Driving the Info Highway

The Internet has hit the road. Drivers can now access anything from custom traffic reports to spoken e-mail messages to video games. But is it safe?

By Steven Ashley

The needle points to “E.” The big rental van and its trailer have guzzled down yet another tank of gas. This time, however, it’s late and nothing but a dark, lonesome highway stretches out ahead. Every several miles there’s a turnoff to some small town, but the signs don’t always say how far these burgs lie off your route or whether there are gas stations in them. You’ve just started hunting down the road map when you remember that the van comes equipped with a voice-activated telematics system, a two-way wireless communications unit connected to both the Internet and a Global Positioning System (GPS) locator. Punching a button on the dash, you say, “Gas.” After a pause, a mechanized voice reads aloud a roster of nearby service stations, including the brand of gas, the distance to each station, even the price per gallon of unleaded regular. Although it’s a bit farther away, you choose the third entry on the machine-verbalized “text-to-speech” list because you have that brand’s credit card. The electronic voice responds with step-by-step driving directions to your next petroleum oasis.

Sooner or later this kind of scenario will become commonplace as more sophisticated automotive telematics technology heads out onto the road. Just as microprocessors colonized motor vehicles during the past decade, a similarly steady transition to telematics will occur as the necessary equipment is installed in new cars and trucks over the next few years, auto industry analysts say. A wireless transmitter and receiver, an antenna, elementary voice-recognition and text-to-speech capabilities, and typically a GPS unit are all that’s needed on board to support what the industry calls the “thin-client” telematics service—the most fundamental set of mobile communications features. Although the basic service package is relatively simple and the changeover seems inevitable, the industry will soon have to address the complex potential safety and privacy issues that the technology raises.

Anytime, Anywhere

AUTOMOTIVE TELEMATICS is based on the notion that today’s motorists are demanding instant access to safety, navigation and convenience services, as well as entertainment programming, anytime, anywhere. Already being spoken about in the eager tones that financial analysts used to describe e-commerce half a dozen years ago, the nascent telematics technologies are expected to fundamentally change the way people interact with cars, where the average American driver spends nearly 10 percent of his or her waking day. “Motor vehicles deserve to be connected to the outside world,” says Chet Huber, president of OnStar, the largest telematics service provider in the U.S. “Today we’re beginning with services that offer safety, security and peace of mind. Ultimately we’ll expand into a lot more interactive services.”

In-vehicle wireless safety and security services—such as emergency roadside assistance, automatic collision notification and remote door unlocking—are already becoming more familiar to the motoring public. These features are offered by Mercedes-Benz’s TeleAid, BMW’s Assist and Hertz’s NeverLost, in addition to OnStar. Subscribers to premium telematics services are meanwhile starting to take advantage of more sophisticated features, such as verbal e-mail messages, digital music, and tailored traffic and weather updates, as well as on-demand news, sports and stock-market reports. And drivers of luxury cars have become accustomed to instrument panels outfitted with color LCD screens that display navigation maps or with other useful driver aids.

“In the five years we’ve been operating, OnStar has delivered 10 million customer interactions,” Huber says. “One out of four General Motors cars has OnStar—that’s 5,000 new subscribers every day. And now many other car brands, including Acura, Audi, Honda, Lexus, Saab
and Subaru, will offer OnStar services as well.” Free for the first 12 months, basic service costs $199 a year, which Huber says is about what it costs annually to keep a cell phone in the car. “To remain competitive, every vehicle in the country will have to be able to deliver at least the basic telematics services,” he predicts.

Looking ahead, engineers are working on ways to avoid built-in dashboard displays, which tend to become obsolete relatively quickly, with new technology that integrates a driver’s personal digital assistant (PDA) into the vehicle system via a center-mounted docking cradle. The PDA would serve as the visual interface. It would even automatically transfer to the vehicle the motorist’s personal information, such as fuel or restaurant brand preference, seat position settings, regular commuting routes and daily work schedule.

Rosy Predictions

ONE OF THE BIGGEST players in the area, auto components supplier Delphi Automotive Systems in Troy, Mich., suggests that half of all new cars could have telematics devices fitted as standard equipment by 2005. Indeed, some observers are forecasting exponential growth for the telematics business. For example, UBS Warburg, a financial services company, expects the market to grow 10-fold, to $47.2 billion, within a decade. Frost & Sullivan, a marketing consulting company, is much more conservative in its prognosis, predicting the North American market to hit $7 billion by 2007. Philip Rowland, principal at the management consulting firm McKinsey & Co., is similarly circumspect, noting that by 2010 the worldwide telematics market could range from $13 billion to $100 bil-
tive games, digital music, movies and videos. Rear-seat services will allow drivers to download entertainment products that can keep the kids busy on long trips, for instance.

The third market, for engine and other mechanical applications, will use data collected by onboard computers to provide such tools as remote diagnostics, software upgrades and “smart” ordering of replacement parts. This technology would permit carmakers or dealers to alert a motorist when his or her engine malfunctions and could even retune the engine when the vehicle is parked late at night.

**Hands on the Road, Eyes on the Wheel**

Despite the technology’s potential, safety and other issues related to its use are yet to be determined. The current debate over the use of handheld cell phones in cars suggests that the telematics human-machine interfaces, and how drivers use them, will be critical. “For many—mostly societal—reasons, consumers are importing a whole series of portable devices into their vehicles for use when they’re driving: cell phones, laptops, personal digital assistants,” says Bob Lange, executive director of safety integration at GM’s Safety Center in Warren, Mich. “First of all, people are spending more of their time commuting. And since everyone’s being subjected to a major time squeeze as well as increasing pressure to be more productive, more and more of these devices are going to be used in the car. Automakers have to be cognizant of these trends and [work] to make it possible for consumers to use these devices safely.”

Automotive safety expert Paul Green agrees: “There is great excitement about the possibility of how these systems might enhance the driving experience. Yet relatively little emphasis has been given to the potential risks associated with the overload these systems might pose to drivers.” Green is a senior research scientist at the University of Michigan Transportation Research Institute in Ann Arbor, which conducts inquiries into transportation topics. “If action is not taken, a significant number of information-system-related deaths and injuries will result,” he
warns. “At this point, safety and human-factors efforts lag far behind electronics development.” This could cause a consumer backlash or prompt the federal government to step in and curtail the use of telematics products in moving vehicles.

**Telematics** is based on the notion that motorists are demanding access to safety and other services anytime, anywhere.

The key unresolved point is how to avoid unduly distracting the driver from the primary mission—driving—while he or she is answering e-mails or finding a restaurant. Says GM’s Lange: “We know that under most driving circumstances the cognitive demand of the driving process is very modest. That’s why we all find ourselves doing other, nondriving-related tasks while we’re driving.”

**Driver Distraction**

**BUT HOW MUCH is too much?** “Unfortunately, driver-distraction data are so sparse that we can’t determine the real magnitude of the problem,” says Michael Goodman, chief of driver research and simulation at the National Highway Traffic Safety Administration (NHTSA) in Washington, D.C. “We believe that a minimum of 25 percent of fatal crashes are distraction-related. Other researchers argue that the number is more like 30 to 50 percent. In any case, distraction-related fatal crashes are very underreported, as the deceased driver is not there to ask and drivers are unwilling to describe the causes because of potential liability. What we do know is that just about any activity people do in cars—eating, adjusting the mirror, changing radio stations—is associated with crashes. When that action coincides with a random event like a dog running out into the street or the onset of a dangerous curve, you’ve got an accident.”

Cellular telephone technology is serving as the model for the adoption of automotive telematics. As with the cell phone, telematics keeps the driver in touch with the rest of the world. Likewise, the potential for telematics to induce driver overload is ever present. Despite continuing controversy about the use of handheld cell phones while driving and the recent bans imposed in New York State and elsewhere, however, conclusive research on the safety implications of in-vehicle electronics use is still relatively meager. Human-factors researchers do say, though, that even hands-free, voice-activated cell phones cause sufficient cognitive distraction to produce driver error.

According to industry figures, there are currently about 105 million cell phones in the U.S., with the total expected to nearly double to 200 million by 2005. Some 70 to 80 percent of cell phone owners use them in vehicles. At the same time, phones are getting cheaper and easier to operate, helping to boost the rise in usage. With more users making more calls, the exposure to potential distraction is increasing and, along with it, the risk of accidents. As Goodman says, “different kinds of distractions are associated with different levels of risk. People do a lot of eating and drinking in cars, but there’s only so much they can eat and drink. The same cannot be said of wireless phone use.”

Interestingly, a conversation using a hands-free cell phone is not quite the same as talking to a passenger. “The phone is just as compelling as talking to a passenger,” Goodman says. “There’s a strong desire to respond and complete the conversation, but the other person is not aware of the driving situation—whereas the passenger, being just as concerned about safety as the driver, tends to keep quiet during challenging driving conditions.”

Concern about on-the-road cell phone use is supported by a new study conducted at the University of Utah and issued by the National Safety Council (NSC). It indicates that conversing on cell phones while driving can lead to significant decreases in driving performance regardless of whether the phone units are handheld or hands-free. The investigation says that cell phone use on the road creates much higher levels of driver distraction than listening to the radio or audio books.

According to the authors, the study’s findings suggest that legislative initiatives that restrict handheld devices but permit hands-free devices in motor vehicles are not likely to reduce driver distractions associated with cell phone conversations significantly (see www.nsc.org/news/nr081501a.htm). “This study adds new data to the ongoing national debate on driver distractions and their causes,” notes Alan C. McMillan, NSC president. “A great deal more research like this is needed, to help us fully understand the public policy implications of the growing use of cell phones and other electronic devices—such as global positioning systems, faxes and computers—in moving vehicles.”

Because of the potential for disastrous driver distraction, more than a dozen countries now restrict or prohibit cell phones and wireless technology in motor vehicles, including Australia, Brazil, Chile, Germany, Israel, Italy, Japan, Philippines, Portugal, Singapore, South Africa, Spain, Switzerland and the U.K. The European Commission 1999 design guidelines for automotive human-machine interfaces state: “Information and communications intended for use by the driver while driving must not distract, disturb, or overload drivers.” Currently in the U.S., there are no accepted industry guidelines or government regulations governing in-car telematics devices.

To ward off a regulatory backlash and avoid product-liability lawsuits, telematics providers are focusing on
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crucial, but still relatively immature and otherwise potentially problematic technologies, such as voice-recognition/voice-activation systems and head-up displays. This equipment will allow drivers to use wireless technology without taking their eyes off the road or their hands off the wheel. But how about ensuring that the driver’s mind stays on the task of driving? How much interaction, or cognitive distraction, can a driver handle before he or she loses focus on the road ahead?

What we do know is that just about any activity that people do in cars—eating, changing radio stations—is associated with crashes.

According to safety specialists, cognitive distraction is one of four general types of driver distraction. The others are visual, auditory and biomechanical. But cognitive distraction, which can occur while contemplating business or personal matters, remembering a list of spoken instructions or even listening to a synthesized voice, is much more elusive and difficult to measure than the other types. What is known is that it diminishes the operator’s awareness of the driving situation.

The question comes down to how and when to give information to the driver. NHTSA has begun a series of studies on the topic. The investigations will make major use of the new National Advanced Driving Simulator, a $50-million high-fidelity system that is just coming online in Iowa City. The simulator will allow scientists to duplicate highway driving in a safe and controlled laboratory setting. NHTSA researchers are also conducting in-vehicle research on test tracks.

Automakers are following suit with their own investigations. Ford, for example, has built a $10-million driving simulator dubbed VIRTTEX, for VIRtual Test Track EXPERiment, to study driver workload and distraction issues related to in-vehicle electronic devices. “The industry needs good, scientifically accepted design guidelines and testing,” says Jeff Greenberg, chief of VIRTTEX at Ford’s Research Laboratory in Dearborn, Mich. “It is important that all of these systems be safe and that the scientific community agrees on what is acceptable.”

Driver Workload Managers

MEANWHILE GM is building a driver-workload-assessment laboratory to evaluate specific telematics devices on a test track. “Until we have good science that tells us how much is too much,” says GM’s Bob Lange, “we will err on the side of limiting driver involvement with high-level tasks. For example, GM has decided to disable destination entry input [driver queries regarding trip routes] for navigation systems while the vehicle is moving. In general, we want to minimize the number of steps to complete a task, by using voice recognition in conjunction with a click or two of a button.”

NHTSA researchers expect the problem to be partially ameliorated through the development of a series of increasingly sophisticated “workload managers.” Now under development at many car companies, such managers would regulate the information flow presented to the driver by monitoring moment-to-moment driving demands. In heavy traffic, for example, an incoming call might be diverted to an answering machine.

“If we were sophisticated enough to truly understand how drivers interact with the environment and the vehicle,” Lange says, “we could conceive of a rather elaborate algorithm that would enable and disable telematics systems.”

TELEMATICS PLAYERS LIST

TELEMATICS SERVICES
Assist, BMW Munich, Germany
ATX Technologies Dallas
OnStar Troy, Mich.
TeleAid, Mercedes-Benz Stuttgart, Germany
Wingcast, Ford/Qualcomm San Diego

TELEMATICS EQUIPMENT
Robert Bosch Stuttgart, Germany
IBM White Plains, N.Y.
Johnson Controls Plymouth, Mich.
Microsoft Redmond, Wash.
Motorola Schaumberg, Ill.
Philips Electronics Eindhoven, Netherlands
Siemens Automotive Regensburg, Germany
Sun Microsystems Palo Alto, Calif.
Visteon Dearborn, Mich.

NAVIGATION SYSTEMS
ComRoad Unterschleissheim, Germany
Webraska Poissy, France

TRAFFIC INFORMATION
Mobility Technologies Wayne, Pa.
Westwood One New York City
“Soon we’ll see the beginnings of a dialogue manager,” he predicts. “At first, it would work by capturing and analyzing currently available vehicle data—throttle position, brake position, steering angle. Then, as we add sensors that can monitor ambient conditions, the dialogue manager can become more effective.”

The all-encompassing nature of telematics systems evokes George Orwell’s Big Brother.

These sensors, many of which now exist but are not yet installed on vehicles, could observe visual conditions (light, dark, foggy), road-surface conditions (wet, dry, icy), and traffic flow and density as registered by radar- or infrared-based adaptive cruise control or collision-avoidance systems. After that, a head-position-monitoring system similar to those used by military helicopter pilots could be developed to follow a driver’s head movements to determine if he or she is paying attention. If a hazard is detected while the driver’s eyes are not on the road, it would send out a warning.

Never Out of Touch

BEYOND SAFETY concerns, the all-encompassing nature of telematics systems evokes George Orwell’s Big Brother.

Telematics technology was certainly anything but a benefit to James Turner, who rented a van from Acme Rent-A-Car in New Haven, Conn., early last October. After Turner had completed a drive to Virginia, Acme informed him that tracking data from the van’s onboard GPS locator indicated that he had exceeded the speed limit three times during his travels. As noted in the rental contract, the company charged Turner $150 for each alleged infraction. First, Turner was incredulous at getting such an unexpected notice from his rental company rather than from the police. Now he’s challenging the fines in court. Meanwhile the Connecticut Department of Consumer Protection has requested that the company sign a cease-and-desist order, which would stop it from issuing speeding fines and compel it to provide restitution to the dozens of customers whom it has charged.

Until safety and privacy concerns are addressed in a comprehensive way, it will remain the responsibility of drivers to keep their minds on driving despite the inevitable distractions caused by telematics features. One thing is certain: America’s celebrated love affair with the automobile will never be the same. It is going become a lot tougher to get away from the rest of the world by driving away in your car.

Steven Ashley is a member of the board of editors.

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