TECHNOLOGY TRANSFER

The Institute could not accomplish its goals without the transfer of its expertise and research results to local, national, and international audiences for use in real-world applications. Technology transfer also communicates to the world who we are, raising the profile of the Institute and its research, and serves to educate students, policymakers, and the general public about ITS issues and solutions.

Our efforts in this area are far-ranging in order to reach a broad and diverse audience of researchers, students, practitioners, policymakers, and others among the general public. Over the past year, we have provided tours and demonstrations of our research and facilities, sponsored seminars, published printed pieces, and maintained and updated our Web site. But perhaps the most direct method of transferring technology has been to send graduating students out into the workforce.

This section of the annual report highlights some of our technology transfer activities over the past year.

Institute technology heads north to Alaska

In 2003, the ITS Institute reached beyond the borders of Minnesota to share its expertise and technology with the Alaska Department of Transportation and Public Facilities. Researchers from the Institute’s Intelligent Vehicles Laboratory (IV Lab) received funding from the Alaska DOT to supervise the installation of driver-assistive systems on two Alaskan vehicles—a snowplow and a snow-blower truck. The systems were developed by IV Lab researchers with funding, in part, from the ITS Institute.

Alaskan transportation officials contacted the Institute regarding the suite of driver-assistive technologies integrated into the SAFEPLOW advanced snowplow. They hoped that Minnesota’s technologies would be able to help snowplow operators working in Thompson Pass, east of Valdez. This important transportation link is subject to heavy snowfalls that necessitate frequent snow removal operations under difficult conditions.

A number of vehicle-guidance and collision-avoidance technologies are integrated on the SAFEPLOW in order to address the difficult and dangerous driving conditions, such as near-zero visibility, that operators of specialty vehicles frequently face. These technologies include a head-up display (HUD), which allows drivers to “see” road markings via images projected onto a combiner mounted close to the windshield, and a driver’s seat that provides tactile warnings in the event of lane departure. [More information on the SAFEPLOW can be... ]
found on the Intelligent Vehicles Initiative’s field test Web page at www.its.umn.edu/research/ivifieldtest/.

Bryan Newstrom, a researcher with the IV Lab, spent three weeks installing and testing the system in Alaska during the winter of 2003–04. During his time there, he trained various Alaska DOT drivers to use the system. “They really liked it and thought it could be useful,” Newstrom said. Considering the similar cold-climate issues facing transportation system managers in Minnesota and Alaska, it seems likely that Institute research will continue to attract attention from other northern areas.

**UMD’s transportation program holds second annual research event**

The Northland Advanced Transportation Systems Research Laboratories (NATSRL) held its second annual Research Day on November 13 at Mn/DOT District 1 Headquarters in Duluth. A large crowd of faculty, students, transportation engineers, and others attended the daylong event.

Twelve project teams presented detailed updates on their research efforts as part of the research poster format added this year. Many of these presentations were given by students, who also answered questions on their specific roles in the projects along with the status of their findings.

Principal investigators gave a brief update on their research in the formal presentation sessions. Highlights included comments from Dr. Martha Wilson, UMD’s Mechanical and Industrial Engineering Department, on her snowplow modeling project. Dr. Taek Kwon, Electrical and Computer Engineering, gave a synopsis of his work in archiving data from Mn/DOT’s road sensors and in developing programs to efficiently access and share the data. Brian Brashaw, a timber and forestry specialist from UMD’s Natural Resources Research Institute, showed a video on the implementation of his research on non-intrusive means of performing inspections on timber bridges.

New research areas under NATSRL were addressed in the afternoon session. Drs. Mohammed Hasan and Fernando Rios-Gutierrez, Electrical and Computer Engineering, discussed their analysis of a sensor in surveying and detecting pavement conditions when ice or snow is present, and Dr. Ryan Rosandich, Mechanical and Industrial Engineering, gave a brief report on his initial work in developing a model to evaluate and quantify the risk in transportation construction project schedules. In addition, Roberta Dwyer, Mn/DOT District 1 engineering project manager, presented an update on Mn/DOT’s research agenda, tying the efforts in progress under NATSRL to current needs and applications within Minnesota’s state transportation program.
Institute featured as Minnesota hosts AASHTO conference

Several ITS Institute research facilities were offered as tour options for attendees of the American Association of State Highway and Transportation Officials (AASHTO) national meeting, held last September in Minneapolis. Conference attendees included state DOT, Federal Highway Administration, and industry representatives from across the country and abroad.

AASHTO conference participants also got a close-up look at some of the research underway at the University. About 20 people rode the TechnoBus—a specially equipped Metro Transit bus implementing advanced navigational and driver-assistive technologies—along the University’s transitway. The bus operated in tandem with SAFEPLow, another of the instrumented testbeds used by the Institute’s Intelligent Vehicles Laboratory, to demonstrate the use of the technology for gang-plowing operations. The TechnoBus riders could see the plow’s operation via live video wirelessly transmitted from the plow.

Other participants viewed an intersection on the transitway equipped with intersection decision support (IDS) technologies. The ITS Institute is part of a three-member national consortium that is creating deployable IDS systems to address specific intersection crash scenarios.

IV Lab technology evaluated for use in mining

In many open-pit mines throughout the world, productivity is often hampered by the presence of heavy fog or dust. Because of the large size of pit-machinery and the possibility of a machine falling off the edge into the pit, mine operations must shut down when visibility is poor. As a result, some mines operate at only 40 percent efficiency.

One manufacturer of heavy mine equipment has recently acquired the IV Lab’s head-up display (HUD) as a way to address low productivity. Due to the precision involved with mine operations, many mines operate high-accuracy (dual frequency, carrier phase) DGPS systems. This positioning capability, combined with high-accuracy geometric models of the open-pit mine, are used in conjunction with the IV Lab HUD to provide equipment drivers with a virtual display of the mine while driving in low visibility.

The manufacturer is currently undergoing simulator and in-vehicle tests to evaluate the feasibility of the system for this application. If initial trials are successful, the system will be tested and evaluated in a mine production setting.

The HUD, shown here on a vehicle at dusk, can help drivers “see” the roadway when low-visibility might otherwise obscure it.
The Institute’s IV Lab initially developed and tested the HUD in conjunction with other driver-assistive technologies to help snowplow drivers safely navigate and clear roads in “white-out” conditions caused by blowing snow.

Institute researcher involved in congressional discussion of homeland security

Professor Shashi Shekhar of the Department of Computer Science and Engineering was invited to present his recent work on evacuation planning at a congressional breakfast on homeland security held February 5 in Washington, D.C.

Among those in the audience were members of Congress and their staff as well as representatives from a number of federal agencies, including the National Geospatial Intelligence Agency, the National Security Agency, the U.S. Geological Survey, the Department of Homeland Security, the National Science Foundation, and the USDOT.

Shekhar provided an overview of evacuation planning, which identifies paths and schedules to move at-risk populations out of the city to safe areas in the event of terrorist attacks, catastrophes, or natural disasters. Its goal is to identify near-optimal evacuation routes and schedules to minimize evacuation time despite limited transportation network capacity and the possibly large at-risk population.

Finding the optimal solution is computationally exorbitant due to the large size and limited capacities of the transportation networks, Shekhar says. His research proposes novel geospatial algorithms to determine viable evacuation plans. Evaluation of his team’s methods for evacuation planning for a disaster at the Monticello nuclear power plant near the Twin Cities indicated that the new methods lowered evacuation time relative to existing plans by providing higher capacities near the destination and by choosing shorter routes.

Visiting researchers help foster strategic partnerships

Over the last year, the Institute continued to work with visiting researchers and instructors. Dr. Thomas Horan, an associate professor at Claremont Graduate University and visiting scholar at the Humphrey Institute of Public Affairs, is part of the Sustainable Technologies Applied Research (STAR) Initiative. Horan is doing research on wireless emergency management systems and telecommunication network planning and access in a rural context.

The Advanced Transportation Technologies Seminar Series provided an opportunity to host Dr. Bradford Parkinson, Professor Emeritus with the Department of Aeronautics and Astronautics, Stanford University, who presented, “The Origins, Status, and Future of GPS.”

The Institute also hosted two researchers from the international arena. Dr. Jeroen Keppens, research fellow from the Centre for Intelligent Systems and their Applications and the Joseph Bell Centre for Forensic Statistics and Legal Reasoning in Edinburgh, United Kingdom, presented a seminar on “Automating Abductive Reasoning for Diagnosis.” Professor Yoram Zvirin, faculty of

Other visiting researchers include Nobuyuki Kuge and Tomohiro Yamamura of Nissan and Erwin Boer of the University of California, who are working with the Institute’s HumanFIRST Program.

**Speakers address vehicle safety initiatives at annual event**

In March, Institute director Max Donath addressed attendees of the third annual ME (Mechanical Engineering) Day. From pioneering automotive crash tests to “smart” driver-assistive systems, vehicle safety research has a long history and a bright future at the University of Minnesota, he said. Donath, who played a leading role in organizing this year’s events, also noted that the development of new safety systems is an integral part of the ITS Institute’s mission, which focuses on using “human-centered technology” to enhance safety and mobility.

The event featured a lecture by Dr. Claus Ehlers of DaimlerChrysler AG, where he is senior manager of System Safety and Assisting Systems. Ehlers oversees a diverse research and development program that includes collision-avoidance, crash-mitigation, and driver-support technologies.

The lecture was followed by a reception and dinner during which Donath narrated a presentation on the groundbreaking work of James “Crash” Ryan, a member of the Mechanical Engineering faculty and an early leader in safety engineering for passenger cars.

**Institute research cited in national, local media**

Because such a vast audience can be reached by local and national media—be it print, radio, or television—coverage is a way to raise awareness about the Institute’s work and the value of research, as well as to give research results to those who can use that information.

The Institute has had a successful year of gaining media attention. The Institute’s research on intelligent decision support (IDS) systems was mentioned in a March 2 article in the *Wall Street Journal*. The article highlighted the use of intelligent transportation systems, in vehicles and as part of the infrastructure, for improving safety. The Institute’s IDS project seeks to reduce crashes at unsignalized rural intersections where traffic on low-volume rural collector roads enters a highway carrying high-speed traffic.

Local television news, as well as the Minneapolis *Star Tribune*, covered a seminar given by Institute researchers Gary Davis and Kate Sanderson, Civil Engineering, on their latest research on metro-area congestion (“Building Our Way out of Congestion?” Oct. 8, 2003).
Professor Rajesh Rajamani, Mechanical Engineering, was interviewed in October regarding his adaptive cruise control research for a segment on tailgating that ran on the local FOX news affiliate.

The September 15, 2003, issue of Inside ITS featured an announcement of the Institute’s grant from the USDOT and a brief interview with Institute director Max Donath about current research projects. Donath was also interviewed by Minnesota Public Radio regarding work on bus rapid transit.

Finally, research associate Kathleen Harder, who focuses on driver behavior research, was interviewed in August for a local NBC news affiliate story on aggressive driving. In addition, her simulations study related to changeable message signs and the AMBER alert system was profiled in a transportation column in the Star Tribune in September.

**Web, publications promote Institute work**

Improvements continued to be made to the Institute Web site over the past year. A new section was added to the research area to highlight projects in several significant areas, including ramp metering, rural intersection safety, simulation and modeling of traffic systems, and others. These topic areas are more specific than the core science and technology areas and are aimed at researchers, professionals, and graduate students with specific implementations in mind.

Web pages focusing on the Institute’s current work in intersection decision support (IDS) were created to promote this new project. Additional Institute-related news articles were added to the site, as well as coverage of the fall semester Advanced Transportation Technologies Seminar Series.

Circulation of the ITS Institute’s Sensor newsletter remained strong, at around 2,200—indicating continued interest in ITS research activities among academic and professional audiences. Other publications included a four-color brochure promoting the work and resources of the ITS Institute, a semiannual and annual report, and research reports.

All communications materials can be found on the ITS Institute’s Web site: [www.its.umn.edu](http://www.its.umn.edu).