driver during a transition from other modes to Conventional Mode without Undue Risk). A Computer Driver may have liability for operation in Conventional Mode if the driving automation system assumes control of some or all of the dynamic driving task or interferes with manual driving in a manner that a reasonable Human Driver would not expect, and that unanticipated assumption of control of some or all of the dynamic driving task proximately causes an accident or collision.

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made an informed decision to enter an obviously dangerous situation (for example, to drive through a wildfire to escape their burning homestead, having activated a provided "emergency override" feature to permit vehicle operation in a situation in which the vehicle would not otherwise be operable). As a practical matter, this amounts to upgrading SAE J3016 Level 2 descriptions to make ODD enforcement required instead of optional.