



# NIATT

**National Institute for Advanced Transportation Technology**

ANNUAL REPORT • AUGUST 2002



PREPARED FOR UNIVERSITY TRANSPORTATION CENTERS PROGRAM

RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION

U.S. DEPARTMENT OF TRANSPORTATION

FUNDING PERIOD JULY 1, 2001 THROUGH JUNE 30, 2002 - FY02



## THEME: ADVANCED TRANSPORTATION TECHNOLOGY

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### MISSION

Our mission is to work with industry, government, and research institutions to develop, evaluate, and market technologies that will improve the design and operation of transportation vehicles and systems.

### VISION

NIATT is a Center of Excellence for research and development of transportation technologies for the state of Idaho, the Pacific Northwest and Intermountain regions, and the United States.

- We educate and train university students and the professional engineering community in vehicle, infrastructure, and traffic control technologies.
- We assist the Idaho Transportation Department and other governmental agencies in meeting their responsibilities for the design, construction, and operation of transportation facilities.
- We work with industries and research institutions to develop and evaluate new transportation technologies and to bring these technologies to the marketplace.
- We seek collaborative research and development projects with the Idaho Transportation Department and other organizations.
- We work with university faculty to develop transportation research agendas and obtain funding for transportation research projects.
- We seek to educate the public about new transportation technologies.

Because of our geographic location, NIATT is able to serve a unique segment of the population. A number of other UTCs focus on transportation issues impacting metropolitan areas. NIATT, along with the regional University Transportation Center TransNow, serves the Pacific Northwest, where population centers are significantly smaller than in other parts of the country. With that in mind, NIATT's Center for Traffic Operations and Control chose to direct its research toward local government agencies and practicing engineers in medium to small cities with populations less than 150,000.

Much of the work completed by our Center for Clean Vehicle Technology relates to the area's environmental concerns of preserving national parks and other pristine areas, while continuing to provide for recreational uses of those same areas. We invest our research dollars in projects involved with alternative fuels and the next generation of vehicles in an attempt to protect and enhance communities and the natural environment affected by transportation.

*Cover photo: The Clean Snowmobile Team, left to right; Karen Den Braven, Principal Investigator; Todd Freeman, Patrick Hess (Team Leader), Carl Kerttu, Jon Pentzer, Nate Bradbury, Dana Wenstrom and Dan McNab, mechanical engineering undergraduates; Chris Dux, electrical engineering undergraduate. Absent from picture: Phil Auth (graduate student); and Mark Chin and Jeremy Hunter, mechanical engineering undergraduate.*



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The National Institute for Advanced Transportation Technology received a two-year green light on new funding for its research on national transportation issues and successful education programs in transportation engineering. NIATT was one of ten University Transportation Centers (UTC) in the nation to win approval for two additional years of grant funding at approximately \$1 million per year through the US Department of Transportation's Research and Special Programs Administration under the Transportation Equity Act for the 21st Century.

NIATT's success derives from an integrated research and education program. The program is based on national and local priorities that help protect the environment and improve operation of the nation's transportation system. Examples are clean vehicle technologies with reduced emissions and better efficiency, traffic signal and control technologies and training for transportation engineers who work on new technologies.

This *Annual Report* highlights NIATT's activities and accomplishments from July 2001 through June 2002 resulting from the University Transportation Centers Program.

To access this report on the Internet, please visit NIATT at <http://www.its.uidaho.edu/niatt>

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**credits:**

Michael Kyte  
Judy B. LaLonde  
Beth Case



**We create teams of undergraduate students, working with graduate students, mentored by expert faculty, to conduct research and develop products.**

## DIRECTOR'S MESSAGE

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Transportation education and research at the University of Idaho has increased dramatically since 1998, largely as a result of the University Transportation Centers grant. During the past three years, we have used the UTC investment of \$1.7 million to develop a comprehensive program of education, research, and technology transfer activities designed to produce needed and relevant technology products and to train the workforce of the 21st Century.

We increased the number of students, faculty, and staff in our transportation program from 78 in the base year to more than 150 in 2001-2002. We generated \$6.4 million in additional investments in our transportation program through new projects and infrastructure enhancements.

As a University Transportation Center, we have a distinct mission. We conduct research that leads to technology products. You will find that our faculty members are committed to purposefully integrating research and education. Not only must our research projects meet critical transportation needs, but we also place a high value on immersing our students in a practical, learning-centered engineering environment. We do not simply hire research scientists. Instead we create teams of undergraduate students, working with graduate students, mentored by expert faculty, to conduct research and develop products.

We are located in a region that prides itself on its mountains, lakes, rivers, and farmland, and where nearly three-quarters of the population lives in towns of less than 30,000 persons. Our faculty, staff, and students are strongly committed to protecting our natural environment. These values and priorities have been identified in our *Strategic Plan* as our primary areas of focus: clean vehicle technologies with reduced impact on the environment, traffic signal controller technologies for small cities, and training for new transportation engineers who work with these new technologies.

In this annual report, you will see many exciting examples of what UTC funding has made possible over the past year. A few of these include

- Our clean snowmobile, which captured first place in a national competition, is so clean that it has lower emissions than the average car that drives through Yellowstone National Park (page 24).
- Our Controller Interface Device (CID), which provides a real-time link between a traffic signal controller and FHWA's CORSIM traffic simulation model, has been licensed and is on the market (page 40).
- Our FutureTruck used 25 percent less fuel than the stock vehicle, produced the lowest emissions, beat the stock vehicle in acceleration, and towed the most weight during the trailer pull event at the Department of Energy's competition (page 27).

- Our Traffic Signal Summer Camp has been successful in attracting not only college students, but practicing traffic engineers, and will serve as a model for a clean vehicle workshop (page 30).
- Our work in new engine technology, conducting studies on a new catalytic igniter and the use of aqualytic fuel, has shown cost-effective ways to improve engine performance and reduce emissions, leading to additional funding (page 38).

In many ways, the proof of our success is not measured by numbers and dollars. It is about the impact that our program has on the people that we work with. It is about technology that will be used to improve our environment and the way we travel about our country. One of our partners tells our story best:

*I feel that a number of parties have benefited from this venture. Perhaps the students themselves gained the most. The CID project gave them the opportunity to turn theory into a real live product. They got a taste of what happens to a design when certain components become obsolete and replacements needed to be found to avoid a redesign. They learned engineering practices and standards used in the industry. They learned that a design needs to be practical and cost effective, yet of first class quality, in order to succeed in the market place.*

*Peter Kohl, Vice President for Business Development  
McCain Traffic Supply, Vista, California*

We have grown dramatically to become a significant contributor to the UTC program. We have been effective in maximizing and leveraging the UTC investment. We are pleased to have been selected for two more years of funding under the TEA-21 bill. We will continue to do what we are doing today because we are passionate about helping our region and nation solve important transportation problems. We welcome your comments and warmly invite you to visit our center, either in person, through our technical publications, or through our website.

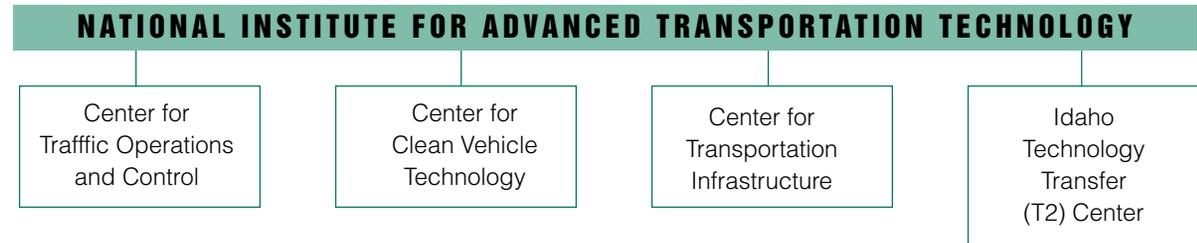
Respectfully yours,  
Michael Kyte  
Director

**In many ways, the proof of our success is not measured by numbers and dollars. It is about the impact that our program has on the people that we work with. It is about technology that will be used to improve our environment and the way we travel about our country.**

**As a University Transportation Center, we have a distinct mission. We conduct research that leads to technology products.**

## MANAGEMENT STRUCTURE AND PRINCIPAL CENTER STAFF

The National Institute for Advanced Transportation Technology (NIATT) is one of six research institutes on the University of Idaho campus. Institute status was granted to NIATT in July 1998 in recognition of its university-wide, multidisciplinary activities. The institute, originally known as NCATT, was established in 1991 under the Intermodal Surface Transportation Efficiency Act (ISTEA).



Although the University Transportation Centers (UTC) program primarily supports the work of NIATT’s Center for Traffic Operations and Control and the Center for Clean Vehicle Technology, the UTC funding has a positive impact on the entire institute and our ability to deliver transportation technology. UTC funds are supplemented from a variety of sources, including the Idaho Transportation Department, Idaho Department of Water Resources, the U.S. departments of Energy and Defense. The research in the Center for Transportation Infrastructure is supported mainly by the cooperative agreement between NIATT and ITD. The Idaho T2 Center receives major funding from the Federal Highway Administration’s Local Technical Assistance Program.

### Management staff

Michael Kyte  
 Director, NIATT  
 Professor, Civil Engineering

Donald Blacketter  
 Director, Center for Clean Vehicle Technology  
 Professor, Mechanical Engineering

Judy B. LaLonde  
 Assistant to the Director, NIATT

Betty Bennett  
 Financial Technician, NIATT

Douglas Moore  
 Director  
 Idaho Technology Transfer (T2) Center

Bruce Drewes  
 Training and Research Manager  
 Idaho Technology Transfer (T2) Center

Ruthie Fisher  
 Administrative Assistant II  
 Idaho Technology Transfer (T2) Center

Kathy Miller  
 Office Specialist

## NIATT AFFILIATE FACULTY

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Ahmed Abdel-Rahim  
*Visiting Assistant Professor, Civil Engineering*

Fouad Bayomy  
*Professor, Civil Engineering*

Steven Beyerlein  
*Professor, Mechanical Engineering*

Kang-Tsung (Karl) Chang  
*Professor, Geography*

Karen DenBraven  
*Professor, Mechanical Engineering*

Michael Dixon  
*Assistant Professor, Civil Engineering*

David Drown  
*Associate Professor, Chemical Engineering*

James F. Frenzel  
*Associate Professor, Electrical Engineering*

James H. Hardcastle  
*Professor, Civil Engineering*

Brian Johnson  
*Associate Professor, Electrical Engineering*

James R. Jones  
*Professor, Agricultural Economics/Marketing Economics*

James Kingery  
*Associate Professor, Range Resources*

Stanley M. Miller  
*Professor, Geological Engineering*

James R. Nelson  
*Professor, Agricultural Economics/Rural Sociology*



*NIATT is located in the University of Idaho's Engineering Physics Building.*

Richard J. Nielsen  
*Associate Professor, Civil Engineering*

Edwin Odom  
*Associate Professor, Mechanical Engineering*

Charles Peterson  
*Professor, Biological and Agricultural Engineering*

Kelly Sale  
*Lecturer, Computer Science*

Edwin R. Schmeckpeper  
*Associate Professor, Civil Engineering*

Judi Steciak  
*Associate Professor, Mechanical Engineering*

Richard B. Wells  
*Associate Professor, Electrical Engineering*

## ENVIRONMENTAL CONCERNS ATTRACT FRANK ALBRECHT TO CENTER FOR CLEAN VEHICLE TECHNOLOGY

**“When it came to research, if I could think it up, Frank would help me make it possible. I feel very fortunate to have had someone like Frank to always believe in me and help me reach my goals.”**

Scott Kahre, Intern



*Frank Albrecht*

UTC funds enabled the Center for Clean Vehicle Technology to hire Frank Albrecht as a research engineer. Under the direction of Dr. Donald Blacketter and Dr. Steve Beyerlein, Albrecht contributes to the long-range planning efforts of the center and has provided support to a variety of projects since March 2001. As he describes it, Frank helps integrate research for two technology platforms—an on-road future generation vehicle and an off-road vehicle designed for pristine areas.

Frank served as Team Advisor for the Advanced Vehicles Concept/FutureTruck team, directing the work of approximately 50 students who worked on some aspect of the FutureTruck project (page 27). Modestly, Frank praises the work of the students on the team, saying, “The team does it all.” But Frank’s efforts made it possible to increase the multi-disciplinary nature of the FutureTruck project, tie research to class projects, and transform a group of individuals into a cohesive team.

Over the summer of 2001, Frank wrote and presented proposals for integrating research into mechanical engineering classes. His proposals were accepted for use in five engineering classes using the FutureTruck as a platform. Four students in two mechanical engineering senior laboratory classes analyzed the vehicle’s aerodynamic characteristics and the energy use of engine-driven accessories. A senior design electrical engineering class of three students worked on the FutureTruck’s control system and a computer science student developed the telemetry system. Scott Kahre, an intern from chemical engineering, took a directed study technical elective class to test and analyze exhaust emissions. A Moscow High School student, James Russell, who had an extended learning internship, assisted Scott. Four students taking the mechanical engineering capstone design class developed the thermal conditioning system.

Frank carried his multi-disciplinary approach outside of the College of Engineering. Three students in the College of Business received class credits for conducting a cost analysis and Tara Tschauder, also from the College of Business, had an internship and received class credits for developing a marketing plan for the AVCT. A team of three students from the School of Communications received class credits for developing and implementing a public relations plan for the FutureTruck.

Following a 24-year Air Force career, Frank returned to school and earned a second BS degree in mechanical engineering. He also holds an MS in Systems Management. A member of the National Registry of Environmental Professionals, he holds the title of Registered Environmental Manager. Frank’s interest in minimizing the impact of development on the environment is behind his commitment to the Center for Clean Vehicle Technology, where he can help reduce the impact of transportation on the environment.

## MOORE TAKES REINS OF IDAHO TECHNOLOGY TRANSFER CENTER

Douglas R. Moore (BSCE, Oregon State University) accepted the position of Director of the Idaho Technology Transfer (T2) Center, one of NIATT's four centers, in August 2001. The T2 Center is part of the Federal Highway Administration's Local Technical Assistance Program (LTAP).

*"The search committee reviewed a number of highly qualified applicants for this position, and Doug turned out to be the top candidate," said Michael Kyte, NIATT Director. "Moore is a natural communicator who knows the engineering community throughout the state. In just a year's time, Doug established the trust of the major transportation agencies in the state of Idaho. They now look to him for leadership in transportation training."*

Moore is a civil engineer with more than 30 years of experience. Prior to accepting his position at NIATT, he was assistant engineer for the Idaho Transportation Department's District 2.

The T2 Center focuses on active, progressive, and cost-effective transfer of highway technology and technical assistance. The program is a direct, hands-on method for moving innovative transportation technologies out of the lab, off the shelf, and into the hands of the people who maintain our local streets and roads. The Idaho T2 Center maintains an active video library on everything from bridge maintenance and asphalt repair to road draining and traffic control. The T2 Center also assists in the transfer of technology developed at NIATT to practicing engineers.



*Doug Moore, director of the Idaho Technology Transfer Center*

“LTAP Centers are vital for delivering critical training for county engineers, highway superintendents, and road professionals. The National Association of County Engineers (NACE) would have no effective training programs without them. The bottom line is we need LTAP strong and active.”

Anthony R. Giancola,  
Executive Director, NACE

## NIATT FACULTY RESEARCHERS HONORED

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*Brian Johnson*

### **Brian Johnson Recognized as Outstanding Researcher**

Brian Johnson, Associate Professor of Electrical Engineering, was honored this year as the Department of Electrical and Computer Engineering Outstanding Researcher. Johnson has been the principal investigator in NIATT's Controller Interface Device Project since 1999 (page 40).

Dr. Johnson's areas of expertise include real time simulation of traffic systems, utility applications of power electronics and power system protection. He is a registered professional engineer in Idaho and Wisconsin and is member of the following professional societies: the Institute for Electrical and Electronics Engineers, where he was recently appointed as a member of the Ad Committee for the Intelligent Transportation Systems Council to represent the Industrial Electronics Society, the International Conference on Large High Voltage Electric Systems and the American Society of Engineering Education.

### **Karen DenBraven Honored by Society of Automotive Engineers**

Karen DenBraven, Professor of Mechanical Engineering, was commended by the Society of Automotive Engineers (SAE) for helping maintain the high quality of standards associated with SAE technical meetings. Dr. DenBraven received a 2002 SAE Oral Presentation Award for the presentation entitled "Making the Connection: The University of Idaho Clean Snowmobile." The basis of the award was the evaluation of her presentation by her peers at the SAE 2002 International Spring Fuels and Lubricants Meeting in May 2002 in Reno, Nevada.

DenBraven and her Clean Snowmobile Team captured first place in the SAE's Clean Snowmobile competition in March 2002 (page 24).

UTC funds support travel to presentations by principal investigators to help disseminate the results of NIATT research.

*Chuck Peterson with  
Michael Kyte*



### **Charles Peterson Receives 2001 National Park Partnership Award**

Agricultural Engineering Professor Chuck Peterson received the 2001 National Park Partnership Award for Environmental Conservation. This award is only one of two awards given nationally. Peterson was recognized for his work on the Yellowstone National “Truck-in-the-Park” project, in which a 1995 Dodge 4x4 running on 100 percent biodiesel completed 93,000 miles of testing as a park vehicle.

Peterson, along with peer panel review member John Crockett of the Idaho Division of Water Resources, are co-chairs for the Tenth Biennial Bioenergy Conference, “Bioenergy 2002,” scheduled for September 2002 in Boise, Idaho (page 44). Peterson has been conducting studies on alternative fuel made from yellow mustard as part of NIATT’s UTC research.



*Edwin Schmeckpeper*

### **Teaching Excellence Award Goes to Edwin Schmeckpeper**

NIATT researcher Edwin Schmeckpeper, Associate Professor of Civil Engineering, received \$2500 at the annual Faculty Excellence Awards Banquet in April 2002 as one of three UI faculty recognized for excellence in teaching. “The recipients of these awards have been selected by their peers and represent the best of the best,” said UI Provost Brian Pitcher.

Schmeckpeper is a proponent of active, collaborative learning. “In all courses, I try to instill in the students a desire for continuous life-long learning,” he says. Schmeckpeper makes a point to stop by the student lounge to chat during his breaks. He has taught at UI since 1992, and received his doctorate that same year from the University of New Hampshire.

His research, much of it supported by the Idaho Transportation Department, focuses on bridge construction.

“In all courses, I try to instill in the students a desire for continuous life-long learning,”

Edwin Schmeckpeper

# EDUCATION

## NIATT EDUCATIONAL PROGRAM INTEGRATED WITH RESEARCH

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NIATT offers a multidisciplinary program of coursework and experiential learning that reinforces its transportation theme. Program elements include:

- a strong educational program that provides undergraduate students and graduate students with a broad range of practical and real-life educational experiences in transportation;
- an undergraduate and graduate program in which students gain an appreciation for the environmental impact of transportation;
- a nationally recognized graduate research program in traffic operations and control and clean vehicle technology;
- a transportation engineering program that provides practicing engineers, especially those in cities of 150,000 or less, with a broader knowledge base and expanded opportunities for experiences in transportation;
- an undergraduate program that educates transportation engineers in intelligent transportation systems and related technologies, such as information processing, communications, control, and electronics;
- an undergraduate program that provides training for mechanical and electrical engineers in vehicle engineering; and
- the Idaho Technology Transfer Center, which is broadened in its responsibilities and a recognized provider of continuing education for practicing engineers.

Our research is supported by more than 100 students at the graduate and undergraduate levels. Student involvement in transportation research often begins with an internship, during which students work with faculty members on research projects. Our research supplements engineering course materials and is used to interest students in transportation engineering. All of our UTC-funded projects support graduate students seeking advanced engineering degrees.

*NIATT interns take part in strategic planning session. (left to right: Melissa Hanenburg, William Webb, Zhen Li (in background), and Justin Price).*



## NIATT INTERNSHIPS PROVIDE ENGINEERING EXPERIENCE TO UNDERGRADUATES

For the first time, summer internships were awarded to undergraduate students pursuing degrees in transportation technology-related areas. Richard Duldulao, a computer science undergraduate, worked with Dr. Brian Johnson on the UTC project developing the controller interface device. Kevin Young, civil engineering undergraduate, worked with Dr. Michael Dixon collecting traffic data and completing simulation runs. Dr. Ahmed Abdel-Rahim directed the work of Eric Skaugset, who helped develop and test an integrated simulation model for Ada County, Idaho. Tamara Cougar, mechanical engineering undergraduate, also worked with Dr. Abdel-Rahim completing freeway traffic and incident data analysis.

Eleven undergraduate students were actively engaged in NIATT research during the fall semester. This research often encourages students to enter graduate school. Ted Bush and Peter Graff, interns in the 01-02 academic year, received MS degrees in civil engineering in 2002. Jarrod Milligan and Phil Auth, interns in the same year, are currently pursuing their MS degrees.

Other students find the experience helpful when searching for a job. When Christina Ryan graduated in May 2002, her resumé included two internships, and she was hired as staff engineer for Holladay Engineering in Boise, Idaho.

Student interns receive up to \$1000 per academic year in hourly wages and gain practical engineering experience putting classroom theory into practice.

### INTERNS IN THE 01-02 ACADEMIC YEAR

Intern	Advisor	Project work
Scott Kahre	Dr. David Drown	emissions of FutureTruck 2002
Tara Tschauder	Frank Albrecht	marketing of FutureTruck 2002
Scott Anderson	Frank Albrecht	fundraising/publicity for FutureTruck
Yuri Merezczak	Dr. A. Abdel-Rahim	freeway incident management
Audra Wright	Dr. Michael Dixon	traffic control. training methods
Joseph Howard	Dr. A. Abdel-Rahim	ITS design
Brent Orton	Dr. Michael Dixon	traffic predictions
Christina Ryan	Dr. Fouad Bayomy	pavement management
Jennifer Poole	Dr. E. Schmeckpeper	corrosion of weathering steel
Rahim Abbasi	Dr. E. Schmeckpeper	investigations of cracking concrete beams

## STUDENT HONORS AND AWARDS

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### **NIATT Students Capture ASCE Trophy**

Intersection timing plans designed by University of Idaho transportation engineering students at the 2002 Pacific Northwest Regional Conference of the American Society of Civil Engineers (ASCE) earned them a first place trophy in April 2002. The University of Idaho student chapter hosted about 300 engineering students from Idaho, Alaska, Washington, Oregon, Montana and British Columbia at the ASCE annual competition. Competitions to design the most workable technologies in Steel Bridge, Concrete Canoe, Concrete Bowling, Surveying, Transportation and Environment.

In the transportation competition, teams had two hours to design a signal-timing plan for a race course with five intersections in a line. Students raced two remote-controlled cars, one coming from each direction, through traffic signals, attempting to minimize the travel time. The team was penalized if their vehicles entered an intersection on yellow or red or went outside the marked lanes. Two technicians from the Idaho Transportation Department served as judges. The team of graduate student Phil Rust and undergraduates, Rahim Abbasi and Andrew Staples, captured first place in the seven-team competition.

UI nearly swept the Steel Bridge competition, which was based on strength, construction speed, economy and structural efficiency. The team qualified for the national competition in Madison, Wisconsin, in June 2002. Placing 31<sup>st</sup> out of 44 competitors, the UI team took second place in speed and economy.

UI undergraduate student Rahim Abbasi, who won the regional Mead paper competition with his paper on Engineering Ethics, also attended the ASCE National Conference.

*Check out the ASCE regional conference website: [http://www.uidaho.edu/student\\_orgs/asce/2002conf/competitions.htm](http://www.uidaho.edu/student_orgs/asce/2002conf/competitions.htm)*

## **Bordenkircher a Key Member of Controller Interface Device Team**

Eugene Bordenkircher's ability to work with firmware—programming a microprocessor to control a system—is what makes him valuable to the Controller Interface Device (CID) project (page 40). Eugene said he was attracted to digital electronics because it was exciting to actually see the results of his work as compared to simply seeing numbers on paper. “You make one little change and you can see big results,” he explained.

During his studies, he met Dr. Brian Johnson, Associate Professor of Electrical Engineering, who recruited Eugene in his junior year to work on the CID project. In May 2002, Eugene received his BS in computer engineering and is continuing at the UI in pursuit of his MS degree.

As a result of his participation in the CID project, Eugene has been involved in traffic engineering events he couldn't have imagined when he started his undergraduate work. In January 2002, he attended the Transportation Research Board's annual meeting in Washington, DC. There, along with NIATT graduate student Zhen Li and Peter Kohl, National Sales Manager for McCain Traffic Supply, Eugene helped demonstrate the CID at an FHWA-sponsored booth.

In February 2002, Eugene and Zhen Li traveled to Vista, California, where the two of them held a training session for seven technical and sales representatives from McCain Traffic Supply. “The McCain people were impressed with the CID,” Eugene reported. Apparently, the group had low expectations of the results of college students and was “amazed” at the CID. It was “good looking and it worked; it wasn't a prototype.”

When asked for his opinion about the engineering program at UI, Eugene echoes what many students say—“I like the environment—it's open. I can talk to any professor at any time and I know them by first name.”



*Eugene Bordenkircher: “You make one little change and you can see big results.”*

“The group had low expectations of the results of college students and was “amazed” at the CID. It was “good looking and it worked; it wasn't a prototype.”

Eugene Bordenkircher, of his work with McCain Traffic Supply Representatives.

## STUDENT HONORS AND AWARDS

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### **NIATT Student Researchers Receive Recognition from College of Engineering**

At the May 2002 graduation ceremony for the University of Idaho College of Engineering, three NIATT students who worked on the Controller Interface Device project (page 40) were recognized as outstanding students. It would not be considered unusual for civil engineering undergraduates to be recognized for their contribution to a transportation research project, but at this ceremony, recognition for *three* outstanding undergraduates came from the University of Idaho's Electrical and Computer Engineering Department.

Jeremiah (J. J.) Remus received an award as the Electrical Engineering Outstanding Senior of the Year. J.J. will enter Duke University this fall as a Masters degree candidate. J.J. worked on the CID project during the first year of UTC funding.



*John Fisher, Electrical Engineering Outstanding Graduate Student of the Year*

Eugene Bordenkircher was recognized as the Computer Engineering Senior of the Year. Eugene, who is continuing at the UI as a graduate student, is presently working on the addition of serial data line communication (SDLC) capabilities to the CID (page 15).

John C. Fisher, recognized as the Electrical Engineering Outstanding Graduate Student of the Year. John, who will receive his Master's degree in Electrical Engineering this summer, worked on a system to analyze the real-time performance of the CID. John will enter Purdue University this fall as a Ph.D. candidate.

## **NIATT Students Repeat First Place Traffic Bowl Victory**

Graduate students Murali Basavaraju, Chhang Ream and Philip Rust, along with undergraduate Craig Dierling, upheld the reputation of the University of Idaho traffic engineering students by capturing first place in this year's Traffic Bowl. Eleven members of the UI student chapter of the Institute of Transportation Engineers (ITE) traveled to Portland, Oregon, in November 2001 for the Annual Traffic Bowl competition sponsored by the Oregon ITE Chapter. Last year's team took first place in the 2000 competition.

The Traffic Bowl can be compared to Jeopardy or Knowledge Bowl, except that all questions are related to transportation. "The students worked hard to prepare and it showed. It takes more than classroom knowledge to win the Traffic Bowl," said Mike Dixon, ITE faculty adviser.

Following the competition, students from the UI and five other universities visited traffic management centers at the City of Portland and Oregon's Department of Transportation, Portland's Transit Dispatch Center (Tri-Met), and the transportation engineering consulting firm of Kittelson and Associates.



*Traffic Bowl team, left to right: Craig Dierling; Chhang Ream; Murali Basavaraju; Phil Rust)*

## STUDENT HONORS AND AWARDS

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### **NIATT Graduate Student Recognized for Leadership**

Binu Abraham had already moved to Sacramento, California, where she is currently working for the transportation engineering consulting firm of DKS Associates when she learned she was being honored as one of three students to receive an International Leadership Award at the University of Idaho. Binu received a cash award at a ceremony in April 2002 during UI's Student Leadership recognition ceremony. The award was given in recognition of her contributions, not only as a student researcher, but also for her work on the Presidential Task Force on Parking, where she took an active role in helping design a new campus shuttle bus system. Binu was also an active member of the Graduate Student Association and the India Students Association.

At DKS, Binu is an Assistant Transportation Engineer. She is currently working on the Sacramento Central City Two Way Conversion Project, looking at the different options for the conversion of one way streets in downtown Sacramento to two way streets.

Binu used both her leadership abilities and forceful personality to convince her DKS coworkers to put together a team to participate in the Institute of Traffic Engineers (ITE) District 6 Western-Northern California Section Traffic Bowl Competition. Skeptical at first, members of the firm were quite pleased when they captured first place.

Binu started her graduate work at NIATT in 1999 working with Dr. Michael Kyte on the UTC-funded project, "Development of Video-Based and Other Automated Traffic Data Collection Methods." She was the recipient of the Dan Fambro Memorial Transportation Scholarship in 2001 and a scholarship from the Rocky Mountain section of the ITE.

*Alexander accepts Student-of-the-Year Award; left to right, Ms. Mary Peters, Administrator of Federal Highway Administration; David Alexander; Ms. Jenna Dorn, Administrator of the Federal Transit Administration; Miss Ellen Engleman, Administrator of US DOT Research and Special Programs Administration.*



## STUDENT HONORS AND AWARDS

### Alexander Accepts Student of the Year Award

David Alexander accepted the award for Outstanding Student of the Year at ceremony held on Monday, January 2002, at the 81st Annual Meeting of the Transportation Research Board (TRB) in Washington, D.C. Alexander received his PhD in Mechanical Engineering in May 2002. As a graduate student, he worked closely with the FutureTruck program, where he served as team leader in the data acquisition and modeling group for FutureTruck 2001 and 2002.

A native of Raphael, California, Dave earned his BS in Physical Science from California State University. He worked as an environmental consultant, developing environmental impact statements, before returning to school for an advanced degree in mechanical engineering at the University of Idaho. His MS thesis focused on designing a hands-on mechanics of materials laboratory course for distance education.

Dave's doctoral research focused on developing mathematical algorithms to solve engineering design problems and applying algorithms to software for modeling hybrid electric vehicles. He was supported by UTC funds for NIATT's Vehicle Simulation project. His hybrid vehicle modeling software has been used to design and analyze vehicle modifications for NIATT's hybrid electric FutureTruck.

Dave has also contributed to the FutureTruck research, interfacing a global positioning system with a programmable logic controller to monitor vehicle energy use, developing a test procedure to evaluate the effects of design changes, and using the chassis dynamometer to determine fuel efficiency and emissions.

Dave presented a paper and poster at the National Renewable Energy Lab's ADVISOR (ADvanced Vehicle SimulatOR ) Users Conference in Costa Mesa, CA, in August 2000 entitled "A Logic-Based, Performance-Driven Electric Vehicle Software Design Tool." He co-authored a paper submitted to the Society of Automotive Engineers describing the FutureTruck 2001 hybrid electric vehicle design concept.

NIATT was pleased to select Dr. Alexander as its Outstanding Student of the Year.

**"I had the opportunity to present my research progress to NIATT faculty and advisors at annual meetings. This was tremendously helpful in preparing and presenting technical information for critical review. NIATT faculty were also instrumental in defining research goals and objectives during the development of my research topic. Students and faculty affiliated with NIATT work closely in a team environment to ensure that research goals are met and in a timely manner. Without the support of NIATT, I would not have completed my Ph.D. within three years, nor would I have developed as strong of a support network as I did."**

David Alexander,  
NIATT Student-of-the-Year

## SCHOLARSHIPS AWARDED

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### **Douglas P. Daniels and Dan Fambro Memorial Scholarships**

Both Melissa Hanenburg and Philip Rust received two scholarships each during 2001, recognizing their interest in transportation engineering and their academic achievements. Melissa and Philip were recipients of Douglas P. Daniels Scholarships, awarded yearly by the Coral Sales Company of Milwaukie, Oregon. The Idaho Chapter of the Institute of Transportation Engineers (ITE) chose Melissa Hanenburg as its annual scholarship winner and Phil Rust was awarded the Dan Fambro Memorial Transportation Scholarship.

Melissa Hanenburg's internship at JUB Engineers in Hayden, Idaho, in the summer of 2001 piqued her interest in transportation engineering. While an intern, she noted that city engineers were not only active in design work but also in making "crucial decisions about their city's fate." A senior civil engineering student, Melissa will begin working towards her MS in the fall of 2002.

In his second year of his MS program, Phillip Rust already has an impressive resume. In the summer of 2001, he had an opportunity to work on projects involving traffic operations and ITS design as an engineer-in-training at Six Mile Engineering in Boise. He is currently doing research on two NIATT projects that combine components of both of those areas. NIATT sent Phil and two other student's to a three-day training program on ITS communication standards sponsored by ITS Washington in cooperation with the Institute of Transportation Engineers.

Phil attended NIATT's first Traffic Signal Summer Camp as a graduate of Washington State University, assisted at the second, and plans to work at the third. In the summer of 2002, he is working for the Federal Highway Administration. Phil has been an active member of the UI ITE student chapter and was on the winning Traffic Bowl team in November 2001.

## Road Builders Clinic Scholarship

The 2002 Road Builders Clinic Scholarship went to Eric Cronin, a junior in civil engineering. Eric is a member of the National Society of Collegiate Scholars and of the Phi Eta Sigma and Tau Beta Pi Engineering Honor Societies. Eric's interests in transportation engineering stem from a love of traveling. "What interests me the most," he wrote in his scholarship application, "is the number of factors that must be taken into consideration in the planning and

construction of a road system." Eric is getting a chance to learn more about planning as he works on an ITS deployment project for Ada County, Idaho, with Dr. Ahmed Abdel-Rahim.

Eric received his award at the annual Road Builders' Clinic held in Coeur d'Alene, Idaho. Phil Rust, Chunyu Lu and Sai Kumar, three NIATT research assistants, also attended the conference.

## ITE STUDENT CHAPTER HAS ACTIVE YEAR

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The UI student chapter of the Institute of Transportation Engineers' field trip to Salt Lake City in April 2002 brought the academic year's activities to a close. Seventeen students had a firsthand look at the improvements made in Salt Lake to accommodate the 2001 Winter Olympics. The students learned about intelligent transportation systems improvements that helped the Salt Lake City mass transit deal effectively with the increased traffic from Olympic athletes and visitors.

Arrangements were made for the students to view the Olympic stadium and other games structures, the design and reconstruction of I-15 and the Church of the Latter Day Saints Conference Structure.



*NIATT students get a look at Salt Lake City's light rail system.*

## UTC FUNDS USED TO UPGRADE EDUCATIONAL FACILITIES

The Center for Clean Vehicle Technology can now boast of a small engine test laboratory for its educational and research projects. The test laboratory has been developed in a space set aside when the Gauss-Johnson Laboratory was completely renovated by the University in 2000.

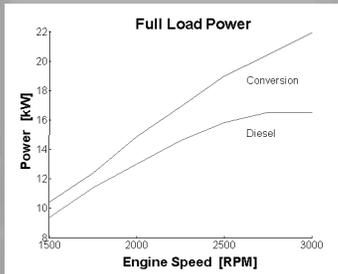
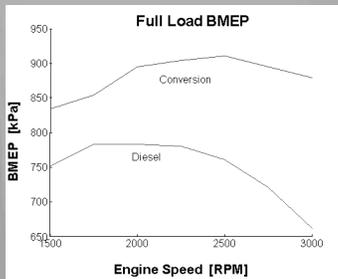
The first addition to the lab was a five-gas analyzer, purchased with UTC funds. A Fourier Transform Infrared Reanalyzer (FTIR), donated by Micron Corporation, was added. The five-gas analyzer serves well as a mobile platform. Both pieces of equipment are used to analyze emissions in small engines running on the alternative fuels developed in NIATT research and from the modified engines (page 38).

Two water brakes, or dynamometers, were added to the engine lab this year. Using a computerized data-acquisition system, student researchers can control input to the engines, modifying variations in throttle and load. For example, the horsepower required by an engine to drive a vehicle uphill compared to the horsepower required to drive downhill differs greatly. Both scenarios can be simulated on the dynamometers. Using the computer, the student researchers can also monitor the engines' outputs—power level, emissions, fuel consumption, combustion pressures and general performance.

A fuel flow meter installed this year permits instantaneous measurement of real-time fuel flow. When a modification is made to a small engine being tested, the change in fuel consumption and efficiency can be measured immediately. All testing is done from an engine control room where the throttle and load control, and data collection are done remotely, eliminating a safety risk.

A final addition to the lab this year was a snowmobile chassis dynamometer for use in the clean snowmobile project (page 23).

The facility not only provides accurate, usable data for NIATT research, but also can be used for engineering classroom projects.



*The dyno facility is able to control load and throttle position while recording data on engine performance. The upgrades system increases precision in engine testing and is used to measure improvements of modifications. Shown are a comparison of a stock diesel Yanmar and one converted for water-ethanol use.*

## IDAHO ENGINEERING WORKS SHOWN TO SUPPORT DEVELOPMENT OF PROFESSIONAL SKILLS

Dan Gerbus, PhD candidate and former NIATT Student-of-the Year, conducted a series of surveys to evaluate the effectiveness of Idaho Engineering Works, an innovative model for developing leadership skills in future engineers using continuous peer-to-peer training, customer communication, ongoing dialogue about personal/professional development, and commitment to excellence in the context of an engineering program.

Sixty-four current members and IEWorks alumni, mechanical engineering faculty, mechanical engineering seniors and alumni participated in the study. Each group was given a distinct survey with unique questions related to job experience, graduation and the participant's background. However, all surveys asked the participants to identify four important professional skills and discuss how IEWorks affects the development of those skills.

From the on-campus surveys, Gerbus determined that current and past members found that involvement in the group tended to improve GPA performance and strengthen research skills. The professional skills identified by the current and past IEW team members matched those cited in literature. The members noted that IEWorks had a positive effect on skill development.

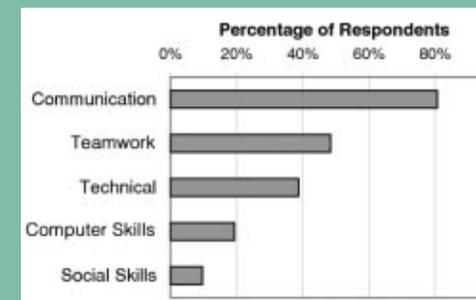
Gerbus's paper, "Improving the Professional Skills of Engineering," was accepted for presentation at the 2002 American Society of Engineering Educators (ASEE) annual conference in Montreal, Canada and is available on the ASEE website at <http://www.asee.org/>.

After the presentation in Montreal, Gerbus discovered, when talking with attending faculty and graduate students, that the nature and purpose of IEWorks/IEW as a team appeared difficult for others with varying frames of reference to understand. "Few grasped the IEW concept. We had similar findings from the UI faculty surveys conducted on campus. They tend to identify IEW by the tasks that we perform, i.e., Senior Design mentors or machine shop supervisors. But to us, the tasks are more of a means than an end. Through the tasks we strive to develop skills not directly addressed in a typical engineering education such as team dynamics, interpersonal communication, and self confidence."

NIATT researchers in the Center for Clean Vehicle Technology consider these skills, typically identified as "soft," to be an integral part of the engineering experience. That is why Steve Beyerlein, UTC researcher and IEW faculty, is involved with a program for Curriculum and Assessment for Senior Design with TIDEE (Transferable Integrated Design Engineering Education). TIDEE is a regional coalition concerned with transferability of design courses between community colleges and universities in the Northwest and is supported by funds from the National Science Foundation. Beyerlein is also involved in a NSF grant project with Don Elger, Professor of Mechanical Engineering, under the Course, Curriculum, and Laboratory Improvement Program, to improve engineering education at UI.

**"We strive to develop skills not directly addressed in a typical engineering education such as team dynamics, interpersonal communication, and self confidence."**

Dan Gerbus  
IEW Mentor



*Top professional skills identified by current IEWorks members.*



*NIATT's clean snowmobile gains  
"King of the Hill" status at 2002  
Clean Snowmobile Challenge*

**"It's all about education.**

**The event provides students with real-world challenges and requires them to work as a team to find solutions. This gives them valuable experience that today's corporations are looking for in their workforce"**

Dan Ableson,  
SAE Foundation President

## CLEAN SNOWMOBILE TEAM CAPTURES FIRST PLACE IN NATIONAL COMPETITION

The University of Idaho is "King of the Hill" when it comes to designing a clean-running snowmobile. The UI's Clean Snowmobile team took first place overall, four trophies, and \$10,500 in prize money in March at the Society of Automotive Engineers (SAE) Clean Snowmobile Challenge (CSC) held in Jackson Hole, Wyoming. The competition is designed to give students throughout the US and Canada the opportunity to further snowmobile technology while gaining valuable design experience.

The clean snowmobile project supports NIATT's efforts to develop and demonstrate environmentally friendly recreational vehicle technologies and, like the FutureTruck (page 28), illustrates how education is linked to UTC-funded research projects. The number of students participating in the Clean Snowmobile group doubled from 7 in the first year of the competition to 14 in the second year. The CSC provides an excellent opportunity for the students to interact with a variety of professionals. They deal with snowmobile manufacturers during the design and construction phases of the project. Governors and legislators attend the competition and interact with the students. Others in attendance include representatives of the National Park Service, the Environmental Protection Agency, the US Department of Energy, state departments of environmental quality, and recreation officials and members of the International Snowmobile Manufacturers Association and other business associations.

The University of Idaho was selected by the SAE as one of 15 participants in the Second Annual Clean Snowmobile Challenge (CSC). The event was organized by SAE three years ago when the National Park Service began considering imposing a ban on snowmobiles because of the noise and air pollution. One goal of the competition is to develop cleaner and quieter snowmobiles and perfectly matches the goals of NIATT's Center for Clean Vehicle Technology. Other goals are to maintain performance and to give students design experience.

"The Idaho team really did their homework. Last year they failed the competition's noise test and finished fifth overall. This year they were shining examples of what development and planning can do in an engineering competition. They should be very proud of what they accomplished," said Dr. Lori Fussell, CSC2002 organizer. Fussell, event co-founder explains the SAE view of the competition this way: "Engaging students to utilize innovation and technology in making sleds that are more environmentally friendly is what this competition is all about."



## Clean Snowmobile Cleaner Than the Average Car!

Because the Clean Snowmobile Team used a BMW 750cc motorcycle engine in an Arctic Cat, with electronic fuel injection and a catalyst, their victory was featured in BMW's Motorcycle Owners of American (MOA) monthly publication (July 2002). Following the MOA president's suggestions for running the engine at high altitudes, the team used a gas analyzer to tune the snowmobile to operate more efficiently at the 7,000-foot altitude at Jackson Hole.

The team started with a "rolling chassis"—a sled without an engine—and chose the four-stroke BMW engine, rather than the typical two-stroke, to reduce pollution and noise and to improve fuel economy. The main disadvantage of a four-stroke engine is its comparatively heavier weight. The team compensated by mounting the engine as low and far back under the hood as possible. Even in very snowy and windy conditions, the UI snowmobile got 19 mpg, the best in the competition. The stock snowmobile, with a two-stroke engine, only got 12 mpg. That's a 56 percent improvement in fuel economy.

The snowmobile's drive train was refined to reduce power losses from the engine to the snow, and attention was given to reducing its sound and emissions. The UI snowmobile is cleaner than the average car that drives through Yellowstone National Park.

Because of their victory in the SAE CSC, the clean snowmobile team was invited to take the vehicle to the Southwest Research Institute in San Antonio, Texas, where detailed emissions testing was completed. The NIATT snowmobile was the cleanest student snowmobile tested—it was also cleaner than all the commercial snowmobiles tested at SRI.



*Visitors inspect the BMW engine on the clean snowmobile at the UI 2002 Engineering Expo.*

**“Use of a catalyst can further reduce snowmobile emissions. The University of Idaho CSC 2002 sled, which incorporates a 4-stroke, closed-loop controlled engine with catalyst, generated the lowest emissions of all sleds [including commercial sleds] tested.”**

Laboratory Testing of Snowmobile Emissions, Report SwRI 08.05486, San Antonio, TX: Southwest Research Institute, July 2002.

“My special congratulations to all the members on this outstanding achievement. I am certain that your success in this competition was the result of great diligence and perseverance. You can be proud of your achievements that represent hours of hard work. This type of commitment and dedication will help you in successfully setting and attaining your goals through the rest of your lives.”

Dirk Kempthorne, Governor, State of Idaho

**NIATT Clean Snowmobile:**

**1st Place Overall**

**Best Performance Winner**

**Best Design Winner**

**Best Fuel Economy Winner**

**Hill Climb Champion**

**Taking Technology to the Classroom**

Dr. Karen Den Braven brings the snowmobile project into the classroom. For the second year, she taught a four-credit one-year technical elective mechanical engineering class that focuses on snowmobile designs that reduce environmental impacts. Technical electives are an important part of the mechanical engineering curriculum, fostering the development of creative ability in design and synthesis of components and systems. There were also two senior laboratory projects—one measuring fuel consumption and one measuring pollution emission.

<b>CSC 2002 Results</b>									
	Best Performance	Best Emissions Economy	Best Design	Best Fuel	Quietest	Most Practical	Best Value	Total Points	Final Ranking
Colorado State University	Not Eligible	401	Not Eligible	0	0	9173.0589	2565.4194	731.04542	3
Colorado School of Mines	Not Eligible	0	Not Eligible	0	0	0	3585.9721	260.29023	12
Michigan Technological University	Not Eligible	0	Not Eligible	0	0	0	859.02235	280.1352	10
University of Waterloo	Not Eligible	208	Not Eligible	0	0	7218.6481	1302.9275	429.28581	8
Minnesota State University	Not Eligible	0	Not Eligible	0	0	0	63.01617	103.47761	15
University at Buffalo, SUNY	Not Eligible	311	Not Eligible	0	0	294.7647	127.36707	603.6407	4
University of Idaho	189.242	383	194.93939	200	97.950188	15056.334	14533.278	1171.437	1
University of Alberta	Not Eligible	278	Not Eligible	0	0	5322.1606	742.1189	506.7874	5
Clarkson University	Not Eligible	0	Not Eligible	0	0	0	3086.1314	308.61615	9
Kettering University	184.637268	332	191.25909	144.698	200	21965.003	16694.032	1168.882	1
University of Wyoming	Not Eligible	0	Not Eligible	100	0	0	13750	499.4697	6
University of Alaska Fairbanks	Not Eligible	0	Not Eligible	0	0	0	0	190.99667	13
Idaho State University	Not Eligible	0	Not Eligible	0	0	0	4280.4079	265.09651	11
University of Wisconsin, Madison	Not Eligible	0	Not Eligible	0	0	0	1625.3583	137.42784	14
University of Wisconsin, Platteville	Not Eligible	0	Not Eligible	103.33467	0	0	4595.5673	451.4633	7

## FUTURETRUCK PROJECT: PRACTICAL TRAINING IN VEHICLE ENGINEERING

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A total of 50 students made up the multi-disciplinary Advanced 2002 Vehicle Concepts Team (AVCT), the backbone of NIATT's FutureTruck entry in the national competition sponsored by the U. S. Department of Energy. The four-year challenge allows the next generation of innovators to help better manage a world energy and air pollution problem. This year, student engineers converted a 2002 Ford Explorer to meet competition as well as urban driving performance standards with low- to zero-emissions.

Twelve undergraduate team leaders directed activities of the AVCT, functioning as if they were company managers tasked with the challenge of rapidly developing a revolutionary vehicle. Two graduate students focused on particular mechanical design and modeling areas. Another 12 undergraduate volunteer students spent precious evenings and weekends dismantling the entire vehicle to a bare shell, fabricating components, integrating all the hardware and software into a functional vehicle, and finally testing the finished product before competition.

Twenty-four students from a variety of departments and colleges on the UI campus varying from architecture to marketing, from environmental science to chemical engineering, completed the team, serving as "specialists" in their fields. Many of these 24 students will likely not be entering a transportation field after graduation, but by participating in this research project, they learned to appreciate the science and engineering involved in attempts to create a cleaner environment by exploring alternative modes of transportation.

*FutureTruck leaders take a break from planning.*

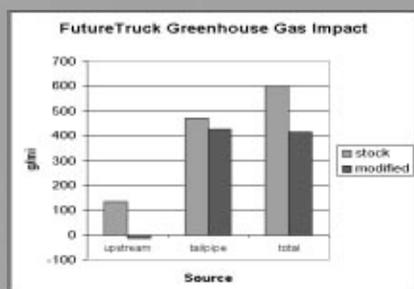


“As a Ford FutureTruck Steering Committee member, a 2000 graduate from the UI Mechanical Engineering department, and a former FutureTruck participant, I am proud to say that Idaho’s team is well deserving of any support necessary to continue the success of NIATT and the Advanced Vehicle Concepts Team.”

Damon Scott, Ford Motor Company, Product Development Engineer



*The UI FutureTruck navigates in the competition's slalom event.*



*The total fuel cycle Greenhouse Gas emissions from the modified version of the FutureTruck met predictions and were far less than those of the Stock Vehicle. This is primarily due to the negative upstream Greenhouse Gas emissions caused by the uptake of CO<sub>2</sub> by the plants that are grown to produce ethanol.*

## 2002 FutureTruck Takes First in Towing Event

The University of Idaho's FutureTruck placed 7th overall in the 2002 FutureTruck Challenge, which took place over two weeks in June 2002. The NIATT vehicle, "Summit," used 25 percent less fuel than the stock vehicle, produced the lowest emissions, beat the stock vehicle in acceleration, and towed the most weight during the trailer pull event. Its hybrid electric system worked as designed with both power assist on acceleration and braking.

The competition, involving 250 student engineers, began at Ford's Arizona Proving Grounds where the vehicle was put through safety, on-road fuel economy, acceleration, trailer tow and off-road testing. The UI's modified Ford Explorer was the only Northwest entry in the nation to demonstrate how it can more efficiently perform and still be environmentally friendly. "Summit" was one of only three entries to attain the ultra-low emission vehicle (ULEV) standard. Think of it as taking a big step toward a "cleaner and greener" automobile—by a sport utility vehicle, no less!

The UI team also beat the stock Explorer in acceleration time (12.037 seconds) in the 1/8-mile acceleration event (11.757 seconds, just .519 seconds less than the first-place team). During the acceleration event, the vehicles are checked for how much "take-off power" they can demonstrate. Testing the acceleration of these modified Explorers is important, because the ability to pass and merge onto freeways are still two big pluses for consumers when it comes to buying wheels. During this event, the vehicles ran one at a time down a 1/8-mile straight course. The elapsed times were measured using photocell-based timing equipment, and trap speeds at the end of the run were recorded by radar.

As one of the five best-running vehicles, the UI students were asked to take slow laps around the Proving Ground racetrack to provide publicity shots. Following that, the team asked permission to do high-speed laps, and reached speeds in excess of 80 mph. Despite this grueling trial in temperatures in excess of 100 degrees, the vehicle never broke down.

The fifteen teams traveled to Riverside, CA, for events measuring consumer acceptability and innovative technical and design elements, and then to Santa Monica for the Awards Ceremony held in the grand ballroom of the Regent Beverly Wilshire hotel. The NIATT team and their modified 2002 Ford Explorer received a monetary award for innovative use of aluminum and the first place trophy for the trailer tow portion of the contest. In the three-stage towing event, a "tow dynamometer" was attached to the vehicle, simulating pulling a 2000-pound trailer up a 5 percent grade.

The team was also proud to capture third place in the oral presentation portion of the competition. According to Frank Albrecht, Scott Kahre, a sophomore in chemical engineering, gave an "amazing" 15 minute presentation, after which he and Doug Welling, the team leader, answered questions.

## Improvements to the Vehicle

Modifications made to the Ford Explorer by the team include

- Internal engine modifications to improve thermodynamic efficiency
- Passive cooling system to eliminate the engine-driven fan and water pump
- Hybrid electric drivetrain
- Improved interior thermal management using less energy than conventional air conditioning systems
- Controls strategy using National Instruments products
- Solar panels on the roof to provide additional electrical power to keep the batteries charged

A hybrid-electric powertrain employs a small electric motor coupled to the front of the modified V6 engine along with a generator array for regenerative braking and a bank of lead-acid batteries for energy storage. A computerized control commands the generators to capture energy during braking, stores the energy in the batteries, and then commands the electric motor to assist the engine during acceleration. A dual voltage electrical system utilizes 12 volts for energy devices and 36 volts for high-energy devices, such as the generators and electric motor.

The instrument panel in the vehicle includes a touch screen display, which is the sole operator device for information, control and entertainment. A telemetry system allows two-way communication with the vehicle, providing system status reports, performance of diagnostics and warning systems. It provides Internet access, as well. Integration of control and telemetry functions provides unlimited capabilities for improving safety and convenience.

<http://www.idahofuturetruck.org>



*"If you've ever tried keeping up with highway traffic in an old 4-cylinder that has bad tires and a tank full of low-octane gasoline, you have some idea of what the teams are up against pulling this kind of load in an experimental hybrid-powered sport utility vehicle, no less!"*

*<https://www.futuretruck.org> (Official FutureTruck site)*

**"The FutureTruck's passive cooling system kept the truck cool even in the grueling 100° temperatures. In comparison, the winning vehicle was towed back to the pits three times with cooling problems. The thermal coatings around the UI vehicle kept the inside of the vehicle relatively cool."**

Frank Albrecht, Team Adviser

*Financial support also provided by  
Ed and Mary Schweitzer  
Parker Ford Nissan, Moscow, ID  
Ford Motor Company  
U.S. Department of Energy  
Governor's Ethanol Coalition  
Idaho Department of Water Resources  
National Instruments*

## TRAFFIC SIGNAL SUMMER CAMP: SO THAT'S HOW A TRAFFIC CONTROLLER WORKS!!

**“I would recommend this program to any of my classmates who want more exposure to traffic engineering, or even young colleagues in the profession who are wanting to have a better understanding of traffic engineering.”**

Mitchell Bartelt  
Graduate student  
Michigan State University

Jason Deweber says he got interested in traffic engineering by sitting at intersections, waiting for red lights to change. Now this 21-year-old from Memphis, Tennessee, sees his career goal as making sure others do not spend too much time at intersections. “It just makes everyone’s day that much better,” he says.

DeWeber was one of 12 students from around the country who attended NIATT’s weeklong Traffic Signal Summer Camp (TSSC) at the University of Idaho in August 2001. In its second year, the camp is the only place in the country where students learn to use the equipment that professional traffic engineers use in the field.

Students spent a week learning different aspects of traffic engineering from designing intersections to working with traffic controllers to coordinating signals at successive city blocks. Students visited signalized intersection sites in the city of Moscow, developed timing plans for the intersections, designed and tested loop detectors and learned to use video detection systems.

The timing plans students developed were tested using NIATT’s new Controller Interface Device (CID). Integrating the CID into the camp shows the way NIATT leverages technology development work to enhance education.

Ten experts from industry, government and other universities served as instructors. They provided the link between theory and practice in the use of traffic controllers, loop detectors, video detection systems and real-time hardware-in-the-loop simulation.

UTC funds are being used to develop new curriculum for the third year of the program, scheduled for August 2002.

### participants:

Scott Arnold, Senior, Michigan Technological University

Mitchell R. Bartelt, Graduate student, Michigan State University

Murali Basavaraju, Graduate student, University of Idaho

Albert Bové Chic, Senior, Escola Technica Superior d’Enginyers De Camins, Barcelona, Spain

Jason Deweber, Junior, Christian Brothers University

Craig Dierling, Senior, University of Idaho

Zorana Krnic, graduate of the University of Sarajevo, Transit Scheduler at Calgary Transit, Canada

Shaun Quayle, Senior, Oregon State University

Chhang Ream, Graduate student, University of Idaho

Sai Kumar Sarapalli, Graduate student, University of Idaho

Matt Wilson, Senior, California State University

Pamela Zilius, Graduate student, University of Washington



*Craig Dierling and Pam Zilius examine designs in the field.*

*ITD engineers study traffic signalization.*



*TSSC participants work with ITD technician Dale Moore designing loop detectors.*



## **ITD Staff Wants Its Own Traffic Signal Camp!**

When Michael Kyte spoke at the annual meeting of Idaho Transportation Department's traffic engineers in Idaho Falls, June 2001, he told the engineers about NIATT's successful Traffic Signal Summer Camps. Because NIATT had already received much interest from practicing engineers elsewhere, he was not surprised when he received an official request from Lance Johnson, the ITD State Traffic Engineer, asking NIATT to conduct a training course for ITD's traffic engineering staff.

As a result, and with the planning efforts of NIATT's T2 Center (Idaho Technology Transfer Center, page 9), eleven ITD engineers took a three-day Traffic Signal course in February 2002. In the evaluations following the course, eight participants gave the course the highest ranking of "quite positive" and all 11 found the course either "very" or "extremely" relevant to their own work. The only complaint was that there was too much information for three days!

The course was provided in a laboratory that was upgraded with a combination of UTC, ITD, and University of Idaho funds.

**“Traffic engineering in cities is a massive puzzle I get to help solve. There’s more to it than the light just turns green at this particular time. It’s behind-the-scenes work that makes society function better.”**

Matt Wilson, a civil engineering graduate, California State University, Sacramento

“The potential audience for a resource such as the *Highway Capacity Manual Applications Guidebook* extends to virtually everyone who uses the HCM or associated software to estimate performance measure for transportation facilities. This will include most city, county, and state transportation agencies, transportation consulting firms, software developers, and universities offering undergraduate or graduate transportation curricula.”

NCHRP 3-64 Proposal

## NIATT EDUCATION PROJECTS ATTRACTS NCHRP FUNDS

Another approach to education that we have taken is to develop materials that are available on-line, for ready reference and use by both our university students and practicing professionals. We started this effort with a project funded jointly by the University of Washington's TransNow and NIATT, which included participation from Oregon State University and Portland State University. This on-line lab manual is available for students taking the junior level transportation course, providing them with lab exercises and supplemental materials to assist them in their course work.

We continued with the concept of on-line materials with two other, currently in progress, UTC-funded studies. One is the development of materials for the unsignalized intersection module of the *Highway Capacity Manual*. When completed, both university students and practicing professionals will have access to training materials, when they need them, for this important part of the HCM. Sample problems and video clips from real world case studies will provide additional guidance.

The second study involves developing educational materials on traffic signal timing. This project, now in the beta test phase, will provide students with example problems and other materials on how to determine signal phasing and timing. And, the materials take advantage of NIATT's Controller Interface Device (page 36) that connects microscopic simulation models with real traffic controllers, providing students with direct experience using traffic control devices.

The experience developed in these projects was one of the reasons that NIATT was selected to participate in a new project funded by the National Cooperative Highway Research Program (NCHRP) to develop educational materials for the *Highway Capacity Manual*.

NIATT is participating with Kittelson and Associates, Rensselaer Polytechnic Institute, New York Polytechnic University, and the University of Florida to develop the guidebook. The project, which began in spring 2002, will be completed by June 2003. This is another example of UTC funds providing the way to participation in nationally funded projects.



*Illustration from the Highway Capacity module showing a stop controlled T-intersection where the minor street left turn vehicles are waiting to accept a gap between the major street vehicles.*

## Developing Web-Based Training Materials

Over the past three years, NIATT has used UTC funds to further the development of materials to enhance the learning experience for both our transportation program students as well as practicing professionals. One such project is our Traffic Signal Summer Camp. Curriculum materials we developed were used for the workshop and to begin a prototype laboratory course for the required Fundamentals of Transportation Engineering.

Michael Dixon, Assistant Professor of Civil Engineering, along with five civil engineering undergraduates, developed prototype web-based training materials for that course (<http://www.its.uidaho.edu/niattproject>). Traditionally, students are educated in traffic signal operations in the classroom. In this setting, they learn the basic concepts of traffic operations at signalized intersections and the way signals can be timed using some fairly simple equations. From this traditional experience, students typically grasp how to apply the equations to develop signal timing plans, but have difficulty in understanding the cause and effect relationships that are represented by the equations. In addition, it is difficult for students to understand how to implement the signal timing plans in actual traffic controllers when completely dependent on classroom exercises.

To maximize a student's effectiveness when they enter the transportation profession, they need to be able to visualize the ways traffic operates under different signal timing plans. If they understand the cause and effect relationships between intersection characteristics, signal timing plans, and how traffic operates, they will be more successful traffic engineers.

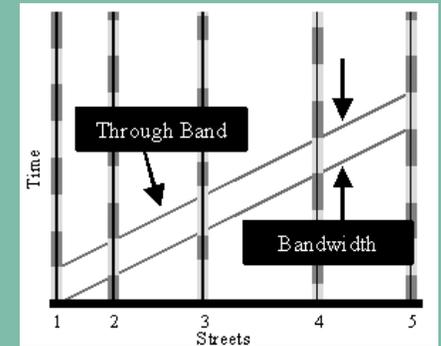
The goal of this program is to provide students with the experience that they need to find viable solutions to problems and to be able to implement these solutions in actual traffic controllers.

## Prototype Materials Fine-Tuned

The web-based training materials were used by 30 civil engineering students in the CE 372 course held at the University of Idaho in the spring of 02. The hands-on material included case studies. Students started from scratch and developed signal-timing plans and then tested them, using simulation programs integrated with real traffic controllers.

Using the experience and information gained in this first trial, Dixon and his students have fine-tuned the materials. Four modules, basic signal timing, actuated timing, coordinated signals, and hardware-in-the-loop simulation, will be used in a new special topics course.

The basic signal timing module will be used in the 2002 Traffic Signal Summer Workshop.



*Time space diagram describing the concepts of through band and bandwidth for coordinated signals. [Image based on Banks, Introduction to Transportation Engineering, 2nd Ed. McGraw-Hill, San Francisco, 2002.]*

# RESEARCH

## RESEARCH FOCUS AREAS

NIATT uses University Transportation Center program funds to conduct research in three areas:

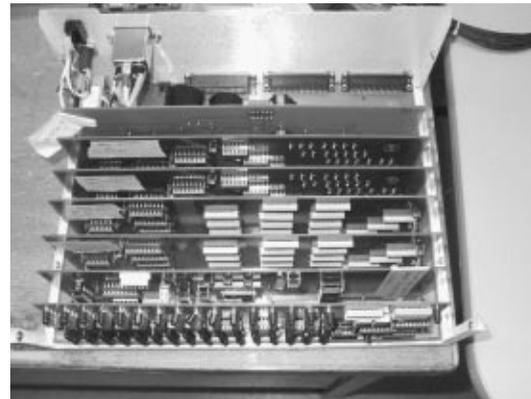
- Traffic control system technologies that are essential to national intelligent transportation infrastructure
- Technologies that support the development of the new generation vehicle
- Capacity building for transportation engineering professionals working in both vehicle and traffic control technology industries

The projects described in this section, while including elements that also meet our educational and technology transfer goals, directly relate to one of the research areas.

*Controller Interface Device (CID) set up in Traffic Control Lab.*



*A peek inside the CID*



*Michael Dixon, Assistant Professor of Civil Engineering, works with Michael Hofener, a Traffic Signal Summer Workshop participant.*



Through our ongoing program of basic and applied research, we advance the body of knowledge in transportation:

- We have established a research and technology program that gives rise to new and improved technology products for traffic control and vehicles.
- We have created concrete, viable products that are judged to be useful by industry, government, and universities.
- We have established a good working relationship with the U.S. departments of Transportation and Energy because of the high quality of our work; and an even more vigorous relationship with our most important partner, the Idaho Transportation Department.
- We have been successful in receiving additional external awards for further research in transportation technology in recognition of our successful research.
- We showcase at the annual Idaho Engineering Design Expo the result of capstone design classes in which our students collaborate to solve real transportation engineering problems.

## TESTING PROVES FEASIBILITY, COST-EFFECTIVENESS, AND AGRICULTURAL BENEFITS

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NIATT's yellow mustard biodiesel project continues the pioneering work of Professor Chuck Peterson and others in the UI's Biological and Agricultural Engineering Department. UI plant scientists have developed yellow mustard varieties, suitable for production in the Pacific Northwest, that have the potential to significantly reduce the cost of the oil used in biodiesel production. The purpose of the project is to produce quantities of biodiesel from these locally grown varieties to test in laboratory engines.

Yellow mustard biodiesel was first tested on an engine teststand. Graduate students helped complete computer programs for the 160-hour test. The fuel was then demonstrated in a 1999 Cummins-powered Dodge 2500 diesel powered on-road pickup truck. After on-road testing of nearly 1000 miles, the average fuel use was calculated at 15.2 miles per gallon, a rate equivalent to standard diesel fuel. While there was no increase in fuel economy, there was a substantial reduction in greenhouse gas emissions. As part of the test protocol, fuel characterization tests verified that the biodiesel produced meets the interim ASTM standard for biodiesel.

The Vandal Trolley's first demonstration run was 10 hours a day for six days, after which it was tested on the chassis dynamometer to compare fuel consumption and efficiency." The SuperFlow 601 Chassis Dynamometer has the capabilities of testing single axle vehicles with a power rating up to 550 hp(410 W) and tandem axle vehicles up to 1100hp(820 W). The SF-601 system is capable of measuring a wide variety of engine parameters such as speed, torque, power, BSFC, fluid temperatures, fluid pressures, etc. This dynamometer is unique in that it was installed beneath floor level so that when not in use the lab could be used for other research projects and teaching needs.



*Sam Jones, graduate student, tests Vandal Trolley on the chassis dynamometer, installed with UTC funds. (photo by Barbara J. Smith)*

*UI's Vandal Trolley  
promotes alterna-  
tive fuel use.*



## BIODIESEL RESEARCH RUNS UNIVERSITY OF IDAHO VANDAL TROLLEY

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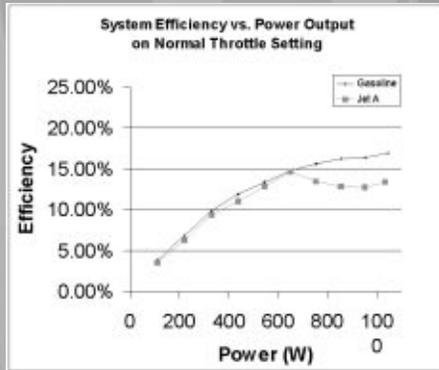
The Silver and Gold Vandal Trolley—the Vandal is the University of Idaho mascot—was a huge hit when it made its debut on the UI campus on April 5, 2002. The 30-seat trolley was acquired in January from the City of Kellogg, who had originally purchased the trolley under a grant from the State of Idaho. The trolley sports signs informing the public that it is powered by biodiesel fuel.

The University of Idaho campus has a central core with parking facilities around the peripheral. Two years ago, a Campus Commons facility was created in the center core of campus. The administration recognized a need for a campus transportation to support its effort to make UI the “residential campus of choice in Idaho and the West,” while ensuring that faculty, staff, students and visitors are able to make adequate use of the parking facilities. Many University and non-university events are held at the Commons. Access to this facility, except by walking, is limited. The elderly and handicapped, especially, have difficulty on the campus.

Part of the NIATT yellow mustard project (page 38) was to prototype a campus “people mover,” using biodiesel fuel and small-scale people movers for efficient short distance transportation. The Vandal Trolley is the first result of those efforts. The Vandal Trolley has an engine design that can burn biodiesel fuel, thereby adding to its environmental friendliness. As such, it becomes a demonstration project to document the efficiency and long-term effects of this alternative fuel in stop-and-start operations.

The terms of the grant require that the trolley only be used for transportation during special events and/or for testing and demonstration. But with the variety of activities on campus, it's in use weekly for events that have great public exposure, such as the Engineering Expo, commencement activities and the Lionel Hampton Jazz Festival, promotional activities, such as Vandal Friday and Parents' Weekends; and for internal events, such as the Staff Appreciation Fair and college and department advisory board meetings.

## EVOLUTION OF RESEARCH



*The converted gasoline running on JetA compares very well with one powered by gasoline, at least until the higher power outputs are reached—the point where Matt Walker is beginning his research.*

UTC funds have provided Judi Steciak and Steven Beyerlein the ability to use the data and test results generated in one year by one graduate student and build and expand on that work in subsequent years in a significant way. The research being done in the area of alternative fuels is a particularly good illustration of that evolution.

In the first year of UTC funding, Andron Morton worked on a conversion of a small Yanmar engine to aquanol, using a catalytic igniter. Morton, who completed his MS in mechanical engineering in 1999 and is now working at Cummins Engine, passed his work to Eric Clarke. Clarke took the Yanmar and completed a full set of performance and emissions testing. Clarke completed his MS in the summer of 2000 and is now a design engineer at Kenworth Truck.

The work of Morton and Clarke now supplies the basis for work being done by PhD candidates Dan Cordon and Xhiangyang Wang and MS candidate Matt Walker.

Dan Cordon, first involved in NIATT research as an undergraduate, began working on his advanced degrees in mechanical engineering by writing a paper using the results of testing done by Morton and Clarke in the process of converting the Yanmar engine from diesel to aquanol. The paper has been accepted by the Society of Automotive Engineers for publication in the fall of 2002 and will serve as the basis of the master's thesis that he will defend this fall. He will continue to work towards a PhD degree.

The reaction mechanism of a catalytic igniter and aquanol fuel involves 100 or more chemical reactions as molecules are swapped during combustion. Xhiangyang Wang's involvement is to develop and study mathematical models of the combustion.

Cordon's current research work involves a larger platform—a van running on aquanol fuel. He has used the data collected from testing on the smaller engine to predict and design conversion for the larger engine. The van is used as a research platform and for demonstration purposes, but the final goal to use this alternative fuel for Idaho Department of Water Resource vehicles.

Matt Walker uses aquanol combustion technology to convert a Honda 4-stroke, one-cylinder (50cc) generator to burn JP8 (aircraft fuel) instead of gasoline. His work supports the military's single fuel initiative. With NIATT's partner, Automotive Research Incorporated, Walker has shown that JP8 can be used in piston engines. This 1000-watt generator can be carried by a single person, making it as efficient as current military generators but much lighter.

*Ethanol-powered van  
used as teststand.*



### **New Engine Technology: Reducing Emissions**

The catalytic ignition research conducted by Steciak and Beyerlein illustrates how NIATT's Center for Clean Vehicle Technology combines basic and applied research to develop engine technology that reduces the impacts of vehicles on the environment. The objective of their research is to develop a catalytic igniter that permits the combustion of extremely lean mixtures in internal combustion engines in order to improve performance and reduce emissions.

The researchers and their students work with ethanol, a renewable fuel, mixed with a high percentage of water. Blends of 70 percent ethanol and 30 percent water have been burned in both low-compression and high compression engines. The team modeled heterogeneous and homogeneous ignition over a range of fuel types, worked with stand-alone engines to quantify igniter durability and developed models to accelerate igniter design for different engine platforms. They collected data on igniter longevity and engine wear using demonstration vehicles.

This work has generated an additional \$492,482 in funding from the U.S. Department of Defense and the Idaho Transportation Department. ITD's support is based on their desire to integrate low-emissions alcohol vehicles into state fleets and small city transit systems. DOD is interested because the catalytic igniter permits combustion of heavy fuels in small engines, eliminating the need to supply more than one fuel type to deployed military vehicles.

**This work has generated an additional \$492,482 in funding from the U.S. Department of Defense and the Idaho Transportation Department.**

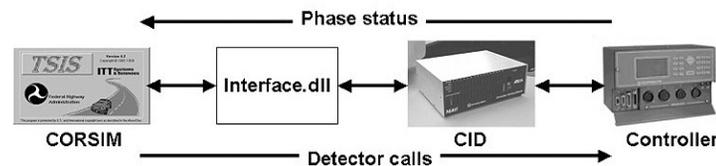
“The CID is a valuable piece of technology, and as more complicated traffic control systems evolve it will be very important to have this kind of technology available. In the future, we plan to use the CID to test and debug other adaptive signal control algorithms as well as closed loop systems.”

Charlie Stallard  
ITT Industries

## NIATT’S CONTROLLER INTERFACE DEVICE USED BY DEVELOPERS OF CORSIM

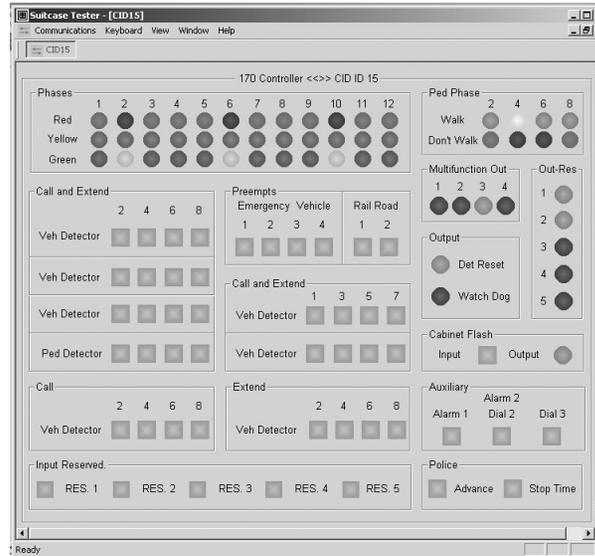
The NIATT Controller Interface Device (CID) has proved to be a valuable device for eliminating many software and system problems prior to field deployment, as well as significantly reducing the deployment time for FHWA's Adaptive Control Algorithms (ACS) project. The ACS project is an attempt to deploy advanced adaptive control algorithms in the field. These algorithms take detector information (detectors are usually placed 700 feet upstream across all lanes), estimate vehicle arrival times and demand for different phases and produce the optimal signal phasing at the intersection. These algorithms require second by second data and provide second by second signal states.

The first phase of the project awarded five separate contracts to different organizations to develop these advanced algorithms. The next phase of the project involved testing the algorithms in a simulation environment (CORSIM) to assess how well they performed. According to Charlie Stallard of ITT Industries, developers of CORSIM, “Before deploying these systems in the field (inside an advanced 2070 traffic controller), it was important to test them using a hardware-in-the-loop experiment using the CIDs.



*The CID enables CORSIM and the controller to exchange data.*

*The CID's Suitcase Tester screen for a 170 Traffic Controller.*



## The CID in Use

RHODES is an adaptive control algorithm that uses upstream detector information and certain prediction techniques to estimate vehicle arrivals and traffic demand at intersections along arterial networks. An optimization algorithm uses these estimates to determine the optimal signal state at each intersection. Simulation results using RHODES showed significant reduction in delay along certain high type arterial networks.

Testing the effectiveness of the algorithm in a hardware-in-the-loop simulation environment with CORSIM was the next critical initiative. First the algorithm was ported to the OS-9 environment in a 2070 advanced traffic controller and interfaced with Gardner Transportation System's NeXTPHase software. In order to debug this software and build confidence in the algorithm, the NIATT CID was used to interface with the 2070 controller and provide actual signal states to the CORSIM simulation engine. In turn, the NIATT CID supplied detector activations from the simulation to the RHODES algorithm housed inside the 2070 controller.

# TECHNOLOGY TRANSFER

NIATT's most significant outcome will be the development and transfer of technology products that are useful to others and that meet national, regional and state priorities. Likewise, the resulting knowledge base will be transferred to operating transportation agencies, research laboratories, and private commercial ventures.

- We cosponsor the annual Idaho Engineering Design Expo. At that expo, we showcase the results of capstone design classes in which our graduates and undergraduates collaborate to solve real transportation engineering problems.
- We make our Web site attractive and informative.
- We conduct short courses and classes for practicing engineers.
- We encourage our principal investigators and their students to publish and present papers at conferences, seminars, and workshops.
- We distribute final reports through the National Technical Information Services, the Transportation Research Board and other professional journals.
- We work to resolve potential issues of intellectual property and licensing rights within the university and with state and federal agencies.
- We aggressively pursue methods of promoting our products, getting them into the hands of the public and private sectors, where they can be produced and marketed.
- We support the work of our Idaho Technology Transfer (T2) Center.

*The BioBug attracts attention at Engineering Expo 2002.*



## FRANK ALBRECHT PRESENTS CLASS ON ALTERNATIVELY POWERED VEHICLES

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The Palouse-Clearwater Environmental Institute (PCEI) sponsored a one-day class in October 2001 taught by NIATT research engineer Frank Albrecht on alternative-powered vehicles. Albrecht, NIATT research engineer, provided information and displayed NIATT vehicles running on electric and hybrid electric power and yellow mustard oil.

The mission of PCEI is to increase citizen involvement in decisions that affect our regional environment. By organizing community activities and promoting environmental education, PCEI strives to help inhabitants of the Palouse find effective and sustainable solutions to local and regional environmental problems.

## NIATT VEHICLES ATTRACT ATTENTION

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A bright yellow mustard Volkswagen Beetle, more commonly known as the BioBug, is the latest vehicle in the fleet of equipment running on UI biodiesel. Where it appears, you can always find an interested crowd of people.

The variety of vehicles NIATT uses as teststands for alternative fuels and clean vehicles help inform the public about possible ways to enjoy today's ability to move from place to place in both personal and recreational vehicles but to help preserve and protect the environment.

The Clean Snowmobile was the center of attraction at the Latah County Fair in the fall of 2001, as was the BioBug at the Fourth of July Parade in Johnson, Idaho. Carrying their trophies with them, members of the Advanced Concept Vehicle Team proudly display the FutureTruck and the hybrid electric Camaro to state and federal legislators, as well as to crowds of students and alumni at University of Idaho sports and signature events.

The vans that run on biodiesel and/or aquanol are displayed at conferences, such as the upcoming international Bioenergy 2002. Students that drive the vans are always ready to talk about their research work, the benefits of biodiesel, and the cleaner emissions when using aquanol.

**Bioenergy 2002 is for bioenergy professionals, technology developers, educators, researchers, government officials, entrepreneurs and others who are united in recognizing the advantages of bioenergy renewable resources and the benefits they offer our people and our planet. Bioenergy 2002 will provide a forum to share and develop new ideas that will improve knowledge of bioenergy's every increasing role as an energy resource.**

## NIATT CO-SPONSORS INTERNATIONAL BIOENERGY CONFERENCE

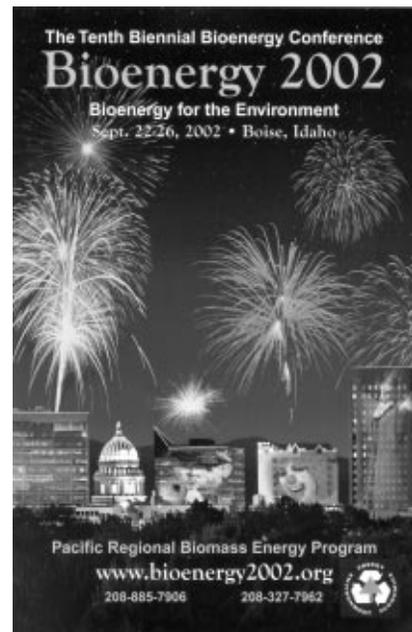
The Tenth Biennial Bioenergy Conference, "Bioenergy 2002," is being held September 22-26, 2002 in Boise Idaho. Dr. Charles Peterson, University of Idaho Professor of Biological and Agricultural Engineering and a researcher doing UTC-sponsored work converting yellow mustard into biodiesel fuel, is one of the chief organizers of the international conference, "Bioenergy for the Environment." John Crockett from the Idaho Department of Water Resources, who serves on the NIATT peer review panel for the Center for Clean Vehicle Technology, is co-chair.

UTC funds are helping support this national conference, co-sponsored as well by the Bioenergy Program of the Department of Energy and the National Park Service. More than 200 papers and 50 posters addressing a range of bioenergy issues will be presented by leading international experts. Cutting edge techniques and technologies will be showcased at the conference.

Two papers reporting the results of UTC-sponsored research will be presented at a special session entitled Ethanol: New Development in Production and Utilization, moderated by Paul Mann from J. R. Simplot. Dan Cordon, graduate student in mechanical engineering, will be presenting a paper, "Comparisons of Gasoline and Ethanol-Water Emissions in Vehicle Driving Cycles," written with Eric Clarke, Steven Beyerlein, and Judith Steciak. Mark Cherry, president of Aqualytic Technologies, Incorporated, a NIATT partner, will present "Aqueous Ethanol Homogeneous Charge Catalytic Compression Ignition," written with Steven Beyerlein and Judith Steciak. Cherry also serves on the Clean Vehicle Center peer review panel.

Two papers resulting from Dr. Peterson's UTC-funded yellow mustard project will also be presented:

- Using Raw Plant and Animal Oils as a Diesel Fuel Extender—A Literature Review," written by Peterson and graduate student, Sam Jones.
- Biodiesel from Yellow Mustard Oil," written by Joseph Thompson and Peterson



[www.bioenergy2002.org](http://www.bioenergy2002.org)

## NIATT RESEARCH FEATURED AT CONGRESSIONAL EXHIBITION

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The results of UTC-sponsored biodiesel fuel research were featured at a national exhibition held on Capital Hill in Washington, DC. The UI was one of 40 participants nationwide at the March 2002 Food and Agricultural Science Exhibition and Reception to show how today's food and agricultural research can affect the future.

Chuck Peterson headed the UI team showing how products from a tiny mustard seed can fuel the cars of tomorrow. Peterson presented the paper, "Fueling Tomorrow: Biodiesel Poised to Become the Next Alternative Fuel" at the exhibition.

The event was sponsored by the National Association of State Universities and Land-Grant Colleges. Its goal was to increase congressional awareness of the latest in research and education.

## IDAHO ENGINEERING DESIGN EXPO 2002 PROVIDES FORUM FOR NIATT PROJECTS

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Sponsored in part by NIATT's UTC funds, the 2002 Engineering Design Expo featured displays and demonstrations of transportation engineering projects. Student exhibits represent many hours of study, teamwork, problem solving, and collaboration with faculty advisors and sponsoring partners from industry. The experience helps to prepare our students for careers as professional engineers in the region and the world.

Grade school and high school students were bussed from around the Moscow, Idaho, area to attend the Expo and a variety of other activities that surrounded this yearly event. Visitors were able to talk with students about new web tools, steel bridge construction, highway design, and other inventions and technical solutions that meet medical, physical, environmental and economic challenges. NIATT's clean snowmobile, the yellow mustard/biodiesel fueled VW, the Controller Interface Device and the FutureTruck were among the displays that attracted more than 2000 visitors. Visitors talked with students involved in Idaho Engineering Works and toured the laboratories and facilities used for NIATT research projects.

More than 50 professionals helped judge 31 booth exhibits and 87 poster exhibits. Seven tours included the Mechanical Engineering Design Suite and the Small Engine Lab (improved with UTC funding). Visitors could ride the UI's biodiesel-powered trolley (page 37) to the Martin Laboratory to see where the fuel is produced and where demonstration vehicles for NIATT projects are tested on the chassis dynamometer. Students also made 17 technical presentations.



*FutureTruck team members  
field questions from interested  
Expo visitors.*

## NIATT STUDENTS WORK WITH PACIFIC NORTHWEST ENGINEERING FIRMS

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Elementary school students were drawn to an Expo booth where a simulated traffic design project used video game-like graphics to illustrate the impact that a road improvement has on traffic flow. To the students, traffic engineering appeared as interesting as a computer game.

Phil Rust, NIATT graduate student, and Christina Ryan a senior civil engineering student and NIATT intern, worked with Kittelson and Associates of Portland, Oregon, as part of their senior capstone design course, developing three roadway improvement alternatives that would successfully mitigate the impacts of additional traffic from a proposed new development, and to recommend one of the alternatives.

The senior project was initiated after a developer in Tualatin, 15 miles south of Portland, Oregon, proposed to build an office park, shopping center and movie theatre near an interstate interchange. Working on possible solutions to increased traffic flow enabled the students to learn how to:

- Predict the amount and distribution of additional traffic a new development would be expected to generate
- Analyze closely-spaced intersections that are over capacity as a system
- Create and present mitigation designs
- Determine which design is best to recommend
- Present design alternatives so that decision-makers would understand the implications of each plan and be able to come to an educated decision on the best course of action.

Because NIATT has established an excellent reputation with engineering firms in the Pacific Northwest and elsewhere, we are able to provide our students with extraordinary opportunities to work with professionals before graduation. This gives students the chance to see how their classroom studies of theory get translated into solutions to real-world problems. Because they are successful with the work they do, the students find their search for meaningful engineering positions after graduation relatively easy.

Technology transfer generally occurs as a result of journal publications and conference participation, but it also occurs when students, particularly NIATT undergraduate and graduates, take the knowledge and experiences they have while working on research projects with them into the transportation community. Joe Geigle, an undergraduate civil engineering student, was recruited by FHWA before his graduation. Phil Rust, civil engineering graduate student, found summer work at Six Mile Engineering in Boise, Idaho, and after graduation, Geoffrey Judd began working with Kittelson and Associates of Portland, Oregon.



*Phil Rust and Christina Ryan display their traffic design at Engineering Expo.*

## BAYOMY DEMONSTRATES WINFLEX PROGRAM AT IDAHO ASPHALT CONFERENCE

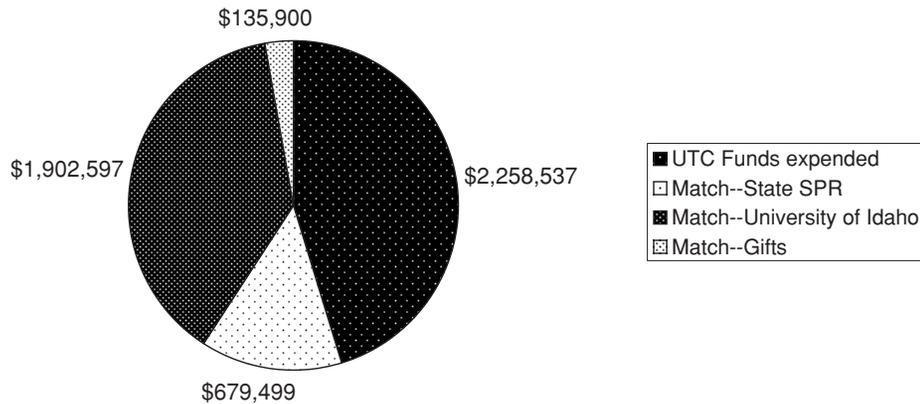
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Dr. Fouad Bayomy, Professor of Civil Engineering, organized the 2001 Idaho Asphalt Conference and presented his software program, WINFLEX 2000, a mechanics-based overlay design program that is capable of including the varied environmental effects in the design of asphalt overlays. Bayomy gave the audience of preview of the improvements that will be made to the upgraded WINFLEX-2002. In his welcome to the 160 participants, Dean David Thompson emphasized the power of knowledge and the importance of scholarship in research documentation.

The conference is held every year in Moscow, Idaho, under the auspices of the University of Idaho, the Asphalt Institute and the Idaho Transportation Department to address issues related to asphalt pavements that are of concern to local and state governments as well as consulting and engineering firms. Contractors and material suppliers have found this conference to be a good forum to address design, construction and management issues.

Dr. Bayomy, a NIATT researcher in the Center for Transportation Infrastructure, works on several projects supported by the Idaho Transportation Department with SPR funds, helping meet the federally required match for UTC funding.

## NIATT UTC PROJECT EXPENDITURES



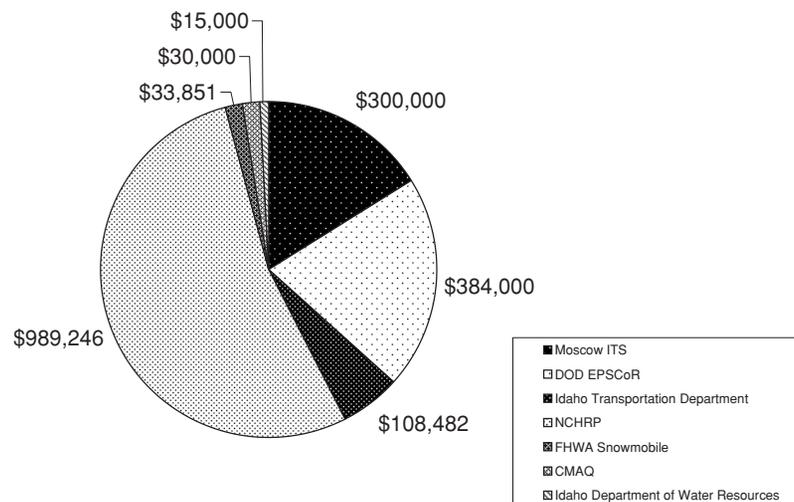
NIATT research and education project expenditures as of June 30, 2002 equal \$2,258,536 of the \$2,641,000 of University Transportation Center Funds allocated.

To date, NIATT has reported \$2,717,916 in matching funds, exceeding the 1:1 match required. Of those funds, 70 percent comes from University of Idaho support.

## PROJECTS RESULTING FROM UTC INVESTMENT

Because of the success of research and education projects conducted by NIATT using University Transportation Center funding, we have been successful in obtaining outside grants and contracts. A total of \$1,860,579 comes from a variety of sources to specifically support research begin with UTC funding.

One can easily see the value-added to UTC funds.



# NIATT RESEARCH PROJECT STATUS

Project Status	Project Number	Project Title	Principal Investigator
New in FY02	KLK206	Traffic Controller Laboratory Upgrade	Ahmed Abdel-Rahim
New in FY02	KLK207	Development of Traffic Signal Training Materials Integrating Hardware-in-the-Loop Simulation	Michael Dixon
New in FY02	KLK208	Software Maintenance Support for Current Generation Controller Interface Device	Michael Kyte
New in FY02	KLK209	Next Generation Controller Interface Device	Brian Johnson
New in FY02	KLK304	Alternative Power Snowmobile Development	Karen Den Braven
New in FY02	KLK308	A Parallel-Hybrid Sport Utility Vehicle	Don Blackketter
New in FY02	KLK311	Biodiesel Fuel from Yellow Mustard Oil	Charles Peterson
New in FY02	KLK319	Catalytic Ignition of Aquanol in Reactor, Engine and Vehicle Environments	Judi Steciak and Steven Beyerlein
Ongoing	KLK203	Development of Video-Based and Other Automated Traffic Data Collection Methods, Phase II	Michael Kyte
Ongoing	KLK204	Development of Internet-Based Laboratory Materials: Phase II—Computer-Assisted Traffic Analysis Training	Michael Kyte
Completed	KLK303	Alternative Powered Snowmobile Development	Karen DenBraven
Completed	KLK323	Idaho Engineering Works	Edwin Odom
Completed	KLK202	Actuated Coordinated Signalized Systems: Phase I—Oversaturated Conditions	Zaher Khatib
Completed	KLK310	Biodiesel Fuel from Yellow Mustard Oil, Phase I	Charles Peterson
Completed	KLK201	Development of Controller Interface Device for Hardware-in-the-Loop Simulation, Phase III	Brian Johnson
Completed	KLK205	Traffic Signal Summer Camp	Michael Kyte
Completed	KLK302	Advanced Vehicle Concepts Team Electric Vehicle: Phase II: FutureTruck 2000	Don Blackketter Steve Beyerlein

Project Status	Project Number	Project Title	Principal Investigator
Completed	KLK306	Vehicle Performance Simulation, Phase III	Don Blackketter
Completed	KLK316	Engine and Vehicle Demonstrations on Aqueous Fuel	Steve Beyerlein
Completed	KLK331	High Performance Auxiliary Power Units, Phase II	Dean Edwards Steve Beyerlein
Completed	KLK317	Reactor Studies of Water-Alcohol Mixtures, Phase II	Judi Steciak
Completed	KLK318	Diesel Engine Conversion to Aqualytic Fuel—Phases I-II (Homogeneous Charge Combustion of Aqueous Ethanol)	Steve Beyerlein
Completed	KLK305	Vehicle Performance Simulation, Phases I-II	Don Blackketter
Completed	KLK315	Spark Ignition Engine Conversion to Aquanol Fuel	Steve Beyerlein
Completed	KLK320 & KLK 321	Optimal Design of Hybrid Electric-Human-Powered Lightweight Transportation	Edwin Odom Don Blackketter
Completed	KLK330	Advanced Lead Acid Battery Development	Dean Edwards



*Snowmobiles are more than just a mode of transportation,” stated Neil Schilke, SAE 2001 President. “These machines are a means to enjoy the natural beauty of the winter season. The recreational use of sleds is part of our personal freedom. Yet, as stewards of our environment, we must enjoy this freedom responsibly.”*

# NIATT

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