INFORMATIONAL HEARING
SENATE COMMITTEE ON TRANSPORTATION AND HOUSING AND
THE SENATE COMMITTEE ON JUDICIARY

Telematics 101: How Much Your Car Knows About You

March 15, 2016
1:30 p.m. to 3:30 p.m.
State Capitol, John L. Burton Hearing Room (4203)

BACKGROUND PAPER

The technological revolution of the later twentieth century that made both the personal computer and the Internet possible is bringing its transformative power to the automotive industry. Over the past few decades, automobiles have become increasingly integrated with computer technology, and new technologies on the horizon could make the future of driving scarcely recognizable to past generations of drivers, both in terms of safety and the way in which occupants interact with vehicles. According to the U.S. Department of Transportation, computer-based vehicle safety applications hold the potential to reduce automobile collisions by up to 80 percent, and real-time data sharing between vehicles and roadway infrastructure could enable travelers to change routes, times, and modes of travel, based on up-to-the-minute conditions, to avoid traffic jams.[1] So different could the future of automotive travel be that some have suggested the act of driving, itself, may be a dying art.[2]

Despite its clear benefits, this technological revolution carries with it the potential risk of economic dislocation and erosion of personal liberties. Traditional business models based on automobiles of the past could struggle to adapt to this new market where cars are as much computer as they are mechanical systems of pistons, hoses, and calipers. In a world where enhanced road safety and efficient road utilization is made possible by vehicles that generate and transmit data to each other and roadway infrastructure, misuse of sensitive data about driver performance and locational histories could undermine the privacy today's drivers have come to expect.

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[1] Intelligent Transportation Systems Joint Program Office, *Connected Vehicle Research in the United States* (Oct. 27, 2015), U.S. Department of Transportation, <http://www.its.dot.gov/connected_vehicle/connected_vehicle_research.htm> (as of Mar. 3, 2016).

[2] *See* Arthur St. Antoine, *The Next Extinction: Drivers* (May 15, 2015), Automobile Magazine, <http://www.automobilemag.com/news/the-next-extinction-drivers/> (as of Mar. 3, 2016).

This joint hearing will explore how today's connected cars operate, what the future of automobile technology looks like, and the choices policymakers may be confronted with as these technologies become more widely deployed.

Overview of Telematics

The terms "telematics" and "connected car technology" refer broadly to those groups of technologies that collect and transmit useful data to and from an automobile. Definitions of these terms vary – some stakeholders include telecommunications devices like mobile phones connected to an automobile within the scope of telematics, while others would limit the definition to include only vehicle-based systems that provide specific services to drivers, like on-board navigation systems. Despite these differences, all uses of these terms seem to include the following commonalities: (1) one or more sensors that detect input from a vehicle, its components, or its occupants; (2) an on-board computing platform that transforms those inputs into useful data; and (3) a communications platform that enables the transmission of data to and from the vehicle. During this hearing, we will hear testimony from a range of experts on what terms like "telematics" and "connected car technology" mean, and how useful distinctions can be made between different systems broadly grouped into this field.

The origin of modern telematics systems can be traced back to on-board diagnostic features added to vehicles beginning in the early 1980s. These early systems collected and analyzed data pertaining to vehicle performance and technical faults, but had limited capacities to transmit this data outside of the vehicle. Beginning with the adoption of second-generation on-board diagnostics (OBD-II) systems in the mid 1990's, more vehicle performance data, including emissions data, became accessible via improved transmission channels to end users outside of an automobile. The deployment of both Global Positioning Satellite (GPS) systems and wireless telephone systems in major metropolitan areas enabled General Motors (GM) to develop one of the first true telematics systems in 1996 – OnStar. This system, through a suite of sensors, telephone and satellite communications channels, and user interfaces, had the capacity to automatically detect vehicle collisions and summon emergency assistance without the need for user input. Using data gathered from GPS satellites and on-board sensors, OnStar systems could transmit vehicle location data in the event of a collision via an on-board mobile phone unit to an OnStar monitoring facility, whose employees would then alert emergency response personnel with pertinent information about the collision. This capacity enabled first responders to quickly learn of an accident even when the occupants of a vehicle were unconscious and unable to summon help on their own, provided the system could communicate with the monitoring facility.

Modern telematics systems have built upon technology pioneered by GM and OnStar, allowing today's vehicles to collect and use (or transmit) more data to enable additional features. Features available on modern telematics systems include vehicle and trailer tracking for fleet management or the recovery of stolen vehicles, satellite navigation and real-time traffic routing, mobile data connectivity that enables occupants to place telephone calls or use the internet, and remote vehicle diagnostic services. Participants in this joint hearing will describe some of the new features and capabilities of modern telematics systems, and present an overview of what future telematics systems might offer.

Policy Perspectives

Automobile telematics systems present a number of potential issues that policymakers will have to weigh as these systems become more sophisticated and widespread. The following topics highlight some of the policy related issues that witnesses at this joint hearing will address.

I. Safety Improvements and Remote Assistance

The possibility of significant improvement in vehicle and roadway safety is one of the most promising potentialities of telematics systems. According to the U.S. Department of Transportation (DOT), in 2009, there were 5.5 million crashes, almost 34,000 fatalities, and 2.2 million injuries on U.S. roads as a result of vehicle crashes. Telematics systems and connected car applications could, according to DOT, reduce the occurrence of these accidents by upwards of 80 percent.[3] Many of these systems work by using vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications to increase a driver's situational awareness of roadway hazards or to avoid collisions through enhanced driving systems like automated braking. In general, V2V communications allow vehicles to be continuously aware of each other, relying on data sharing among nearby vehicles to warn drivers about potentially dangerous situations that could lead to a crash, like the fact that an obscured vehicle ahead is rapidly breaking or that multiple vehicles are simultaneously approaching a blind intersection. V2I communications between a vehicle and roadway infrastructure similarly help prevent collisions through in-car driver advisories and warnings, and infrastructure controls. For example, V2I systems could alert a driver that they are about to veer off the edge of a roadway, or optimize the timing of roadway signals to provide clear routes for emergency vehicles.

Several technology companies and traditional automobile manufacturers have also begun development of driverless or fully automated vehicles. Like vehicles equipped with V2V and V2I-based driver augmentation systems, autonomous vehicles rely on a

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[3] Intelligent Transportation Systems Joint Program Office, *Connected Vehicle Research in the United States* (Oct. 27, 2015), U.S. Department of Transportation, <http://www.its.dot.gov/connected_vehicle/connected_vehicle_research.htm> (as of Mar. 3, 2016).

series of external and internal sensors, computer processors, and telecommunications systems to operate safely in their environment. By eliminating the possibility of collisions due to human error – which is the underlying cause of most accidents – autonomous vehicles could greatly improve roadway safety for both vehicle occupants and pedestrians. However, a number of technological and policy issues need to be resolved before autonomous vehicles are widely deployed on roadways, including questions on liability should an accident occur while a vehicle is operating in autonomous mode.

Additionally, several automobile manufacturers and aftermarket providers are developing, or have already developed, sophisticated automated crash response systems similar to OnStar. One such product sold by Verizon allows automobile owners to add telematics functionality to their cars that will automatically alert first responders in the event of a collision or help route roadside assistance to a disabled vehicle using GPS position data.[4]

II. Enhanced In-Car Features

Aside from safety improvements, many telematics systems offer advanced convenience features for drivers and vehicle occupants, like hands-free calling or on-demand concierge services. Some of these products, like the one sold by Verizon, use imbedded GPS sensors to help owners locate stolen vehicles, or receive turn-by-turn directions. Others, like GM's most recent iteration of OnStar, allow vehicle owners to remotely unlock or start their vehicles through the use of an on-board mobile telephone connection, or receive reminders about routine maintenance or vehicle health through wireless transmission of vehicle performance and mileage data to analytic computer systems operated by OnStar.

III. Fleet Management and Regulatory Compliance

Telematics products on the market today allow operators of commercial fleets the functionality to monitor the movements of their vehicles and the driving habits of their employees. One such product sold by TomTom Telematics allows fleet managers to monitor driving behavior, fuel consumption, and GPS location in real time, equipping business owners with tools to potentially reduce fleet travel times, mileage, and consumption levels.[5] Similarly, automobile manufacturers can collect and aggregate performance data supplied by vehicle telematics systems to conduct research on the performance of their vehicle fleets and detect regulatory compliance issues, like common vehicle system failures, that warrant issuance of a safety recall.

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[4] *See* https://www.hum.com/features.aspx

[5] *See* http://business.tomtom.com/en_us/

IV. Traffic Management and Environmental Performance

According to the U.S. Department of Transportation, traffic congestion costs the U.S. economy an estimated $87.2 billion per year, with 4.2 billion hours and 2.8 billion gallons of fuel spent by drivers sitting in traffic.[6] Telematics systems like V2I and on-board data transmission devices can collect and transmit traffic performance data to transportation agencies, allowing them to manage transportation systems for maximum efficiency and minimum congestion. These systems could also be used to capture and transmit data related to a vehicle's environmental performance to manufacturers and regulatory agencies, allowing for the monitoring of fleet-level environmental performance in real world conditions, and providing policymakers with data that could be used to inform environmentally responsible transportation planning.

V. Privacy and Cybersecurity

Despite the many benefits telematics systems offer to both consumers and policymakers, the amount of data collected by these systems and the sensitivity of this data could, if improperly managed, undermine the privacy interests of California residents. Using large datasets gathered over time by a telematics system, it may be possible to reconstruct the locational history of a vehicle and extrapolate certain details about the car's driver, including their "political and religious beliefs, sexual habits, and so on."[7] Information about driving habits and patterns could prove valuable to commercial firms, and the unrestricted use or sale of this data may result in unwanted solicitation or adverse commercial decisions. Data handling practices vary among parties who receive information from telematics systems, and industry standards have not yet emerged on matters such as data sharing and selling, data retention, data use and access, or consumer choice over the collection and use of telematics data. Without sufficient safeguards, telematics data collection and handling practices could undermine the fundamental right of privacy guaranteed in Article I, Section 1, of the California Constitution.

Similarly, insufficient telematics data and system security practices may undermine public safety and the safety of passengers in telematics-equipped vehicles. Recent research has demonstrated that computer hackers may be able to seize control of a vehicle through its telematics system, allowing them to remotely operate steering

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[6] Intelligent Transportation Systems Joint Program Office, *Connected Vehicle Research in the United States* (Oct. 27, 2015), U.S. Department of Transportation, <http://www.its.dot.gov/connected_vehicle/connected_vehicle_research.htm> (as of Mar. 3, 2016).

[7] *See United States v. Jones* (2012) 132 S. Ct. 945, 955-956.

controls, brakes, and other critical safety systems.[8] Deliberate, targeted attacks against telematics-equipped vehicles, especially those traveling at high rates of speed, could have disastrous consequences. If similar vulnerabilities were to emerge in future connected highway infrastructure, such as systems that regulate the flow of traffic for autonomous or semi-autonomous vehicles, the public safety threat to vehicle occupants and nearby pedestrians could be significant.

VI. Consumer Choice and Right to Repair

Telematics systems offer consumers and automotive repair professionals real-time access to extensive data about a vehicle's performance. Access to such data and the ability to fine-tune software algorithms running a vehicle's systems may, in the near future, become just as important as a traditional mechanic's diagnostic and technical abilities. As with data handling practices, industry standards governing access to this important data source have not yet emerged. Consumer choice concerning where vehicle repair services are obtained could be imperiled if access to data generated by a vehicle's on-board computer system is unduly restricted to specific parties, and lack of access to real-time performance data could result in the diversion of business to those selected by the party in control of a vehicle's telematics data stream. Unduly restrictive practices could significantly impact small businesses left without access to telematics data and could result in economic dislocation within California's automotive repair industry.

Conclusion

Telematics systems offer a number of benefits that could greatly improve the safety and efficiency of California's roads and highways. However, without proper standards and responsible practices, this new technology could undermine public safety, privacy, and economic well-being. This hearing will help acquaint policymakers with how telematics systems operate, as well as with some of the policy issues raised by their use.

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[8] *See* Andy Greenberg, *Hackers Remotely Kill a Jeep on the Highway—With Me in It* (Jul. 21, 2015), Wired Magazine <http://www.wired.com/2015/07/hackers-remotely-kill-jeep-highway/> (as of Mar. 11, 2016).