

In-Vehicle ITS in the US: Current Status

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Thank you for your introduction. It is a pleasure to be with you today.

Let me also thank the Japan International Transport Institute for the invitation to talk to you today about a topic of considerable personal interest, in-vehicle ITS.

The objective of my presentation is to inform you about in-vehicle ITS technology. After a brief description of related research at the University of Michigan to establish a context for the remainder of the presentation, I will provide some information about the size and growth of the US ITS market and then will shift to in-vehicle products and services. I will first focus on the private passenger vehicle and then will move to the commercial vehicle, predominantly trucks and trucking fleets. In the interest of time, I will not be able to discuss in-vehicle systems in transit vehicles, an area of growing and exciting ITS deployment in the US. Let me apologize in advance for this omission.

In terms of transportation-focused research centers at the University of Michigan that are housed in the academic side of the University, let me briefly report on two, the ITS Research Center and the Trucking Industry Program.

The ITS Research Center is one of the original three ITS Centers of Excellence that was funded during the mid-90's. Although the Center originated with a variety of different research and development directions, these essentially narrowed down to:

- Driver assistance systems, primarily adaptive cruise control, lane departure technology and collision warning and avoidance technologies.
- Various 'infotainment' technologies, with emphasis on route navigation.
- Routing and scheduling, primarily for pick up a delivery, for trucking fleets.

The University of Michigan's Trucking Industry Program, or UMTIP, was established in 1995 through a generous grant from the Alfred P. Sloan Foundation. The UMTIP objectives are to:

- Develop an understanding of the trucking industry by going out into the industry and gathering data.
- Identify compelling issues affecting the industry.
- Direct doctoral-level research on these issues.

In so doing, we have brought together a broadly interdisciplinary group of faculty and graduate students to study labor issues, economic issues at both the firm and industry levels, and operational issues. A large percentage of operational issues that we have studied are enabled by information technologies that fall under the heading of ITS, such as mobile communications and real-time asset tracking, thus forming a very close link with the ITS Research Center.

UMTIP is one of several industry programs that the Sloan Foundation supports, one of which is the International Motor Vehicle Program at MIT, the program responsible for the book “The Machine that Changed the World,” which was largely responsible for introducing lean manufacturing to the US durable goods manufacturing industries. The source of knowledge, was of course, the Japanese auto industry, primarily Toyota.

Let’s now move on to some recent, post 11 September, projections and information about the world and US telematics markets.

In a 29 October news release published by ITS Access (www.itsa.com), Allied Business Intelligence, Inc., projected that the “world telematics market for personal vehicles will rise from the current level of \$3 billion to almost \$13 billion by 2006, with recurring annual service revenue accounting for over \$4 billion of the \$13 billion total.”

The same publication, on October 29th, also reported from a survey by eBrain Market Research, a division of the Consumer Electronics Association, that “while only 3% of US households actually own a telematics device, 14% of car owners familiar with the product have used one. Nearly 75% of those who have tried telematics did so on a car other than their own, including rental vehicles. Among those who have used telematics devices, the reaction is overwhelmingly positive; 83% found the product to be ‘very or somewhat useful.’” The implications are that in the US “mobile navigation and information systems, or telematics devices, are poised to enter the mainstream as consumers increasingly come into contact with the burgeoning technology.”

We have an understanding of who is the US customer and why he or she purchases telematics products and services. The eBrain survey also indicated that “telematics users are more likely to be male, age 18-34, highly educated, have household incomes above \$75,000, and have access to the Internet. Among the many features offered by the technology, consumer interest is largely driven by increased safety features, such as the ability to send distress signals, monitor car maintenance, traffic information, and the ability to obtain maps.”

Moving on to in-vehicle products and services, the Intelligent Vehicle Initiative, or IVI, is an ITS program initiated by USDOT and focused on in-vehicle systems. Safety is the top priority of these envisioned systems, which include various types of collision avoidance and warning systems, automated crash notification, lane position indication, vision enhancement, vehicle diagnostic and prognostic monitoring systems, and vehicle dynamics and stability control systems.

Let me spend some time discussing one in-vehicle technology that has recently been deployed in the US. This system is adaptive cruise control or ACC. ACC has just been introduced in the US by Lexus, but has been available in Japan and Europe for several years now. If we look world-wide, ACC adds approximately \$1,500 to \$3,000 to the cost of a car.

ACC systems are cruise control systems that are designed to work at speeds above 40km/h and decelerate or brake if the vehicle comes within a pre-set headway (usually one or two seconds) of the vehicle in front. A laser beam, in the case of Toyota and Lexus, or a radar, in the case of the rest of the industry, is used to sense the vehicle ahead. A discussion of the advantages and disadvantages of one approach over the other can be found in one of the references presented in my written remarks. (W.D. Jones, "Keeping Cars from Crashing," IEEE Spectrum, September 2001, pp. 40-45.)

The very brief history of ACC is interesting. Toyota introduced the first ACC system on a production vehicle in the Spring of 1998. The vehicle was a compact luxury sedan only sold at the time in Japan. Later in the same year Nissan also introduced an ACC system in one of its luxury sedans.

In the Fall of 1999, Jaguar began offering an ACC for the XKR, which were sold in Britain and Germany. The suppliers included Delphi Delco, TRW Automotive Electronics, and Siemens, a truly international supplier team.

Last Fall, Mercedes-Benz introduced an ACC in Europe for its C- and S-class models. The suppliers included two US-based companies, M/A-Com and Filtran Microcircuits.

We remark that in spite of the fact that conventional cruise control is much more popular in the US than it is or has been in Europe or Japan, the Big-3 have yet to have an ACC system in production. This will change next year, when both GM and Ford plan to introduce ACC systems – GM in a Cadillac and Ford in a Lincoln. By then several other auto makers, including Opel, Saab, and Volvo, are expected to have ACC systems on some of their new models.

We are not aware that any automotive electronics firm that has developed an ACC system has actually won a commitment from a major OEM, although several systems are being marketed. Two such systems are Eaton's Vorad system and Autocruise, a joint venture between TRW Automotive Electronics and a French company, Thomson-CSF. We will mention the Vorad system again later when we discuss in-vehicle systems for trucks.

Possible next generation ACC systems include cooperative adaptive cruise control, or CACC, which is already being tested in California. Current generation ACC can only respond to a difference between its own speed and the speed of the car ahead. CACC will allow two or more cars to communicate and work together to avoid contact, which may allow cars to follow at closer headways than are now permitted by current ACC systems.

As another possible next generation ACC system, Fujitsu Ten, Ltd, has a system under development in Plymouth, Michigan, that is designed to work at speeds under 40km/hr in stop and go traffic.

A likely consequence of the gradual insertion of these in-vehicle systems over the next 5 to 15 years is that the relationship between the driver and the vehicle will change in a very fundamental way, with the human's role gradually decreasing to at most steering, perhaps only requiring vigilance. Thus, we predict the driver will become more of a vehicle supervisor.

There are many other commercially available in-vehicle ITS systems in the US, two of which I will now briefly describe.

The first is an electronic payment system familiar to the Northeast part of the US and is associated with the E-Z Pass Interagency Group. This Group is most often identified with toll collection, and indeed, the E-Z Pass electronic toll collection system has six million toll tags in circulation, certainly one of the largest in the US. However, the E-Z Pass Interagency Group has broader interests in electronic payment than just toll collection. The E-Z Pass system is being used in a pilot test "at the drive-through windows at two McDonald's locations on Long Island, and the agency that oversees the system is studying whether to expand elsewhere, including gas stations and parking garages." (NYT, 25 Oct 01, p. D1)

Most of us have heard of OnStar, the General Motors subsidiary and GPS-based system that now has approximately 1.5M subscribers. What we perhaps aren't aware of is how the OnStar list of services continues to grow. The basic safety and security plan includes accident assistance, air bag deployment notification, roadside assistance, remote door unlock, remote diagnostics, and stolen-vehicle tracking. The premium service plan includes all safety and security plan services plus concierge services, route support, and recently Virtual Advisor, which allows the driver or a passenger to connect to the Internet.

Although many of us are familiar with OnStar, few of us are aware that millions of GM cars, and a smaller number of cars made by other US OEMs, on the road today are equipped with event data recorders. "GM started installing the data recorder, which is the size of a videocassette, in some car models in the early 1990's so that engineers could determine how the car's safety features, like activation of airbags, performed in a crash. More advanced devices were included in many 1999 models made by GM, recording some 16 different parameters, including vehicle speed, brake status, and gas pedal position five seconds before impact." (NYT, 25 Oct 01, p. D8) There are obvious, at least in the US, concerns over what could be viewed as an intrusion of privacy, although since 11 September this year, there has been "little support in the US Congress for tightening Federal privacy laws." (NYT, 25 Oct 01, pp. D1 and D8)

Where areas have toll facilities, electronic toll collection not only reduces delays to travelers, but also reduces the costs and security of counting coins.

What we see pictured above is:

- Part of the PikePass system, a statewide system in Oklahoma,
- And a transponder that is put on the windshield. The computer chip in the transponder stores account information. A “Fastoll” transponder from Northern Virginia’s Dulles Toll Road system is pictured.

In terms of toll collection efficiency, manual toll lanes can accommodate 350 to 400 vehicles per hour while an electronic toll lane peaks at 1,000 vehicles per hour. (Review of ITI Benefits: Emerging Successes, FHWA, Sept. 1996.)

Moving on to in-vehicle systems for commercial vehicles, while telematics and driver assistance systems are expected to make the private car travel quicker, safer, and more pleasant for the driver and passengers, reduced and highly predictable travel time is the essence of commercial fleet management and profitability. “The key to minimizing travel time is obtaining accurate, timely information. Automated fleet management systems aim to obtain, process, and transmit disparate pieces of data, such as maps, turn restrictions, weather forecasts, and traffic conditions, in order to find” not only the quickest route but the most reliable route. (L.E. Sweeney, “Dynamic Map Systems Make the Difference,” ITS World, May/June, 2001, pp. 10-11)

The truckload, or TL, segment of the US trucking industry has been a leader in using information technology to enhance efficiency and in turn profitability. A TL trucking company’s business is focused on moving large loads from origins directly to destinations without stopping at consolidation centers. Barriers to entry are very low in this segment of the industry, and as a result, the TL industry is very cost focused. Much of the movement of drivers and loads is unpredictable, and as a result, knowing where the assets are at any given time is a challenge. Approximately 65% of the power units in the TL industry are equipped with some sort of vehicle location and two-way communications capability. Roughly 85% of this market uses the OmniTRACS system, a mobile communications system owned by QUALCOMM that “provides satellite-based two-way data messaging, automatic vehicle positioning, and complete dispatch and back-office integration capabilities.” (ITS Access, “QUALCOMM Announces Shipment of Over 400,000 OmniTRACS Units,” 23 Oct 01) A recent UMTIP survey on technology use in the trucking industry indicates that trucking companies equipped with systems having such functionality, whether they are OmniTRACS units or their competitors, average roughly 22% more miles annually than trucking companies that are not so equipped. This represents a profound increase in fleet productivity.

Regarding other ITS systems that are focused on efficiency improvement, Elite Logistics, Inc., a company focused on telematics and asset management, has recently announced that it is teaming with Productive Data Systems, Inc., or PDS, to integrate “Elite’s Page Track telemetry systems with PDS’s suite of inventory tracking and database management software.” PageTrack can gather and communicate cargo status and GPS-based location information to PDS’s database systems,” thus, allowing a trucking company to play an expanded role in the supply chain. (ITS Access, 18 September 2001.) This is consistent with the trend that as many durable goods manufacturing firms have been downsizing and outsourcing, many trucking firms have been becoming more vertically integrated. A more detailed discussion of how the US trucking industry is becoming more vertically integrated can be found in one of the references presented in my written remarks. (Nagarajan, A., Canessa, E., Mitchell, W., and White, C. C., “The Economic Impact Of Internet – Usage In The Trucking Industry,” Proceedings of Conference on the E-Business Transformation: Sector Developments and Policy Implications, the Brookings Institution, 26-27 September, 2000.)

Real-time traffic information is now available for fleets in the US, as has been the case since last year in Europe, through a wholly-owned subsidiary of Trafficmaster Plc, Teletrac. Fleetstar is the name of the service, a location based fleet management system that periodically provides directional routing, route adherence, and other information. (ITS Access, 7 September 2001.) Research at the University of Michigan, supported by the Michigan Department of Transportation and based on real data, is showing that real-time traffic information is especially valuable during rush hour in Southeast Michigan, a part of the US with a high concentration of automotive assembly plants, producing expected reductions in total travel cost regularly in excess of 10%. This research project is expected to be completed, and the research results made available for general distribution, by the end of this calendar year.

“Collision avoidance is still largely futuristic in cars, but it’s been around for years on big rigs. Since 1994, Eaton Vorad Technologies, has equipped more that 10,000 trucks with collision-warning systems that alert the driver when the vehicle ahead is dangerously close. ... data collected over hundreds of millions of kilometers of highway service with these systems suggest that they reduce accident rates by as much as 70%. The Vorad system uses radar to detect objects up to 107 meters ahead, while other radars on both sides of the truck’s cab pick up objects in the blind spots alongside the vehicle.” (W. D. Jones, “Keeping Cars from Crashing,” IEEE Spectrum, September 2001, p. 44.)

Much of the interest at UMTIP since 11 September has been concerned with understanding the relationship between intermodal freight efficiency and security, analyzing the security threats and vulnerabilities to the trucking industry and more generally the businesses that move freight, and understanding the financial implications of all of this at the firm and industry levels. The is captured in large part by a recent headline in the Wall Street Journal (22 October 2001, p. A18), “When Just-in-Time Becomes Just-in-Case.” A burning question that we are confronted with is: can ITS, specifically some in-vehicle ITS systems that improve the freight information highway and enhance asset and cargo visibility, be an

enabler that enhances both efficiency and security in the intermodal movement of freight? Examples of such systems are electronic container seals, electronic nesting of cargo and assets, and asset and cargo tracking. This burning question is also being faced by the Intermodal Freight Technology Working Group, or IFTWG, a consortium of public agencies and private sector firms that we are coordinating with that share the common objective of developing a process to harmonize freight information technology in order to advance and improve the US's global economic competitiveness and its ability to meet security and other important domestic needs.

This brings to an end my prepared remarks. I would be delighted to answer any questions.

Thank you.