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The Quasi-Autonomous Car as an Assistive Device for Blind Drivers: Overcoming Liability and Regulatory Barriers

Dana M. Mele, J.D.

I. Introduction

The concept of a self-driving car is no longer the stuff of science fiction. From as early as the 1960s, engineers have worked on designs for autonomous vehicles.[1] However, in 2004, two challenges were extended that catapulted the race into hyper-drive. The Department of Defense ("DoD") Defense Advanced Research Projects Agency ("DARPA") issued the first DARPA Challenge, asking engineers to compete to create an autonomous vehicle that would contribute to research and development of autonomous vehicles for military purposes.[2] In the same year, the National Federation for the Blind ("NFB") announced a challenge to create another type of vehicle using cutting edge intelligent technology—a car designed for blind drivers.[3]

Google recently raised public interest, legal dispute, and safety concerns by developing a fleet of autonomous vehicles and, perhaps unsurprisingly, several other manufacturers now have

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[1] John Markoff, *Google Cars Drive Themselves, in Traffic*, N.Y. TIMES, Oct. 9, 2010, *available at* http://www.nytimes.com/2010/10/10/science/10google.html?pagewanted=all.

[2] DARPA, *Grand Challenge '05*, *available at* http://archive.darpa.mil/grandchallenge05/overview.html (last visited Apr. 9, 2013).

[3] *About the Blind Driver Challenge*, NATIONAL FEDERATION OF THE BLIND, http://www.blinddriverchallenge.org/about-the-blind-driver-challenge (last visited Apr. 9, 2013).

driverless car prototypes in the works.[4] The vision of a former DARPA challenge runner-up, the Google car uses artificial intelligence to mimic decisions human drivers make.[5] Google argues that eliminating human decision from the equation will make roads safer.[6] After all, human error accounts for most of the 33,000 deaths and 1.2 million injuries on roads throughout the nation each year.[7] Google's autonomous vehicle program has already achieved 200,000 miles of computer-controlled driving without a single accident, and the company is already lobbying for state laws to permit driverless vans and taxis, hoping to achieve that reality by 2013 or 2014.[8] The major obstacle to achieving this goal is untangling major issues pertaining to liability.[9]

The NFB challenge raises questions of its own. In February 2011, Mark Riccobono, a blind executive of the NFB, drove a customized Ford Escape around a track filled with obstacles and another vehicle at Daytona International Speedway.[10] Dr. Dennis Hong, head of the team of engineers who designed and created the customized vehicle, estimates that with the technology,

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4 Sarah Jacobsson Purewal, *Nevada Approves Self-Driving Cars after Google Lobbying Push*, PCWORLD, Feb. 17, 2012, *available at* http://www.pcworld.com/article/250179/nevada_approves_selfdriving_cars_after_google_lobbying_push.html.

5 Markoff, *supra* note 1.

6 *Id.*

7 John Markoff, *Collision in the Making Between Self-Driving Cars and How the World Works*, N.Y. TIMES, Jan. 23, 2012, *available at* http://www.nytimes.com/2012/01/24/technology/googles-autonomous-vehicles-draw-skepticism-at-legal-symposium.html (Google's vehicle has been involved in one accident but attributed the accident to human error, claiming that the accident occurred while the vehicle was in manual mode).

8 *Id.*

9 *Id.*

10 Keith Barry, *High-Tech Car Allows the Blind to Drive*, WIRED.COM, Feb. 15, 2011, *available at* http://www.wired.com/autopia/2011/02/high-tech-car-allows-the-blind-to-drive/

blind drivers could be capable of travel on public roadways within five to ten years.[11] The car, designed for blind drivers, presents potential benefits for both blind and sighted individuals. It will contribute to goals of independence and autonomy for individuals with disabilities and provide valuable innovative technologies to increase safety for all drivers. Yet as with the Google fleet, technology is not the problem. The hindrance lies in questions of liability.

Despite potential benefits to blind and visually impaired as well as sighted individuals, however, barriers such as the potential liability to manufacturers and lack of a regulatory scheme may prevent this car from ever reaching the market. The vehicle is a new and likely a highly dangerous product with a substantial risk for manufacturer liability, and the lack of uncertainty regarding liability and marketing the vehicle without regulations in place will likely prove a large deterrence for manufacturers contemplating design and production. The potential for unpredictable and severe liability and an uncertain market due to lack of regulations for a product of this type may prove a fatal deterrence to manufacturers if no steps are taken to mitigate these barriers to production.

As with the fully autonomous car, determining liability for the "quasi-autonomous"[12] technology used in the car designed for blind drivers is difficult since its operation rests on the premise that the vehicle will deliver accurate information to the driver, and that the driver will use this information to make independent decisions. Because of the delicacy of this relationship, the line separating human error from robot error becomes razor thin, and determining liability is even more difficult than in the autonomous vehicle scenario. This note will discuss the issues of

[11] Barry, *supra* note 10.

[12] Although it is sometimes argued that all so-called autonomous vehicles are technically quasi- or semi-autonomous in a literal sense, I use the term "quasi-autonomous" throughout this note to distinguish vehicles that are operated by humans through interface technology rather than by computer decision-making technology.

liability and lack of regulation implicated by the quasi-autonomous car designed for blind drivers, why it is important that the liability and lack of regulation barriers be overcome, and how this might be accomplished.

Part Two of this note will briefly examine the evolution of the car designed for blind drivers and the technology it employs. Part Three will discuss the barriers to introducing this car to the marketplace, focusing on the problems presented by various liability theories and the challenges posed by manufacturing a vehicle without a dedicated regulatory scheme in place. Part Four will propose solutions to the problems discussed in Part Three, specifically, placing a limitation on applicable tort theories and creating a regulatory scheme for vehicles designed for blind drivers. The note will conclude with a proposed set of considerations for regulating licensure, ownership, and operation of these quasi-autonomous vehicles.

II. Inception of the Blind Driver Challenge and the Evolving Quasi-Autonomous Vehicle

The car designed specifically for blind drivers has long been in the works. The technology required to realize the original conception, once begun, has evolved rapidly. Unfortunately, the introduction of this car onto the public roadways may be a much longer journey. This section will proceed by briefly introducing the history and objectives of the NFB Blind Driver Challenge. It will then examine the evolution of the technology used in the development of the vehicle and designed in response to the challenge, which will be used for the purposes of this note as a prototype for cars designed for blind drivers using similar interface technologies. The section will conclude with a brief look at future uses of the technologies utilized in the vehicle.

A. Development of a Car for Blind Drivers

The concept of a car that can be driven by blind drivers is hardly novel. Dr. Mark Maurer, president of the NFB, had spoken publicly about the possibility of developing such a vehicle for years prior to the inception of the Blind Driver Challenge.[13] On January 30, 2004, however, the NFB Jernigan Institute, the first research center created and run by blind individuals, was opened, and the Blind Driver Challenge ("BDC") was extended.[14] The BDC offered a challenge to universities and developers of innovative technology to formulate and build an interface technology that would allow blind people to drive a car.[15] The essence of the challenge is to develop technology that is not fully autonomous, giving a blind individual the role of a passenger while the car drives itself, but instead a non-visual interface that permits a blind individual to assume the role of driver using essentially assistive technology to inform the driver about driving conditions.[16]

The reason the NFB emphasizes non-visual interface technology instead of pure autonomous technology is reflected in the stated purposes of the BDC. The first objective is to advance non-visual access technology and to close the gap between access technology and technology in general.[17] Solely autonomous vehicles relegate blind individuals to the role of a passenger. This fails to advance technology that will enhance non-visual access and further widens the gap between the technology used to drive for sighted and blind drivers. If technology

[13] *About the Blind Driver Challenge*, *supra* note 3.

[14] *Id.*

[15] *Id.*

[16] *Id.*

[17] National Federation of the Blind, NFB Blind Driver Challenge, https://nfb.org/nfb-blind-driver-challenge (last visited Apr. 9, 2013).

for blind drivers is limited to fully autonomous vehicles, it will perpetuate an active/passive distinction between sighted and blind drivers.

The second objective is to increase awareness in the scientific community about barriers facing blind individuals.[18] The challenge itself serves this objective, but purely autonomous vehicle technology runs the risk of minimizing the barriers blind individuals face because fully autonomous technology simply does not address these barriers. While a purely autonomous vehicle mimics human decision-making functions,[19] interface technology highlights the numerous pieces of typically visually presented information that drivers must gather in order to make driving decisions. The interface technology reinforces the existence of these barriers for blind individuals, while fully autonomous vehicles gloss over the barriers by gathering the data, processing it, and eliminating the human element.

The third objective is to solve problems facing blind and sighted individuals and create new opportunities and paths to success through the use of non-visual technology.[20] This goal encourages non-visual technologies that will benefit both blind and sighted individuals and will help to move innovation toward design that is universally accessible for people with and without visual impairments. Fully autonomous vehicles arguably meet the objective of contributing a universally accessible design, but again, the universal application is limited to providing a new passive role for both blind and sighted individuals, whereas the rest of the objectives favor an active role for blind individuals.

The fourth and final objective of the BDC is to alter public perception of blind individuals by demonstrating the ability to drive using assistive technology, and to show blind

[18] National Federation of the Blind, *supra* note 17.

[19] Markoff, *supra* note 1.

[20] National Federation of the Blind, *supra* note 17.

individuals as people with ambition for greater independence.[21] Here, fully autonomous vehicles would fail most markedly. Assigning blind individuals a passive role severely undermines the goal of demonstrating the ability to drive with assistive technology. In addition, while fully autonomous vehicles will increase independence in some measure by allowing greater transportation freedom, it will not empower the individuals to interact with the technology and participate in the process. The individual will still be a passenger and not a driver.

The history of the BDC shows remarkable progress in the pursuit of these goals. As mentioned above, the idea of a car for blind drivers was formulated far before the BDC was initiated. The NFB first began raising money for the Jernigan institute in 1999, at which time Dr. Maurer announced that one of the Institute's projects would be the development of such a vehicle.[22] At the groundbreaking of the Institute in 2001, Dr. Maurer stated that researchers who create products to increase access for blind individuals to information, to transportation, and to the business community would form an important component of the Institute's mission.[23] At the grand opening of the Institute in 2004, the NFB showcased a mock-up of a vehicle for blind drivers and announced the challenge for the first time.[24] In 2005, the NFB invited all American

[21] National Federation of the Blind, *supra* note 17.

[22] Mark A. Riccobono, *Driving Independence and Innovation through Imagination: The NFB Blind Driver Challenge*, BRAILLE MONITOR, Dec. 2009, *available at* http://www.nfb.org/images/nfb/Publications/bm/bm09/bm0911/bm091103.htm (last visited Apr. 9, 2013).

[23] *Id.*

[24] *Id.*

universities to take up the challenge, and in 2006, Virginia Tech was the only school, or invitee, to accept.[25]

Virginia Tech's Dr. Dennis Hong and his group of undergraduate students at Robotics and Mechanisms Laboratory ("RoMeLa") designed their first vehicle in the 2008-2009 school year.[26] In May 2009, Wes Majerus and Mark Riccobono, of the Jernigan Institute, were the first completely blind from birth people to drive the original model through an obstacle course of traffic cones.[27] In the summer of 2009, Virginia Tech's BDC team participated in the NFB Youth Slam, in which blind students tested the team's first model.[28]

The goal of the current BDC challenge as of 2011 is to not only put a vehicle on the road, but to have blind individuals drive it from the NFB Jernigan Institute to the NFB National Convention.[29] To meet these objectives, the technology, first formulated in 2008, has had to make enormous progress in little time.

B. The Technology of the RoMeLa Car

As the goals of the BDC have progressed, the technology employed to meet those goals has likewise advanced. The Virginia Tech team chose to meet the BDC challenge by starting

[25] *Blind Driver Challenge History*, VIRGINIA TECH ROBOTICS MECHANISMS LABORATORIES (NOV. 10, 2010), available *at* http://www.romela.org/blinddriver/BDC_History (Apr. 9, 2013) [hereinafter *Blind Driver Challenge History*].

[26] *Id.*

[27] *Id.*

[28] Riccobono, *supra* note 22.

[29] *Id.*

with an existing platform, and developing non-visual driver interfaces to allow blind individuals to drive the integrated vehicle.[30]

Virginia Tech's original 2008-2009 design team chose a stock dune buggy as the platform for the first attempt.[31] The team aspired to create a vehicle that would maximize both independence and safety by allowing a blind driver to navigate and drive through a traffic cone course.[32] This original design relied on a Hokuyo single plane laser range finder sensor ("LRF") to gather information about obstacles surrounding the vehicle.[33] The team then created a "click wheel" to convey the information to the driver by delivering audio cues in the form of "clicks" for each measured "turning unit."[34] The driver would respond to the cues by turning the wheel accordingly and altering the direction of the vehicle.[35] Finally, the team designed a vest to deliver tactile information about speed to let the driver know when to decelerate the vehicle or to initiate an emergency stop.[36] Vibrating motors inside the vest line both sides of the driver's chest and are programmed to vibrate on the right side if the speed limit set by the program is exceeded by the driver, and to vibrate on both sides if an emergency stop is required.[37] The test

[30] *Blind Driver Challenge History*, *supra* note 25.

[31] *Id.*

[32] *Id.*

[33] *Id.*

[34] *Blind Driver Challenge History*, *supra* note 25.

[35] *Id.*

[36] *Id.*

[37] *Id.*

drives of this original vehicle were successful. However, the vehicle itself vibrated excessively, a feature the team chose to work on in its next design.[38]

The Senior Design Team at Virginia Tech's RoMeLa labs found that the vibrations in the 2008-2009 design interfered with the operation of the interface technology, so they chose a new platform, a golf cart, as the basis for the 2009-2010 vehicle.[39] This new platform was chosen primarily in order to solve the problem of the interference caused by vibrations, and because of the additional advantage of a quiet engine.[40] The 2009-2010 team also decided to replace the click wheel system with a new tactile information system, "DriveGrip."[41] DriveGrip uses vibrations on the hands to deliver turning information, such as when to turn, where to turn, and how far to turn.[42] The team also chose to redesign the tactile vest in order to make it adaptable to more platforms, and the end product was a tactile shoe.[43] In addition to information about deceleration and emergency stopping, the tactile shoe delivers information about accelerating and braking through vibration along the top and bottom of the shoe.[44]

The 2010-2011 design team again broadened its vision by selecting a TORC ByWire XGV as its platform.[45] The ByWire XGV, discussed below, is a modified drive-by-wire Ford

[38] *Blind Driver Challenge History*, *supra* note 25.

[39] *Id.*

[40] *Id.*

[41] *Id.*

[42] *Blind Driver Challenge History*, *supra* note 25.

[43] *Id.*

[44] *Id.*

[45] *Id.*

Escape Hybrid developed to test unmanned vehicle technologies.[46] In addition to using an actual car for its platform, the 2010-2011 senior design team worked to improve the DriveGrip technology and to develop SpeedStrip, an innovative interface that communicates to the driver when to accelerate, decelerate, and stop.[47] SpeedStrip delivers the information to the driver by means of vibrations in the back and the bottom of the driver seat.[48] The driver then decides the amount of pressure to apply to the brakes based upon the strength of the SpeedStrip vibrations.[49] Installed on a TORC ByWire XGV, the 2010-2011 goal of this design was to empower the driver with more independence to make decisions and to enhance maneuverability, allowing the car to take part in the Rolex 24 GRAND-AM road race at Daytona International Speedway.[50]

In June of 2010, Virginia Tech's RoMeLa joined forces with TORC, a developer and manufacturer of modular unmanned vehicle technologies, to create the 2010-2011 BDC design.[51] RoMeLa's Dr. Hong announced that the design team chose TORC's ByWire XGV because of its performance, compatibility with RoMeLa's design system, and record of reliability in order to prioritize safety.[52]

TORC's ByWire XGV is a modified Ford Escape Hybrid with drive-by-wire conversion modules, which is a "thoroughly tested" basic platform onto which innovative technologies can

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[46] *Blind Driver Challenge History*, *supra* note 25.

[47] *Id.*

[48] *Id.*

[49] *Id.*

[50] *Blind Driver Challenge History*, *supra* note 25.

[51] TORC Robotics, *NFB Blind Driver Challenge Team Chooses TORC's ByWire XGV as Base Research Platform*, Press Release, Oct. 13, 2010, *available at* http://www.torctech.com/media/press-release/nfb-blind-driver-challenge-team-chooses-torcs-bywire-xgv-base-research-platform/ [hereinafter TORC Robotics Press Release].

[52] *Id.*

be integrated.[53] The Drive-by-Wire Ground Vehicle Platform, from TORC's Robotic Building Blocks line of products, is a robotic system controlled by a computer.[54] This system allows all functions required to drive the vehicle safely, including the throttle, brakes, steering, engine, fuel levels, lights, signals, horn, and wheel speeds.[55]

The XGV modified Ford Escape Hybrid also features a PowerHub power distribution module.[56] The TORC PowerHub is designed to distribute power throughout unmanned systems by computer control, and may be controlled remotely.[57] Finally, the XGV is equipped with TORC's SafeStop wireless emergency stop system.[58] The SafeStop system was developed to allow unmanned vehicles to be paused or stopped by remote control by disabling the operation of the vehicle completely.[59]

As its next step, the RoMeLa team has chosen to prioritize developing technology to maximize driver safety.[60] In order to achieve this goal, the team will focus on the three primary

[53] TORC Robotics Press Release, *supra* note 51.

[54] TORC, Robotic Building Blocks, http://www.torcrobotics.com/robotic-building-blocks (last visited Apr. 9, 2013).

[55] *Id.*

[56] TORC Robotics Press Release, *supra* note 51.

[57] TORC, PowerHub Power Distribution Module for Robotic Systems, http://www.torcrobotics.com/products/powerhub-power-distribution-module-robotic-systems (last visited Apr. 9, 2013).

[58] TORC Robotics Press Release, *supra* note 51.

[59] TORC, SafeStop Wireless Emergency Stop System for Unmanned Vehicles, http://www.torcrobotics.com/products/safestop-wireless-emergency-stop-system-unmanned-vehicles (last visited Apr. 9, 2013).

[60] Virginia Tech Robotics Mechanisms Laboratories, Blind Driver Challenge Future, http://www.romela.org/blinddriver/BDC_Future (last visited Apr. 9, 2013).

hardware components of the system.[61] These components are the sensors, the audio and steering angle interfaces, and the tactile vest.[62] The team also plans to work on the software system in order to improve the way collected data is processed so that it can be more easily synthesized and delivered via the interface system.[63] In addition to fine-tuning the current DriveGrip and SpeedStrip technologies to deliver information about speed adjustments and timing and degree of turns, the team will work on a new technology, AirPix.[64] AirPix will use a system of compressed air pushed through small holes in patterns, similar to an air hockey table.[65] AirPix will create a "tactile image" that a driver can access by holding his or her hand over and feeling the pattern as if a picture of the environment were projected against it.[66] Perhaps the greatest improvement of this system is that it maximizes the potential for blind drivers to make independent decisions based on their own judgment using the information about the environment provided by the technology.

The current state of the car uses all of these technologies to allow the most independence on the part of the driver. On Jan. 29, 2011, Mark Riccobono drove the XGV model around the inner track of the Daytona International Speedway at 25 miles per hour, navigating around obstacles and another vehicle.[67] According to Jesse Hurdus, a TORC software engineer, the vehicle used at that time "replicated the eyes of a human and the parts of the human brain and

[61] Virginia Tech Robotics Mechanisms Laboratories, Blind Driver Challenge Future, http://www.romela.org/blinddriver/BDC_Future (last visited Apr. 9, 2013).

[62] *Id.*

[63] *Id.*

[64] Barry, *supra* note 10.

[65] *Id.*

[66] *Id.*

[67] *Id.*

nervous system" used for driving with hardware, software, and sensors.[68] In addition to the equipment described above, the car used a GPS system, cameras and laser scanners, and an "Inertial Measurement Unit" to replicate the functions of the inner ear.[69] The team plans on making future improvements, however.

The goal for the future of RoMeLa's BDC is to meet the initiative's ultimate challenge: to develop and build a workable vehicle that a blind person can drive independently.[70] Dr. Hong predicts that blind drivers could potentially travel on public roadways within the next five to ten years.[71] However, in keeping with the challenge's goal of increasing independence for blind people and using non-visual interface technology for both blind and sighted people, future uses of the technology developed for the BDC encompass wide-ranging possibilities outside of assisting blind people to drive independently.

C. Future Uses

Scientists predict that the technologies may be used to enhance the use of appliances, offices, and schools.[72] For example, the AirPix technology currently being developed by RoMeLa and other non-visual interfaces developed by the lab for the BDC may be developed for

[68] Barry, *supra* note 10.

[69] *Id.*

[70] Work Continues to Advance, Adapt Blind Driver Technology, http://www.vt.edu/spotlight/impact/2011-02-28-bdc/daytona-side.html (last visited Apr. 9, 2013).

[71] Barry, *supra* note 10.

[72] *Id.*

classroom use, so that when a teacher writes on a blackboard, blind students will be able to access the information through the interfaces and read what the teacher writes.[73]

Sighted individuals will also benefit from the technology. The interface technology can enhance a sighted person's ability to drive in heavy fog, for example, or in the dark, where vision is impaired by environmental factors.[74] The laser-range finder technology used to create a warning alarm system for dangerous conditions will benefit sighted as well as blind drivers.[75] In addition, existing technology to prevent lane departure and active cruise control can potentially be enhanced by these new innovative interface technologies.[76] Although these benefits are wide reaching and universally applicable, however, the threat of liability may prevent them from reaching the public.

III. Barriers to Production: Liability and Lack of Regulation

A car developed for blind drivers faces serious barriers, despite the rapidly developing technology and the vast potential benefits and uses. The potential liability of the manufacturer of the prospective car that may be developed and marketed for blind drivers is a key factor, since questions of liability may influence the zeal with which this goal is pursued, and a high risk of liability may have a chilling effect on innovation.[77] M. Ryan Calo, a fellow at the Stanford Law School's Center for Internet and Society and Co-Chair of the Artificial Intelligence and Robotics

[73] Barry, *supra* note 10.

[74] *Id.*

[75] Work Continues to Advance, Adapt Blind Driver Technology, *supra* note 70.

[76] Barry, *supra* note 10.

[77] *See* Richard Acello, *Robot Rules Lawyers Ponder Liability for Actions by "Thinking" Machines*, ABA J., May 2010, at 29.

Committee of the ABA, cautions that the uncertainty about liability in the field of robotics could discourage innovation and cause the United States to fall behind other countries in a vital area of technological development.[78] Lack of provisions in vehicle regulatory schemes to provide for blind drivers and cars developed for blind drivers with built-in assistive technologies are also a major barrier to allowing the car a pathway to the marketplace, since the manufacturers have no incentive to make the car if regulations prohibit its use. The sections below will discuss the problems posed to manufacturers by negligence and strict products liability theories and by a lack of applicable regulatory provisions.

A. Barriers Posed by Potential Liability Theories

First, it is difficult to determine liability in computer and robotic products. Since this car encompasses both, this signals a potential problem for manufacturers. Courts are generally unwilling to impose liability for injury caused by computer unless the injury is physical and is caused by computers or software, usually where a medical or navigational malfunction results in physical injury.[79] This is a potentially foreseeable problem for a car equipped with hardware and software to facilitate navigation by supplying a blind driver with navigational and environmental data.

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[78] M. Ryan Calo, *Open Robotics*, 70 MD. L. REV. 571, 576 (2011).

[79] *Id.*

B. Problems Posed by Applying a Negligence Theory

Various experts have suggested applying negligence theories in cases involving computer software and hardware.[80] This could have both positive and negative consequences from a public policy standpoint. On one hand, developers of software and computer systems, if exposed to greater liability, will have a greater incentive to create safer products, and are in the best position to prevent harmful security breaches in the first place.[81] On the other hand, as discussed in this note, too much exposure to liability will deter manufacturers from placing the product on the market in the first place.

In order to succeed in a negligence claim, an injured plaintiff must prove that the defendant owed her a duty of care, that the defendant breached the duty of care, that such breach was the proximate and factual cause of the plaintiff's injury, and that the plaintiff suffered a compensable injury resulting from the breach of duty.[82] Applied to an accident resulting from a scenario in which a blind driver makes a decision based upon faulty information due to a software error, and causing physical injury, the following problems may arise.

First, the plaintiff driver bringing a claim against the manufacturer of the car must establish that the manufacturer owed her a duty of care.[83] Regarding the software, the manufacturer may owe a duty to design and develop secure software that is not defective, and a

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[80] Michael D. Scott, *Tort Liability for Vendors of Insecure Software: Has the Time Finally Come?*, 67 MD. L. REV. 425, 441 (2008).

[81] *Id.* at 442.

[82] *Id.*

[83] *See* RESTATEMENT (THIRD) OF TORTS: PHYS. & EMOT. HARM § 6 (2010) (Comment B discussing the elements of liability for physical harm caused by negligence). [Hereinafter Elements of Negligence].

duty to inform the driver of hidden dangers, as well as how to use the car safely.[84] The duty of software manufacturers would likely include an assessment of the foreseeability of harm caused by a malfunction.[85] In this case, the foreseeability of a malfunction of the software may be considered high because the technology is new and untested. The degree of certainty between the vulnerability of the software and harm is also an important consideration.[86] Again, the degree is likely high, because the purpose of the product is for drivers who would not otherwise be able to drive safely to rely on the software and other technological features of the car to make informed decisions in order to perform the task of driving safely. Without secure software, the product is inherently and highly dangerous to the user and to others. Because the driver relies on the information these technologies provide, the degree of danger inherent in the product is not analogous to the danger of a blind driver using a car with typical features, and the duty owed is higher than that of a manufacturer of a car that does not offer these features and market itself as a car for blind drivers. It is a specialized vehicle that would be inherently dangerous regardless of degree of impairment or lack thereof because the purpose of the product is to rely on the software and robotic features. Therefore, the duty of care should be very high, creating one substantial obstacle for manufacturers.

As far as breach of duty,[87] experts in the field of computer liability urge that vendors of software should be found negligent if they market products when there is a high foreseeability of

[84] Scott, *supra* note 80, at 443.

[85] *Id.* (positing that the determination of duty is largely policy-based and will require courts to consider the foreseeability of malfunction or security breach in the case of software liability, *quoting* Michael L. Rustad, *The Negligent Enablement of Trade Secret Misappropriation*, 22 SANTA CLARA COMPUTER & HIGH TECH. L.J. 455, 519-20 (2006) for the latter proposition).

[86] *Id.*

[87] *See* Elements of Negligence, *supra* note 83.

harm and "readily available means 'to eliminate or reduce the risk of harm.'"[88] By this standard, there may be a high foreseeability of harm because of the arguably inherently dangerous nature of the product. This creates a second potential problem for the manufacturer, but only if the plaintiff can prove that there are readily available means to eliminate or reduce the risk of harm.

As for factual cause,[89] it will be difficult to prove that "but for" the defect, the injury would not have occurred since the car is designed to maximize the driver's independence and decision-making ability through interface technology, unlike the self-driving cars being developed by Google and designed by other manufacturers. However, the plaintiff may also show that the alleged negligence was a substantial factor in causing the injury,[90] and the plaintiff injured by either a design or warning defect in a ByWire XGV type car for blind drivers may have little trouble demonstrating that this defect was a substantial factor in causing the injury.

In order for the plaintiff to prove proximate cause,[91] she will have to prove that the injury was a foreseeable result of the negligence.[92] In a case often cited in software liability discussions, the U.S. Court of Appeals for the Second Circuit held that where a manufacturer of navigational charts supplied faulty information in its charts leading to a fatal plane crash, the provision of the incorrect data was the proximate cause of the injury and the defendant manufacturer was liable.[93]

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[88] Scott, *supra* note 80, at 443.

[89] *See* Elements of Negligence, *supra* note 83.

[90] Scott, *supra* note 80, at 443.

[91] *See* Elements of Negligence, *supra* note 83.

[92] Scott, *supra* note 80, at 443.

[93] Saloomey v. Jeppesen & Co., 707 F.2d 671, 677 (2d Cir. 1983) (holding that even though the court below found that the pilot and air traffic controller were also negligent, the manufacturer's negligence in the manufacturing and inspection of the navigational charts was the proximate cause of the injury); *See also* Brocklesby v. United States, 767 F.2d 1288, 1297 (9th Cir. 1985) (upholding a jury verdict on the

Professor Michael Scott, author of seven legal treatises on information technology law, distinguishes *Saloomey v. Jeppesen & Co.*, from software security cases because it involves an easily identifiable negligent act, whereas security breaches in software are difficult to identify.[94] However, in the case of a driver relying on interface technologies, as in *Saloomey*, the primary negligent act is providing faulty information, upon which the use must rely in order to safely and properly operate the vehicle. If courts analyze the hypothetical presented as analogous to *Saloomey* as is often suggested for software liability cases resulting in physical injury, there is a high likelihood that the plaintiff can prove proximate cause.

Taken together, there is a chance that on a negligence theory, a plaintiff will be able to prevail against a manufacturer of a car designed for blind drivers, creating a barrier for production and marketing. However, further and likely more serious barriers exist under strict products liability theories.

C. Problems Posed by Applying a Strict Products Liability Theory

If a negligence theory poses risks to the manufacturer, a strict liability theory presents a potentially larger threat. Under a design defect, warning defect, or manufacturing defect, public policies would be served but the risks to the manufacturer would be so high that the possibility of barring the product from reaching the marketplace is a crucial consideration.

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grounds that Jeppesen, the same manufacturer, was negligent for failing to warn consumers of latent defects in a navigational chart resulting in an airplane crash that killed 6 crew members).

[94] Scott, *supra* note 80, at 449.

For example, there is a design defect where a foreseeable risk of harm could have been avoided or reduced by the use of a reasonable alternative design ("RAD").[95] In the case of the vehicle designed for blind drivers, there is currently and will likely at first be no RAD. But a RAD could easily and at any time be developed, placing the manufacturer in a vulnerable position when the product is at the point of inception and rapid innovation is crucial in order to ensure both that the product becomes available and that technology continues to evolve to create a safer and more efficient product.

Under a manufacturing defect analysis, manufacturers may be liable even if their safety standards are reasonable. A product has a manufacturing defect when it "departs from its intended design even though all possible care was exercised in the preparation and marketing of the product."[96] This presents a particularly serious danger to manufacturers of new products that have the potential to cause serious physical injury. In this case, a car that requires the manufacturing of novel and previously untried hardware and software that must operate flawlessly in order to avoid a very high risk of serious physical injury is a dangerous gamble.

Finally, under a warning defect claim, a manufacturer may be held strictly liable if a product is defective due to inadequate warnings or instructions and foreseeable risks of harm could have been reduced or avoided by reasonable alternative instructions or warnings.[97] Again, although like a design defect, this theory allows for a consideration of reasonableness, because the product is new. The strict liability theory creates high stakes for the manufacturer, and a

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[95] RESTATEMENT (THIRD) OF TORTS: PROD. LIAB. § 2 (1998).

[96] *Id.*

[97] *Id.*

"reasonable alternative" creates more danger than it avoids because the competition is largely unknown and will likely spring up suddenly and develop rapidly.

D. Breach of Warranty under Article 2 of the Uniform Commercial Code

One final possible theory of liability is breach of warranty under Article 2 of the Uniform Commercial Code ("U.C.C.").[98] Software dedicated to a particular use and bundled with a tangible product generally falls under Article 2 of the U.C.C. and allows vendors to shield themselves from liability by using warranty disclaimers and by limiting liability and remedies.[99] This description may apply to the ByWire XGV since it depends on software. Both express and implied warranties can be disclaimed by contract and are usually presumed to be valid. However, warranty disclaimers are construed strictly in the favor of the purchaser.[100] Nonetheless, no court to date has held a software vendor in violation of an express warranty, and courts have usually upheld implied disclaimers of warranty only if the warranty is not unconscionable and if there is privity of contract between the parties.[101] In addition, courts have split on the question of whether each party in a chain of distribution must disclaim warranty in order for the disclaimer to be effective.[102] In the case of a car, which often has several steps in the chain of distribution, this leaves much leeway. Nonetheless, under Article 2, whether through warranty disclaimers,

[98] *See* U.C.C. § 2-312(1)(a) (implied warranty of title); § 2-313(1)(a) (express warranties); § 2-314 (implied warranty of merchantability); § 2-315 (implied warranty of fitness for a particular purpose).

[99] Scott, *supra* note 80, at 435-37.

[100] *Id.* at 437.

[101] *Id.* at 439.

[102] *Id.* at 438-39.

limited liabilities, or limited remedies, manufacturers are shielded from liability and therefore given a greater opportunity for innovation without fear of legal responsibility. However, because of the dangerous nature of the car, the software package and the manufacturer may be exposed to more liability.

E. Barriers Posed by Lack of Regulation

A second difficulty in the movement toward placing the car designed for blind drivers on the market is a lack of regulation. In general there is little regulation in the field of autonomous technology, so it is minimally helpful to look to this area as far as formulating regulations. Professor Susan Brenner argues that pervasive technologies – technologies intended to be used by all, and not merely by specialists that have a pervasive effect – presents difficulties for the law, although consumer technologies, which she calls modestly pervasive, have traditionally allowed for a set of rules based on a non-pervasive system.[103] However, Professor Brenner posits that this is based on the fact that most consumer technologies have limited potential for misuse.[104] Professor Brenner categorizes both automobiles and computers as pervasive and consumer technologies.[105] According to Professor Brenner, the problem with these rules is that they are based on problems of defective implementation, which relies on expert use, and not proper implementation; however, she points out that in the case of automobiles, society has successfully created rules to regulate "civilian" use.[106] The integration of automobile use - predicated already

[103] Susan W. Brenner, *Law in an Era of Pervasive Technology*, 15 WIDENER L.J. 667, 671-72 (2006).

[104] *Id*. at 671.

[105] *Id.* at 708-10; 733-34.

[106] *Id.* at 763.

on human control of a product that must not be defective - with software, which is loosely regulated, is the dilemma for those contemplating regulatory schemes for a car designed for blind drivers.

The operation of motor vehicles is regulated. Since 1908, states have required drivers to pass mandatory tests and possess various eligibility qualifications in order to earn a license to drive.[107] So-called new technology, including software, however, is very lightly regulated. For example, government agencies have not yet implemented regulations to control the use of products containing nanotechnology.[108] In the context of software manufacturer liability, there are no established regulations that govern "the performance of software programmers and developers."[109] M. Ryan Calo writes that technology policy is currently shaped by concerns about the optimal conditions for innovation and competition.[110] He writes further, however, that in the context of robots, government regulation could make products safer.[111] This suggests strongly that the stringency of the regulation and the freedom to innovate, or such perceived freedom, are in tension.

IV. Overcoming the Barriers to Production

In spite of the obstacles facing policymakers and lawmakers in devising schemes to regulate and create liability frameworks for vehicles with autonomous vehicles designed and

[107] Brenner, *supra* note 103, at 712.

[108] Shalyn Morrison, *The Unmanned Voyage: An Examination of Nanorobotic Liability*, 18 ALB. L.J. SCI. & TECH. 229, 245 (2008).

[109] Scott, *supra* note 80, at 472.

[110] Calo, *supra* note 78, at 578.

[111] *Id.* at 604.

marketed for blind drivers, there are some solutions. One of the biggest concerns in both imposing liability and regulation has been the danger of the chilling effect potential liability may have on valuable innovations. Despite these concerns, the car and the technologies it employs present great benefits to blind and sighted individuals, to the disability community, and to the general public. They contribute important innovations that can be utilized in a variety of products to enhance safety, efficiency, and convenience in numerous contexts. On balance, the benefits of striving to place a car for the blind on the market outweigh the difficulties that must be overcome in order to do some. This section will detail some of the benefits and uses of the car and other applications of the technology it uses, propose a solution to the liability concerns that create a barrier for manufacturers, and discuss possible regulatory regimes for quasi-autonomous cars designed for and driven by blind drivers.

A. Benefits of Overcoming the Barriers

Having a quasi-autonomous car for blind drivers on the market will benefit blind and sighted individuals. The original objectives of the Blind Driver Challenge were to “close the gap” between access technology and general technology, to increase awareness in the scientific community about barriers facing blind individuals, to solve problems facing blind and sighted individuals and encourage technology that is universally accessible to all, and to alter the public perception of the blind by demonstrating the ability to drive using assistive technology.[112] These objectives, and the car RoMeLa labs has created and continues to perfect, are consistent with objectives of federal disability law, which advance independence and accessibility of individuals with disabilities as a paramount national concern. I argue that access to driving, as a means of

[112] Riccobono, *supra* note 22.

independent travel, is among those concerns, and that current disability law supports this contention.

Although the Americans with Disabilities Act of 1990 and the ADA Amendments Act of 2008 (together "ADA") do not allow a general right to accessible roads or highways, or a right to travel on state controlled highways, the findings and purpose of the ADA are consistent with promoting independence and assistive technology as a means to achieve that end.[113] The Department of Transportation ("DOT") contains some general provisions that may provide some guidance for lawmakers wishing to craft regulations or further define travel accessibility under the ADA.[114] The regulations also include a general non-discrimination clause, which provides that "[n]o entity shall discriminate against an individual with a disability in connection with the provision of transportation service."[115]

The Rehabilitation Act of 1973 also supports the development of a car for blind drivers in its general purpose. Section 504 contains a general non-discrimination provision which states that "[n]o otherwise qualified individual with a disability in the United States, as defined in section 705(20) of this title, shall, solely by reason of her or his disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance or under any program or activity conducted by any Executive agency or by the United States Postal Service."[116] While the ADA covers state programs, such as Departments of Motor Vehicles, the Rehabilitation Act covers programs ad

[113] *See* Americans With Disabilities Act of 1990, 42 U.S.C. § 12101 et seq. (2006).

[114] *See* 49 C.F.R. §37 Subpart A (2011).

[115] *Id.* at § 37.5(a).

[116] 29 U.S.C. § 794 (2006).

activities that accept federal funding as well as Executive agencies. The DOT, for example, has issued requirements for federal highways.

The DOT regulations provide that discrimination by an entity that receives federal funding is prohibited on the basis of disability.[117] Discrimination includes denying a person with a disability the opportunity to participate or benefit from an aid, benefit, or service, that the opportunity must be substantially equal to that afforded a person without a disability, and must be as effective in affording equal opportunity "to obtain the same result, to gain the same benefit, or to reach the same level of achievement" as persons without disabilities.[118] The federal highways are regulated, in that highway rest area facilities, curb cuts, and pedestrian over-passes, under-passes and ramps must conform to accessibility standards.[119] Although the DOT has chosen to regulate only small portions of the highways, it suggests that the government has an interest in increasing accessibility in travel on federal highways for drivers with disabilities. Although the government has thus far declined to extend the regulations so far, the manufacturing of these cars provides an incentive and important reason to do so.

Furthermore, the recent Federal Highway Administration's (FHWA) Americans with Disabilities Act (ADA) Program has extended access for individuals with disabilities, although it has not gone so far as to cover highway travel by automobile. Still, taking the sum of these laws together, the spirit and intent, along with the trend of expansion and the underlying goal of increasing independence, suggests that major federal disability laws support the entry of a quasi-autonomous car for blind drivers onto the market, as well as the introduction of drivers who are blind and have visual impairments into the group of automobile consumers and highway drivers.

[117] 49 C.F.R. § 27.7 (2011).

[118] *Id.* at § 27.7(b)(1)(i)-(iii).

[119] *Id.* at § 27.75 (2011).

In addition, the Assistive Technology Act of 2004[120] ("ATA") supports the conclusion that the car designed for blind drivers might be considered assistive technology. First of all, giving blind Americans the opportunity to drive is consistent with the findings and purposes of the ATA. The ATA promotes independence, participation, self-determination, the ability to pursue and successfully carry out a career, and generally promotes the objectives of inclusion and integration, also major objectives of the NFB Blind Driver Challenge.

Under the ATA, a vehicle can be an assistive technology device. The ATA defines an assistive technology device as "any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities."[121] This vehicle falls well within this definition, and the individual features qualify as well as modifications.

The ATA may also provide an avenue for funding, an obstacle that stands in the way of getting the car designed for blind drivers from design to reality. The ATA provides for grants to states to maintain "comprehensive statewide programs of technology-related assistance" for programs that increase access to assistive technology and maximize the ability of individuals with disabilities to obtain assistive technology.[122] Such funding could be applied to state programs designed to help blind individuals obtain training, licensure, insurance, and other requirements for driving. Programs could be established with this funding, or other state grants in a similar spirit, to provide driver's education taught by and for blind individuals for the purpose of driving the specialized quasi-autonomous cars under the regulations to be prescribed

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[120] Assistive Technology Act of 1998, 29 U.S.C. § 3001 (2006).

[121] 29 U.S.C. § 3002(4) (2006).

[122] *Id.* at § 3003(e).

by state authorities. Under this provision of the ATA, funding could also go toward a voucher program to help individuals gain access to rental cars since it facilitates access to assistive technology that fosters independence.

In addition to the important role the car for blind drivers would play in the disability field, the technology would enhance safety in driving. While completely autonomous vehicles promise a safer car because car accidents are nearly always attributable to human error, the figures that support this conclusion fail to take into account that human calculation is able to avoid collisions that computers cannot. For example, a fully autonomous car would not be able to interact with other human signals, such as a safety worker signaling the car to stop or pass, and even when the cars have been developed to match human capabilities they may not be able to interact appropriately with human drivers—for example when human drivers bend rules by rolling through stops or break traffic rules.[123]

In contrast, the interface technology of the quasi-autonomous car is designed precisely to present accurate information to enhance, not compete with, human decision-making. Because the car is designed with such a purpose in mind, the technology would aim to provide non-visual information about the safety worker's signals in the example above, or the environmental factors, including obstacles like other cars. During the 2011 test drive of RoMeLa's ByWire XGV, Riccobono navigated the car around obstacles and passed another car on the same path while maintaining completely control. The car is designed to promote driver autonomy. Universal benefits for blind and sighted drivers include application of the technologies to low vision environments, such as dark or foggy driving conditions.[124] However, because the risk of liability

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[123] Markoff, *supra* note 7.

[124] Barry, *supra* note 10.

and lack of regulations in place threaten to prevent the car from reaching the marketplace, steps must be taken to minimize liability and put regulations in place.

B. Liability Should Be Limited to Negligence

Placing limits on manufacturer liability will mitigate the deterrence problem. If the exposure to liability is reduced, manufacturers will have incentive to pursue further development of the quasi-autonomous car for blind drivers, and the benefits of having such a car available will provide advantages to the general public as well as to blind drivers. Specifically, limiting liability to negligence and eliminating a strict liability theory will encourage innovation and the end result will benefit consumers and serve to increase independence for blind individuals.

As discussed above, strict liability theories pose substantial threats to manufacturers because of the low burden placed on plaintiffs. Under a manufacturing defect claim, a plaintiff need not show that the manufacturer acted unreasonable. Under a warning or design defect a plaintiff need only show that a reasonable alternative existed that would have reduced or eliminated the risk of injury, an obstacle too easy to overcome in this instance. Because the product is so new, as discussed above, the possibility of a reasonable alternative is too unpredictable for a manufacturer and the risk of exposure to liability is substantial enough to deter pursuing further development of the product and marketing it, regardless of the benefits to the public.

On the other hand, manufacturers may shield themselves with disclaimers, as mentioned above, under breach of warranty theories of liability. However, this provides too much protection and does not create enough incentive to create a product that reflects the highest safety standards.

By limiting the avenues of liability to negligence, the manufacturers will not be able to waive liability and thus will have the incentive to use the highest safety standards, but they will be shielded from strict liability, so they will better be able to predict liability claims. Burden to the industry will likely be considered as well as the cost and availability of solutions and insurance.[125] This burden will likely be high, since the technology is still in development, and when the car is first marketed, the cost will likely be high and the market may be small. Under a scheme that allows only negligence, a manufacturer will owe a duty of care to a plaintiff, which, as discussed above, may be high considering the nature of this particular product and the reliance that a blind driver would foreseeably place on a vehicle marketed as essentially an assistive device. But the manufacturer may also have an advantage due to the nature of the product, since the dangers of using such a product will be plain and a plaintiff may be deemed to have assumed the risk of using it.

In addition, proximate cause may be difficult for a plaintiff to show. Although the reasoning employed in *Saloomey* works in favor of plaintiffs,[126] Professor Scott's argument that *Saloomey* is different from software security cases because it involves an easily identifiable negligent act points to a difficulty plaintiffs must overcome.[127] While *Saloomey* involved one dedicated function, the car will involve many different interacting technologies facilitated by an operating platform, and it will be difficult to pinpoint the site of a malfunction in order to prove proximate causation. The use of interface technologies and interaction between the vehicle and the driver further complicate the determination of proximate cause where negligence is found on

[125] Barry, *supra* note 10.

[126] *Saloomey*, 707 F.2d at 677.

[127] Scott, *supra* note 80, at 449.

the part of the plaintiff and the defendant. Whereas in *Saloomey* the court was able to assign proximate cause to the manufacturer despite the negligence of several parties, the nature of the interface technology of RoMeLa's ByWire XGV and similar vehicles will make the determination more complex.

C. Regulation of Similar Vehicles and Technology Components

A further barrier, as mentioned above, is that without regulations specifically defining the "rules of the road" for the quasi-autonomous vehicle, manufacturers may be deterred from producing the car. If the car cannot be lawfully utilized on public highways, it will not likely make it to the market. Despite the lack of autonomous and quasi-autonomous vehicles on public highways, standards exist for specific types of autonomous vehicles not meant to travel on public roads. Unfortunately, they are limited in scope and may provide little meaningful guidance. For example, the American Society of Mechanical Engineers' ("AMSE") / American National Standards Institute ("ANSI") Standards regulate automated functions in trucks.[128] American National Standard B56.5 applies to unmanned, automatic guided industrial vehicles, automated functions of manned industrial vehicles, and industrial vehicles modified to operate in an unmanned, automatic mode.[129] The 2005 Standards include design, construction, and testing condition standards for the manufacturer[130] and operation standards for the user.[131] Because the standards apply only to industrial use, the main problem with applying them to regulations for

[128] Industrial Truck Standards Development Foundation, ASME B56.5, Safety Standard for Guided Industrial Vehicles and Automated Functions of Manned Industrial Vehicles [hereinafter ASME B56.5 Safety Standards].

[129] *Id.* at 1.

[130] *Id.* at 7.

[131] *Id.* at 5-6.

quasi- or fully autonomous cars, is that as Professor Brenner points out, regulations designed for the professional do not translate to regulations for pervasive technology—that is, technologies designed for use by the lay user, as non-industrial cars are contemplated to be. However, these regulations give some frame of reference for the basic categories of concern—such as general safety practices in automated vehicles or automated functions like handling of emergency stopping features, changes in environment, changing of batteries, warning and safety devices, installations, override features, and diagnosis and repair.[132]

In addition, the Department of Commerce's National Institute of Standards and Technology ("NIST") developed the Industrial Autonomous Vehicle Project ("IAVP") to "further the intelligence of vehicle platforms for navigation via measurements, standards and advanced technology developments.""[133] The IAVP includes both military and DOT projects.[134] The projects deal with the development and advancement of standards and measurements in autonomous vehicles.[135] For example, NIST worked as one project goal to clarify ASME's Standard ASME B56.5a-1994 regarding the definition of non-contact bumpers, i.e. laser sensors.[136] Another project involved developing vision-based technology to allow autonomous vehicles to follow lanes.[137] Although many of the standards are directed toward industrialized vehicles, as are the ASME standards, the standards may be helpful in the design and

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[132] ASME B56.5 Safety Standards, *supra* note 128, at 3-5.

[133] Roger Bostelman, Maris Juberts, Sandor Szabo, Robert Bunch and John Evans, National Institute of Standards and Technology, Department of Commerce, *Industrial Autonomous Vehicle Project Report*, NISTIR 6751, June 7, 2001, *available at* http://www.isd.mel.nist.gov/projects/iav/index.htm.

[134] NIST, *Industrial Autonomous Vehicle Project*, Oct. 2, 2006, *available at* http://www.isd.mel.nist.gov/projects/iav/index.htm.

[135] Industrial Autonomous Vehicle Project, *supra* note 134, at 2.

[136] *Id.* at 3.

[137] *Id.* at 5.

manufacturing of the specialized cars as safety and regulation of the field become a crucial factor.

Also pertinent to that consideration are the SAE Aerospace Standards, developed by the AS-4 committee.[138] The AS-4 committee is a joint endeavor of the Joint Architecture for Unmanned Systems Working Group ("JAUS WG"), commissioned by the Office of the Undersecretary of Defense, Acquisition, Technology, and Logistics, Strategic & Tactical Systems/Land Warfare and the SAE.[139] The main objective of the SAE AS-4 committee is "to publish standards that enable interoperability of unmanned systems for military, civil and commercial use through the use of open systems standards and architecture development."[140] Four subcommittees address the specific areas of Architecture Framework, Network Environment, Information Modeling and Definition, and Performance Measures.[141] Once again, although these standards may prove very useful for the industry and may provide some frame of reference for developing regulatory standards, these measures are specifically formulated for a specialized and contextual use, and will be of little use to non-specialist users.

More relevant is state recognition of autonomous vehicles. Last year, Nevada became the first state to "legalize driverless vehicles, and laws to the same effect have been introduced in Florida and Hawaii."[142] The Nevada law in question defines an "autonomous vehicle" as "a motor vehicle that uses artificial intelligence, sensors and global positioning system coordinates

[138] SAE International, SAE AS-4 Technical Committees – Unmanned Systems, 2011.

[139] *Id.*

[140] *Id.*

[141] *Id*.

[142] Markoff, *supra* note 1.

to drive itself without the active intervention of a human operator."[143] Section 482A.100 of the law authorizes and mandates the Department of Motor Vehicles to adopt regulations for the operation of autonomous vehicles on state highways.[144] The regulations must (1) establish requirements autonomous vehicles must meet before they may travel on state highways; (2) establish requirements for the insurance that is required to test or operate autonomous vehicles on state highways; (3) set minimum safety standards for autonomous vehicle and their use; (4) provide for testing of such vehicles; (5) restrict testing to certain geographic locations; and (6) establish any other requirements the Department deems necessary.[145] The Nevada state model may be helpful in beginning to develop a scheme for general state-by-state regulation of quasi-autonomous vehicles, but the question of how cars developed for blind drivers should be regulated leaves open many questions. Should insurance requirements be the same or heightened for blind drivers and cars marketed for this purpose? Are minimum safety standards the same for autonomous cars and for cars developed for blind drivers? Once again, does the degree of "active intervention of a human operator", as the statute defines it, make all the difference?

D. Formulating Regulations for Licensure, Ownership, and Operation

The regulations must be formulated, as the Nevada statute suggests, to cover vital areas of safety that autonomous vehicles and features implicate but manual driving does not. A vehicle based on interface technologies for blind drivers requires more. These regulations must be carefully designed to address safety issues that may arise from the ownership and operation of

[143] NEV. REV. STAT. § 482A.030 (2011).

[144] NEV. REV. STAT. § 482A.100(1) (2011).

[145] NEV. REV. STAT. § 482A.100(2) (2011).

the vehicle on state highways as well as local roadways.[146] For example, the regulations may set forth driver test requirements in order to ensure that drivers are adept at operating the interface technologies and features with which the car is equipped. The test should be tailored to test the driver's ability to interact with and operate the features of the car in conditions generally required by state licensing agencies, along with other driving challenges the agencies may choose to impose, such as to drive through conditions designed to test the features with which the car is enhanced. However, caution must be taken that any driver examination tests the ability to use the features safely, and does not unfairly disadvantage blind or visually impaired drivers.

The test should be an evaluation of ability to use the car to drive safely commensurate with the standards now used to test drivers' abilities with manually operated cars. Such a test should be used to contemplate some flexibility for evolving technology, but base the evaluation in basic safety standards. State variations will exist, but similarities will revolve around these basics. There is also a question of reasonable modification for drivers with visual impairments. In the case of the car itself designed for blind drivers, however, it could be argued, as discussed above, that the car is itself an assistive device. But since the function of licensure is not limited to use of the technology, but includes driver education and issuance of a driver test, it involves a state service. So under the ADA a reasonable modification is a consideration, provided and assuming it does not fundamentally alter the state service.[147] If these services are offered on a standard formulated to be equally accessible to individuals with and without disabilities, the question is most easily resolved. Although the states may legitimately impose vision

[146] At present, the Nevada statute only addresses state highways. *See* NRS 482A.030 (2011).

[147] 28 C.F.R. § 35.130 (2011).

requirements, they must be grounded in a safety requirement.[148] Therefore, if it can be determined that operation of the RoMeLa car, for example, is safe without a vision requirement, a public entity would be prohibited from barring blind individuals from obtaining licenses to drive those vehicles if there were regulations governing the licensure and operation of these cars.[149]

One possibility for implementing a regulatory scheme is to begin with a pilot program. State legislatures may choose to adopt statutes such as the Nevada statute, tailored toward quasi-autonomous vehicles with interface technologies for blind drivers and devise pilot regulation programs for bringing the vehicles to the roads. For example, the program may start by restricting such cars to single, dedicated lanes, as carpool lanes are presently used, on major highways, and slowly integrating into larger traffic patterns. In addition, there may be some restricted driving areas that prohibit use of autonomous and/or quasi-autonomous vehicles, which may address some of the concerns analysts have identified with each, both on practical and legal/regulatory terms. By beginning with a pilot "test" program and slowly expanding, lawmakers will have an opportunity to test out what many experts in the field now predict to be a reality—that autonomous, and even driverless cars will populate the roads in the near future. Allowing quasi-autonomous interface technology cars to play a role in that evolution of

[148] *See* AA Title II Technical Assistance Manual II-3.7200, *available at* http://www.ada.gov/taman2.html#II-3.4400 ("An individual is not "qualified" for a driver's license unless he or she can operate a motor vehicle safely. A public entity may establish requirements, such as vision requirements, that would exclude some individuals with disabilities, if those requirements are essential for the safe operation of a motor vehicle.").

[149] *See id.* ("The public entity may only adopt "essential" requirements for safe operation of a motor vehicle. Denying a license to all individuals who have missing limbs, for example, would be discriminatory if an individual who could operate a vehicle safely without use of the missing limb were denied a license. A public entity, however, could impose appropriate restrictions as a condition to obtaining a license, such as requiring an individual who is unable to use foot controls to use hand controls when operating a vehicle.").

technology will ease the transition and promote further participation of individuals with visual disabilities in the everyday activity of driving, a substantial move forward in independent travel.

V. Conclusion

With the introduction of legislation to regulate autonomous vehicles on public highways and the increased testing of these cars, it is credible that a vehicle designed to facilitate independent driving for blind individuals might be marketable. The technology that the only car currently being developed for such a purpose—RoMeLa's customized XGV—could bring to the public would benefit blind and sighted individuals, increase driving safety, and enhance products currently on the market. The danger that liability poses to manufacturers could be a major deterrent, however, presenting a disincentive to designing and producing the vehicles. Strict products liability theories are particularly dangerous because of the low burden the plaintiff must meet in order to prevail. In direct contrast, breach of warranty claims may be too lenient because if manufacturers can waive their liability through disclaimers they may not be given enough incentive to exercise care and to hold themselves to the highest standards of safety. By limiting applicable liability theories to negligence, manufacturers will have an incentive to strive for the highest safety standards but will also have some predictability in assessing liability claims, and will not be unfairly burdened by a strict liability system. In addition, by adopting a regulatory system that is crafted to meet the safety requirements and practical considerations of the quasi-autonomous car, perhaps looking to the Nevada statute as a model for the necessary areas that should be addressed by regulations, states may open the door further for manufacturers, since there is little incentive to create a vehicle that cannot be driven legally on the public roads. Once these barriers are cleared, the introduction of the quasi-autonomous vehicle will improve life for countless individuals nationwide. To do so will further the objectives of federal disability law and enhance safety, efficiency, and innovative automobile technology for all drivers.