

POSITION STATEMENT

Capitalizing on Intelligent Transportation Systems Technology Opportunities

(Approved by the IEEE-USA
Board of Directors, 20 June 2014)

IEEE-USA strongly endorses a national initiative to utilize Intelligent Transportation Systems (ITS) to improve vehicular safety and mobility, increase economic productivity, reduce energy consumption and enhance air quality. While the nation's interstate highways are one of its greatest achievements, the United States has fallen behind many European and Asian nations in the application of ITS technologies to improve the safety and mobility of automobiles, trucks and buses. America's outdated surface transportation system is beginning to negatively impact its international competitiveness and the quality of life of its citizens.

Global and U.S. transportation systems are inextricably linked to the nation's economic growth. Transportation is a key economic and productivity enabler, connecting people with work, school and community services and linking business enterprises with domestic and global markets. The federal government must take a leadership role in continuing efforts to modernize our transportation systems using ITS technologies. To do so, IEEE-USA recommends that the federal government:

- Continue to support federal initiatives that foster collaboration among public and private sector stakeholders in pursuit of a vigorous national transportation research program that capitalizes on U.S. leadership in information and communications technologies. Key research objectives should include the improvement of transportation productivity, safety and efficiency through the use of Intelligent Transportation Systems (ITS).
- Fully fund the U.S. Department of Transportation's Connected Vehicle Research Program to advance the state of the art in vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications and enable America's roads and highways to function as a truly integrated system of connected vehicles and infrastructure.
- Ensure that the availability of licensed wireless spectrum for safety critical connected vehicle applications is not jeopardized by competing commercial uses.

- Incentivize broad deployment of ITS tools and strategies that improve mobility, efficiency and safety on all modes of surface transportation.
- Promote research on pre-competitive enabling technologies that will support future automated driving capabilities and conduct independent evaluations of ITS impacts on traffic congestion, vehicle safety, energy consumption and emissions control.

IEEE should take an active role in disseminating accurate information, based on firm technical foundations, about the development of enabling ITS technologies. The growing interest in vehicle automation has stimulated more wishful thinking than realism in trade press, general interest media and Internet reporting on the subject.

This statement was developed by the IEEE-USA Committee on Transportation and Aerospace Policy and represents the considered judgment of a group of U.S. IEEE members with expertise in the subject field. IEEE-USA advances the public good and promotes the careers and public policy interests of the more than 206,000 engineers, scientists and allied professionals who are U.S. members of the IEEE. The positions taken by IEEE-USA do not necessarily reflect the views of the IEEE or its other organizational units.

BACKGROUND

Intelligent Transportation Systems (ITS) use technology to enable government agencies and private users to keep transportation systems performing as efficiently and safely as possible. Examples of ITS technologies include traffic signal optimization and retiming, transit signal prioritization, safety service patrols, driver warning and control assistance systems, electronic border crossing systems, vehicle credentialing, incident monitoring and hazard detection systems.

Intelligent Transportation Systems (ITS) offer one of the biggest and best opportunities the United States has to utilize its roads and highways to their full potential. ITS can also advance climate change and energy conservation goals all while improving vehicle mobility, safety and efficiency. It can do so by helping traffic to flow more smoothly; reducing wasteful stop-and-go traffic; and enabling vehicles to drive safely. More effective transportation system operation and management are vital to the economy, and central to transportation agency missions.

According to the Texas Transportation Institute, traffic congestion in 2012 resulted in 5.5 billion hours of extra travel time and an extra 2.9 billion gallons of fuel burned, for a total annual cost of \$121 billion. ITS R&D funding is minuscule compared to the total cost of crashes and congestion, which drain the economy of more than \$400 billion per year, close to three percent of the nation's GDP.

U.S. commitments to ITS have fallen behind those of other countries with respect to spending on research, development and deployment. And while the limited U.S. investments in ITS R&D have been concentrated on incremental near-term developments and "Day One" deployment opportunities, European and Asian governments have been

investing heavily in longer-term research, with a greater potential for improving transportation system performance. Other countries have achieved wider-scale deployment of current generation ITS technologies, due to more centralized transportation decision-making structures, stronger traditions of public-private cooperation, and greater consumer willingness to pay to be early adopters of new vehicle technologies.

DOT's Connected Vehicle Research Program is a public-private effort to enhance safety and provide real time information to traffic managers and travelers through vehicle-to-vehicle (V2V) and bi-directional vehicle-to-infrastructure (V2I) data communications. This program is testing advanced wireless communications, sensors, GPS navigation and computer processing applications to identify threats and hazards in the roadway environment and to communicate alerts, warnings, and other real-time traffic information to drivers. Many other safety-related applications are possible using connected vehicle remote sensing and high-speed communications capabilities. V2V applications can enable vehicles that brake suddenly to warn nearby vehicles, ensuring safer braking. Such applications can also activate adaptive cruise control devices to establish and maintain safe distances between vehicles and to communicate warnings about road hazards and dangerous driving conditions to nearby vehicles.

Other connected vehicle applications involve vehicle-to-infrastructure (V2I) and infrastructure-to-vehicle (I2V) data communications. These applications include systems in which roadside equipment broadcasts safety-related information to approaching vehicles. The infrastructure collects environmental and situational data from other vehicles, or from land-based monitors, such as cameras or weather sensors. Such data can include information about stopped traffic, slippery road surfaces, imminent traffic signal changes, or hidden traffic approaching an intersection. V2I and I2V systems can collect vehicle speed, traffic congestion and other useful information and transmit it to nearby drivers. ITS can also assemble speed profiles that minimize energy use, vehicular emissions and sudden stops, providing societal benefits, as well as immediate benefits to individual drivers.

In today's connected vehicle environment, most time-critical and safety critical information is shared wirelessly among vehicles and between vehicles and infrastructure using dedicated short range communications (DSRC). This technology, as specified in IEEE standards 802.11p and 1609, is based on licensed use of 75 MHz of spectrum in the 5.9 GHz band. The Federal Communications Commission's recent proposal to open this spectrum for shared use with unlicensed WiFi applications poses a potentially serious threat to the viability of time-critical and safety-critical ITS applications. The FCC should take steps to ensure that that ITS applications retain priority for this spectrum's use, and that other users do not jeopardize transportation safety.

ITS can provide the infrastructure to support any of the transportation financing methodologies being considered, to replace the current fuel tax over the next generation. For this application, and for other ITS applications based on data communications, systems developers, operators and regulators will need to be vigilant to protect the security and privacy of the data being exchanged.

Although results vary from country to country, ITS technologies are having a dramatic impact on traffic congestion in other cities worldwide. In Stockholm, for example, a dynamic toll system (based on vehicular flow into and out of the city) has reduced traffic by 20 percent, decreased wait times by 25 percent, and cut emissions by 12 percent.

The information technology and motor vehicle manufacturing industries have shown considerable interest in developing automated driving systems for road vehicles. Such systems have the potential to produce significant improvements in operating road transportation systems. However, the general public, and even many people in the transportation policy and technology worlds, have been misled to expect high levels of automation to become available for public use in an unrealistically short time. Vehicle automation is likely to advance incrementally, with a much more gradual transfer of dynamic driving responsibilities from humans to automated vehicle systems.

The benefits of automated driving (improved traffic flow, vehicle safety, energy conservation and emissions reductions) are unlikely to be realized until autonomous vehicle technology is combined with connected vehicle technology - so that motorized vehicles can actively coordinate and cooperate with each other. Sponsors of research on automated driving in Europe, Japan and the United States and many in the vehicle manufacturing industry recognize that the two technologies must be combined.

Developing and deploying automated driving systems is likely to be more complicated and take longer in the United States than in other countries. This is because regulatory responsibilities are divided between the federal and state governments and there are diverse approaches to driver licensing, vehicle registration and automobile safety standards.

The long-term goal of fully automated driving under all road and traffic conditions (an automated taxi that requires no driver) will not be realized until a number of technological challenges can be overcome, at a cost that is affordable to vehicle purchasers. These challenges include: vehicle safety threat detection; fault-tolerant vehicle control; and safety-critical software systems.

Driving environments are so complicated that automated driving systems designers and developers cannot be expected to anticipate every hazardous situation that vehicles will encounter over millions of hours of operation. The software challenges are likely to be the most critical, because of the cost and complexity of software development and quality assurance processes, and their limited ability to ensure reliability, eliminate coding errors and prevent deliberate attacks.

The most revolutionary change that fully automated driving will require will be the development of software that can make life-and-death decisions in real time and without human supervision.

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