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 designed 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 redesigned 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.

NATSRL Research Day showcases Duluth projects

The Northland Advanced Transportation Systems Research Laboratories at the University of Minnesota Duluth, in partnership with Mn/DOT District One, held its first annual Research Day in November 2002 to showcase ongoing work by UMD researchers. The event, which was open to the public, was held at the Mn/DOT District One Headquarters in Duluth.

The presentations highlighted the ongoing research activities of UMD faculty and students in the Electrical and Computer Engineering, Mechanical and Industrial Engineering, and Computer Science departments. Dr. Taek Mu Kwon presented a summary of his projects with Mn/DOT in computing traffic statistics and large-scale data archiving. Dr. Jiann-Shiou Yang, who specializes in traffic flow modeling and simulation, presented updates on his analysis of the Miller Hill Corridor traffic flow and his initial modeling efforts for Duluth Entertainment Convention Center special events. Dr. Stanley Burns is researching the effects on inductive loop detectors and the various vehicle signatures impacting data compilation.

Dr. Martha Wilson and Dr. David Wyrick are both working closely with Mn/DOT fleet operations. Wilson and her graduate students are modeling snowplow operations in northeastern Minnesota with a goal of improving efficiency and effectiveness of winter road maintenance activities (see related article, pages 18–19). Wyrick and his students are analyzing all aspects of managing and maintaining fleet operations and benchmarking the best practices.

Other sessions included a variety of new research endeavors initiated

University of Minnesota Duluth researchers participated in NATSRL's first Research Day.

From left: Robert Johns, Rep. John Kline, Max Donath, and Michael Manser view the HumanFIRST Program's driving simulator.

IV Lab researcher Pi-Ming Cheng, left, greets Rep. Martin Sabo during a tour of the TechnoBus.

this year, from advanced timber bridge inspection techniques to the utilization of satellite images for detecting and counting vehicles.

NATSRL is a cooperative program of UMD and the ITS Institute. It provides an education and outreach program to acquaint students with transportation-related problems and offers opportunities for students to actively participate in research areas.

Congressional staff, visitors view Institute labs and research

During the past year, the Institute has opened its door for tours and demonstrations of its laboratories and research projects. Visitors have included local and national government officials, legislators, and the general public, among others. These efforts give visitors a first-hand look at the work underway at the Institute, which in turn increases the Institute's visibility and support for its activities.

In December 2002, U.S. Congressman John Kline heard an update by ITS Institute director Max Donath about research being performed in the Institute's Intelligent Vehicles (IV) Laboratory during a visit to the Center for Transportation Studies. Kline then viewed a demonstration at the HumanFIRST lab by research associate Mike Manser.

In November, Donath presented an Institute briefing to Dick Larson (Congressman Gil Gutknecht's office), Katie Delmore (Congresswoman Betty McCollum's office), Louis Moore (Congressman Martin Sabo's office), Mark Matuska (Congressman Mark Kennedy's office), and Deven Nelson (Congressman James Oberstar's office), who were attending a Congressional staff day hosted by CTS. In addition, the staff saw demonstrations of the HumanFIRST Program by program director Nicholas Ward; the IV Lab and the TechnoBus intelligent vehicle by program manager Craig Shankwitz; and the ITS Institute Lab by lab manager Ted Morris of CTS and John Hourdakis of the Department of Civil Engineering.

Members of the Minnesota House of Representatives Transportation Policy and Transportation Finance Committees experienced transportation research in progress at the University during a visit in March. The TechnoBus, demonstrating the latest in high-tech navigational equipment, transported the legislators to and from the University, with a demonstration on the intercampus busway. The group also toured the HumanFIRST Program's facilities, which include a driving simulator that allows researchers to test driver response to various situations. University hosts included Max Donath, Nicholas Ward, and Lee Alexander, research fellow with the Intelligent Vehicles Lab.

In April, U.S. Congressman Martin Sabo toured the TechnoBus and HumanFIRST lab in conjunction with speaking at the CTS Annual meeting. Sabo recently left the House Transportation Appropriations Subcommittee to become the ranking member of the new Homeland Security Subcommittee.

Institute research, facilities showcased at ITSA

About 75 attendees of the 2003 ITS America national conference, held in Minneapolis in May, took part in tours and demonstrations of

Tours and demos give visitors a first-hand look at the work underway at the Institute, which in turn increases the Institute's visibility and support for its activities.

The Intelligent Vehicle Initiative's work with global positioning systems was part of a feature on the cable History Channel.

ITSA attendees toured the ITS Lab (above) and the HumanFIRST Program's facilities (below).

the ITS Laboratory, the HumanFIRST Program, and the Intelligent Vehicles Laboratory.

During the ITS Lab tour, participants viewed the lab's comprehensive simulation resources, wireless access to traffic imaging systems located along the I-94/I-35W commons area, and large-screen displays, including the Digital Immersive Environment, which uses the illusion of 3-D to allow users to step into a research digital-world environment.

While touring the HumanFIRST Program, participants observed its state-of-the-art driving simulator in action. This Virtual Environment for Surface Transportation Research, or VESTR, wraps around an instrumented Saturn vehicle. The simulator plays an important role in HumanFIRST research, which investigates driver acceptance and use of proposed new systems, as well as how those systems might produce undesirable driver responses and adaptation.

Another technical tour was given of the Institute's Intelligent Vehicles Lab, during which participants rode the TechnoBus, the latest addition to the program's research vehicle fleet. Along the route to the Minnesota State Fairgrounds, the bus traveled on the University's BRT-like intercampus transitway while the driver demonstrated the TechnoBus's haptic steering and virtual rumble strip technologies. At the demo area, participants could view the head-up display and feel the tactile feedback systems. The technologies were demonstrated in both a snowplow and a State Patrol vehicle. Among the tour participants was FTA Associate Administrator Barbara Sisson, who drove both the bus and the snowplow.

In addition to the tours and demos, at this year's conference the Institute once again joined with the Minnesota Guidestar program to create and manage an informational exhibit. Institute staff members were on hand to answer ITS-related questions and distribute Institute publications to the many visitors who stopped by.

IV Lab appears on History Channel

The Intelligent Vehicle Laboratory's work on global positioning systems (GPS) was part of a feature on the cable History Channel. Segments with BMW and General Motor's OnStar were also part of the show.

The segment featured the IV Lab's Intelligent Vehicle Initiative and BRT lane-assist projects. These projects increase safety for the drivers of specialty vehicles through the use of vehicle-guidance and collision-avoidance technologies. Led by ITS Institute director Max Donath and IV Lab director Craig Shankwitz, University researchers are developing and testing a variety of these technologies, including high-accuracy differential GPS.

The projects are funded by the Federal Highway Administration, Federal Transit Administration, Minnesota Department of Transportation, Metro Transit, and industry partners.

A History Channel crew worked with Mn/DOT, State Patrol, University of Minnesota, and Metro Transit staff to film a squad car, a snowplow, and the TechnoBus, all of which are equipped with centimeter-level GPS technology.

For the filming of the TechnoBus along state highway 252, the camera crew traveled alongside the bus to show it in traffic. On state highway 7 near Hutchinson, the crew filmed a re-enactment of a car chase

Television crews filmed IVI project vehicles for a feature on GPS.

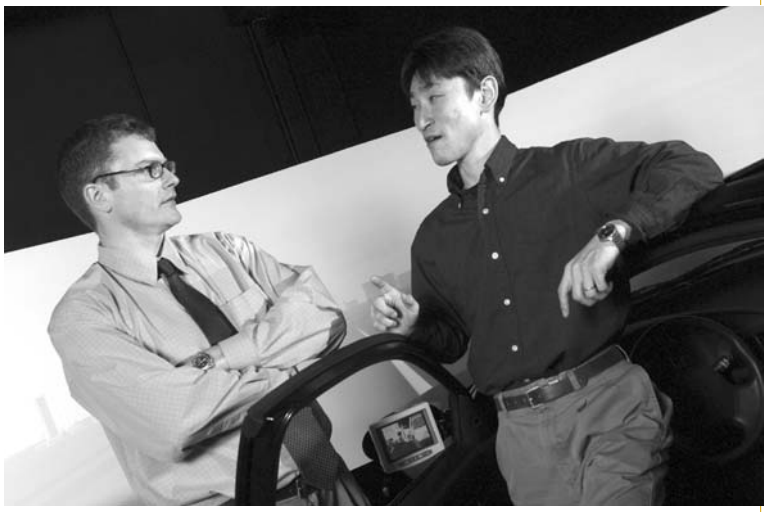
and repeated runs of the state patrol vehicle in operation.

John Scharffbillig of Mn/DOT, Jeff Goldsmith of the Department of Public Safety State Patrol, and Shankwitz were all interviewed for the segment.

Institute director presents seminars on DGPS and human-centered technologies

Institute director Max Donath presented the seminar, "DGPS-based Augmented Reality: 'Seeing' the Roads and Staying in the Lane," at the University of Washington last summer. About 30 students, faculty, and transportation professionals gathered to hear Donath discuss vehicle collision statistics, a head-up display of the local geospatial landscape, and prevention of lane-departure accidents. DGPS-based technology can greatly improve the safety of vehicles operating during a whiteout or in other low-visibility conditions. He described the USDOT's Specialty Vehicle Intelligent Vehicle Initiative, a field operational test being conducted to evaluate the system on snowplows and emergency response vehicles.

Donath also challenged participants to consider new human-centered technologies for reducing road fatalities at the CEO Forum on Safety, held at the Annual Meeting of the American Association of State Highway and Transportation Officials (AASHTO) held in Anchorage, Alaska, in October.



HumanFIRST director Nicholas Ward (left) with visiting scientist Nobuyuki Kuge

Visiting researchers help promote exchange of ideas

Visiting researchers often create a win-win situation by bringing unique skills and experience to a research program, then taking new knowledge back to the organizations they return to. The ITS Institute, therefore, does what it can to promote these mutually beneficial relationships.

Since October of 2002, visiting research fellow Nobuyuki Kuge of the Nissan Research Center in Yokosuka, Japan, has been working with the Institute's HumanFIRST Program on its intelligent driver-support system (IDSS) research with Nissan. Such a system would give drivers multi-sensory information in order to help them better control their vehicles and manage distractions that might lead to crashes.

The IDSS research is evaluating prototypes in a comprehensive manner in relation to safety enhancement, usability, ease of driving, and possible system-induced problems. During his year-long assignment with the HumanFIRST Program, Kuge hopes to help establish methodology in terms of the driver support-system evaluation, working with driving simulator experiments and data analysis.

"With ITS research becoming more and more active, how to measure driver cognitive aspects while using systems…[involving] work load, distraction, and adaptation remain hot issues," Kuge says. "I believe that my experience at the University can help improve my knowledge regarding these issues."

Kuge has been with the Nissan Research Center for the past 10 years, where he's involved with the research and development of ITS and telematics products. Examples of past projects he's worked on include

The IDSS research is evaluating prototypes in a comprehensive manner in relation to safety enhancement, usability, ease of driving, and possible system-induced problems.

an emergency braking advanced advisory system for the Japanese government and driver behavior analysis for adaptive cruise control.

Other collaborations with visiting researchers include those with Dick de Waard from the University of Groningen (the Netherlands), Jeff Caird from the University of Calgary, and Erwin Boer of the University of California, all of whom are working with the Institute's HumanFIRST Program. Associate Professor Thomas Horan of Claremont Graduate University serves as a visiting scholar at the Humphrey Institute of Public Affairs, where he is working with the Sustainable Technologies Applied Research initiative. In addition, Eil Kwon, the Institute's advanced traffic systems program director, helped facilitate research between Mn/DOT's Office of Traffic, Security and Operations and the University as he conducted work on urban traffic dynamics.

TechnoBus research covered in media

Articles on the Institute's TechnoBus appeared in both the Minneapolis *Star Tribune* and *St. Paul Pioneer Press*, as well as in the University's newspaper, the *Daily*, last fall. Coverage described in detail the lane-assist technology intended to help bus drivers safely navigate the freeway shoulders designated for bus use during rush hours. The prototype lane-assist system on the TechnoBus features laser and radar-based collision avoidance devices as well as a head-up display, a virtual mirror, and assisted steering to help keep the bus centered in its lane despite weather and road conditions.

Several other publications, including the *Fresno Bee* and the *Urban Transportation Monitor*, ran coverage of the technologies developed for the bus as well as for the IVI Lab's SAFEPLOW. Two international publications—*Traffic Technology International* and *ITS International*—ran articles featuring the Institute's research into intelligent vehicles, ramp metering, and simulation technology.

Coverage described in detail the lane-assist technology intended to help bus drivers safely navigate the freeway shoulders designated for bus use during rush hours.

Web, publications promote Institute work

The Institute continued to improve its Web site (www.its.umn.edu) over the last year. A restructuring and graphic redesign made the site easier to use and more attractive. The research section of the site was given a high priority, and the options available to users searching for research project information were expanded. Information on projects carried out prior to 1999 was also added to the site, increasing the amount of searchable information available online. Development of topical Web pages to pull together multiple related research projects was also initiated.

A new Web project was initiated during FY03, with the goal of presenting information directly from the Institute's research and administrative database directly on the Web. This will speed up the information posting process and bring new types of information to users. The project is slated for completion within 2004.

News articles on the ITS Institute Web site were also included in the Center for Transportation Studies' *Research E-News*, an electronic mail newsletter in HTML format, widely circulated within the transportation research community.

Other communications this past year continued to further the Institute's mission by raising awareness among academic and professional communities and by disseminating the results of Institute research as well. Publications included the Institute's quarterly *Sensor* newsletter, a source of detailed information on specific research projects; promotional brochures describing the Institute's Intelligent Vehicles program and ITS Laboratory; a semiannual and annual report; and research reports. All communications can be found on the Institute's Web site (www.its.umn.edu).