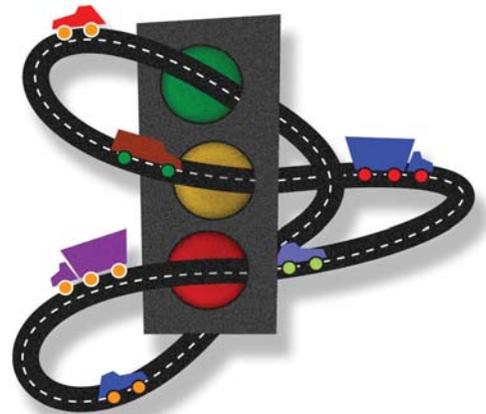University of Idaho

Semi-Annual Report

July 1, 2004-December 31, 2004

National Institute for
Advanced Transportation Technology

prepared for
University Transportation Centers Program
Research and Special Programs Administration
US Department of Transportation

NIATT

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Doug Moore, Director
Bruce Drewes

February 1, 2005

Amy Stearns
RITA; Room 8417
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400 7th Street, SW
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Dear Amy:

I am pleased to transmit to you our semi-annual report for the period July 1 through December 31, 2004.

We believe our report shows that UTC funding continues to support our efforts to train and educate new leaders who are prepared to meet the nation's need for safe, efficient and environmentally sound movement of people and goods.

Many of our success stories this period report our efforts in transferring technology through publications, workshops, presentations and continued development of the controller interface device. Also apparent in these stories is evidence that success in our UTC research has led to additional outside funding to support our research.

I invite you to read more about these and other successes of which we are proud.

Enclosed in this report, as required, you will also find Part B, our Research Project Status, and Part C, the Financial Status.

Best regards,

Michael Kyte

Michael Kyte
Director

MK/jb

Readying a Prototype SDLC Interface for CID Beta Testing

Meeting Industry Standards

The Controller Interface Device (CID II) developed by NIATT researchers and being manufactured by McCain Traffic Supply is connected to the type I connector on Type 170 controllers and the A, B, C and D connectors on NEMA TS 1 and TS 2, type 2 controllers, by way of a parallel interface.

Industry sets standards for the way in which electronic devices are connected. The current link protocol calls for an SDLC (synchronous data line communication) interface. As controller manufacturers are changing their production lines to adhere to this new protocol, NIATT recognized the need to develop an add-on to the CID. The SDLC project will add support to a controller type (NEMA TS2, type 1) that is currently not supported by the CID. In addition, usability will be increased for other SDLC equipped traffic controllers.

Brian Johnson and his student researchers are ready to set up beta testing for the SDLC interface they developed. The expectation is that the interface will be part of a "new" McCain CID that will include a new daughterboard, hood and plug-in.

The CID project was initiated at the request of FHWA, and the continued development of the CID continues to be an FHWA priority.

CIDs Now in All ITD Districts

While on sabbatical, Michael Kyte worked on a research project funded by the Idaho Transportation Department to integrate NIATT's controller interface device into ITD's traffic signal program.

He conducted a two-day workshop in Boise on signal timing and the CID. CIDs have now been distributed to five ITD districts and headquarters.

For more information, contact Brian Johnson (bjohnson@ee.uidaho.edu) or Richard Wall (rwall@ee.uidaho.edu).

Other CID Developments

The CID II is the result of several years of hardware and software development through NIATT. One recent development was to make the CID compatible with Windows XP (instead of just Windows 2000, 98 and ME).

Another improvement expanded the capability of the CID for applications where the number of input/output connections limit performance. The design uses the existing CID hardware with modifications to the software and firmware to allow paralleling a larger number of CIDs.

Initially the CID only worked with TSIS/CORSIM. NIATT researchers have developed interface software for VISSIM and SimTraffic and are nearing the completion of an interface for Paramics.

Still ongoing is work is to improve the documentation of the CID software to make it easier for future students/ or faculty members to develop new software applications for the CID.

Conference Presentations/Publications

E. M Suwal, T. Cuff, B. Hamlett, B. K. Johnson, R. W. Wall, A. Abdel-Rahim, "Modeling Advanced Traffic Signal Control Systems: A Communication Network Prototype," Proceedings of the 7th Annual IEEE Conference on Intelligent Transportation Systems, Washington D.C., pp. 367-371, Oct. 3-6, 2004.

Z. Li, M. Kyte, B.K. Johnson, "Hardware-in-the-Loop Real-time Simulation Interface Software Design," Proceedings of the 7th Annual IEEE Conference on Intelligent Transportation Systems, Washington D.C., pp. 1012-1017, Oct. 3-6, 2004

J. Waite, M. Benke, N. Nguyen, M. Phillips, S. Melton, P. Oman, A. Abdel-Rahim, & B. K. Johnson, "A Combined Approach to ITS Vulnerability and Survivability Analyses," Proceedings of the 7th Annual IEEE Conference on Intelligent Transportation Systems, Washington D.C., pp. 262-267, Oct. 3-6, 2004.

A. W. Krings and P. R. Merry, "A Functionality Based Hierarchical Model for Survivable Intelligent Transportation Systems," Proceedings of the 7th Annual IEEE Conference on Intelligent Transportation Systems, Washington D.C., pp. 262-267, Oct. 3-6, 2004.

New Combustion Laboratories Open in UI Facility in Boise, Idaho

Engineering Programs in UI-Boise Move into New Building

The University of Idaho (Boise Center) moved engineering programs into a new building on Front Street in Boise, Idaho, in the fall 2004. The building includes laboratory space dedicated to the study of renewable transportation fuels by faculty and students in NIATT's Center for Clean Vehicle Technology. Three spaces (a combustion lab, a control room and fluidized lab) combine to 1,400 square feet.

Judi Steciak and Steven Beyerlein and their student research teams have been working for more than six years on a number of projects related to engine performance, particularly relating to the use of alcohol-based fuels as an alternative to gasoline. Their successes have led to additional support from the University, including this dedication of laboratory space for their research. A plug flow reactor, constructed with UTC funds, that was in operation in Moscow, was also moved to and installed in the new facility.

Research Receives Outside Funding
Steciak and Beyerlein's research also led to an NSF equipment grant that permitted the purchase of a gas chromatograph-mass spectrometer and other analytical equipment that is currently being installed in the facility. This purchase was augmented by additional funding from the College of Engineering, the Boise Engineering Program, and returned overhead funds gained from UTC expenditures.

Idaho State Board of Education (SBOE) funds, also combined with returned overhead from UTC expenditures, supported the purchase of laboratory equipment.

The scope of projects funded by the Idaho Transportation Department (ITD) and the Idaho Department of Water Resources included dynamometer and over-the-road durability data, additional emissions monitoring and integration into public transit and vehicle fleets operating with Aquanol, using catalytic ignition.

Using UTC Funds to Accomplish Goals

The UTC funds supporting these projects have led to achievements in all areas identified by DOT as necessary to advance U.S. technology and expertise in transportation and contributed to NIATT's growth and the respect it garners in this field.

Education and Human Resources
Over the past six years, 10 graduate students working on the Steciak/Beyerlein projects have received advanced degrees. One is currently working towards his PhD and two additional graduate students continue. Another 4 undergraduate students have worked on the projects. At least 7 of the graduates are now working in transportation.

Research Performance and Quality
The quality of the research is reflected in the extent of their outside support and collaborative efforts with the Department of Defense, Automotive Resources, Inc., the Idaho Transportation Department, the Idaho Department of Water Resources, and Valley Transit. The projects have generated a base of experimental and analytical data that can be used to support the implementation of low-emission engine concepts.

Technology Transfer
Steciak and Beyerlein's research group has consistently presented the results of their work at regional and national conferences and published the results of their work and the test-platform vehicles have been used to promote clean and efficient fuels in displays throughout Idaho.

Valley Transit van converted to a dual fuel platform using catalytic igniters.

For more information, contact Judi Steciak (jsteciak@uidaho.edu) or Steven Beyerlein (sbeyer@uidaho.edu).

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Biodiesel Users Share Ways To Meet Energy Policy Act Requirements

Biodiesel Utilization Workshop Held in Boise

Confusion and growing pains by states to meet the federal regulations of the U.S. Government Energy Policy Act attracted more than 110 national attendees to a UI Biodiesel Utilization Workshop Sept. 9-10 in Boise.

The federally legislated EPAct aims at reducing the consumption of petroleum-based fuels for transportation through improving fleet fuel efficiency by using alternative fuels and vehicles. The policy focuses on replacing petroleum-based fuels with alternative non-petroleum fuels by 20 percent in 2005 and 30 percent in 2010. Besides federal mandates, fleets also are faced with individual state laws addressing air quality and pollutant cleanup.

Biodiesel is a renewable, nontoxic, biodegradable fuel that meets the EPAct requirements. The workshop, led by UI's Charles L. Peterson, interim dean of UI engineering, and Jon Van Gerpen, new chair of the Biological and Agricultural Engineering Department, is part of a five-year, $950,000 USDA education grant to study market barriers to biodiesel usage. UTC funds have helped further the work of Peterson, Brian He, and now, Jon Van Gerpen, in pioneering biodiesel work.

Jim Evanoff, Yellowstone National Park ranger and workshop attendee, is convinced that biodiesel can meet EPAct regulations and help reduce harmful emissions in the park. He has driven over 175,000 miles in the first 100 percent biodiesel vehicle to be tested in a national park. The 1992 test vehicle is a joint research project with the national park and UI's Biological and Agricultural Engineering department.

"When people ask me about performance and mileage, I tell them I get 25,000 miles to the acre," said Evanoff, referring to the renewability and reusability of biodiesel in the park. More than 350 pieces of park equipment now use 20 percent biodiesel fuel, including garbage trucks, tourist buses, generators and boilers.

Other workshop attendees included state departments of transportation and other fleet managers and consumers, who discussed both sides of biodiesel usage.

Jeannie Wilson, senior fleet specialist for Missouri's DOT, expressed frustration with variable biodiesel fuel quality. She said her office has a new supplier every week due to the department's bidding structure that requires the best weekly prices.

Owen Hasson, one of Missouri's maintenance superintendents, is committed to using biodiesel and meeting federal and state regulations. However, he says the multiple supplier system brings problems with quality of fuel, flow issues, increased vehicle maintenance and frequent tank cleaning.

"Bringing together national fleet managers with differing experiences of biodiesel use helps us all fine-tune procedures and management issues connected with biodiesel as an alternative fuel meeting EPAct standards," said Van Gerpen. He said he was encouraged by the information and solutions exchanged among the biodiesel suppliers and consumers.

UI is considered to be the pioneer of biodiesel research and usage in the U.S. and continues to be a leader in biodiesel education.

UI's BioBug Refueled with Biodiesel at Yellowstone National Park

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For the 2005 SAE Competition -- a New UI Snowmobile

Readying a Direct-Injection Two-Stroke

The UI Clean Snowmobile Challenge Team is well on its way toward another victory in the SAE Clean Snowmobile Challenge. The team recently completed preliminary tests of its new direct-injected two-stroke snowmobile engine, comparing it with a stock Polaris 600 cc two-stroke engine.

Comparisons were made at five standard modes of operation with no exhaust catalyst. Mode 1 represents the snowmobiles running at full throttle, full torque; Mode 5 represents the engine at idle. The graph (below, right) shows that the UI direct injected engine significantly reduces the brake-specific hydrocarbons (BSHC) plus brake-specific oxides of nitrogen (BSNOx) at all modes of operation when compared with the stock engine. Fuel usage is also reduced by half (graph below). The engine maintains stock power, while increasing torque.

The next steps in preparation for the March competition are to modify the fuel map and add an exhaust catalyst to further improve emissions. The team is also concentrating on reducing noise emissions and improving power transfer to the track via use of a direct drive system.

The paper prepared for the 2004 Challenge was published as a peer-reviewed paper by SAE: Paper No. 04SETC-85 "University of Idaho's Clean Snowmobile Design Using a Direct-Injection Two-Stroke with Exhaust Aftertreatment," authors Nathan Bradbury, Nathaniel Beach, and Karen Den Braven. It is also anticipated that the results from the spring 2005 Challenge will also be a peer-reviewed publication of SAE.

The team has obtained significant support from two snowmobile manufacturers. Polaris is supporting the team with equipment donations and making their engines available at cost. Another manufacturer (who wishes to remain anonymous) is providing the team a significant amount of supplies and parts.

Last year's team captain Nathan Bradbury, who received his BSME in the spring of 2004, is back on the team as a graduate student. Over the summer, he had an internship with a snowmobile manufacturer. Nate is constructing a turbocharged snowmobile as well as working on the 2005 competition snowmobile.
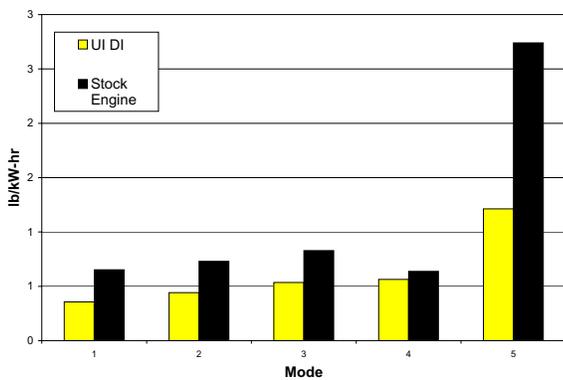
Brake Specific Fuel Consumption
UI Direct Injections Compared to Stock Engine
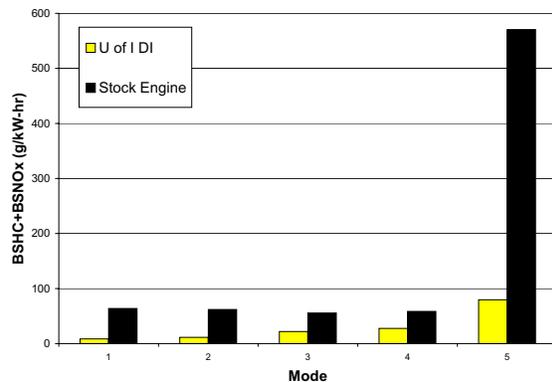
Brake Specific Hydrocarbons and
Brake Specific Oxides of Nitrogen
UI Direction Injection vs. Stock Engine

For more information, contact Karen Den Braven (kdenb@uidaho.edu)

Students Take Experience into Industry

AVCT Members Valued for Knowledge and Experience

After graduation in May 2004, two students began working at corporate jobs that parallel their experience with NIATT's Advanced Vehicles Concepts Team. AVCT members Jeremy Forbes, BSEE, a development engineer with Micron Corp. in Franklin, Tennessee, and Richard Statler, BSME, a development engineer with Neoplan USA, both attribute their success in getting these jobs to their experience and knowledge gained while working on the FutureTruck vehicles.

Jeremy Forbes was the AVCT vice president and team leader for the electrical power and electronic control systems on the 2002 Ford Explorer hybrid electric vehicle project. Jeremy led the effort in designing, building and testing the electric drive system which stored energy with Maxwell ultra-capacitors and delivered the power through a three-phase induction machine. System control was managed through a National Instruments PCI eXtensions for Instrumentation software, LabView software and field point modules. National Instruments and LabView donated software and hardware as a result of white papers written by Forbes and submitted to them by the team.

Forbes' work at Micron, a research and development company that works mainly on military contracts and SBIRs, is in development of a "power neuro system" that will start a 24V military vehicle even when the batteries are totally discharged.

Richard Statler served as the AVCT president and team leader for the mechanical powertrain. His group built a new transfer case that directed the power from the electric motor and combustion engine to the front and rear axles. Recycling several internal components from the stock unit, Richard and his team developed a lightweight and efficient gear drive that was as quiet as the stock system. By securing sponsorships for the drive chain, aluminum casting, and heat treatment, Richard and his team built the transfer case at a cost below budget.

Final FutureTruck Competition

At least partially a result of Jeremy and Richard's leadership, the AVCT earned a sixth place finish in the 2004 FutureTruck competition.

This year's competition, held at Ford's Michigan Proving Ground on June 9-17, was the grand finale of the program. Teams squared off in eight days of vehicle testing that measured acceleration, towing ability, fuel economy, off-road performance, and tailpipe and greenhouse gas emissions, among other features. FutureTruck 2004 ended with a victory tour that stopped at various sponsor facilities, with a finish line ceremony at Ford's World Headquarters in Dearborn, Michigan.

In addition to the official 6th place award, the UI team received recognition after every event when other students and Ford engineers gathered around the vehicle to question the team members to learn how the SUV functioned so smoothly.

Following the competition, the president of Micron Corp. hired Forbes to develop similar capacitor-based energy storage systems. A Ford engineer who was an AVCT technical advisor and who subsequently transferred to Neoplan USA was instrumental in hiring Statler to develop hybrid electric transit buses.

> *"I am so glad I spent the extra time during college to get involved with FutureTruck. Not only did my work on the project put me in contact with my present employer, but I am also using skills I picked up while on the team. I use LabView every day. I just gave a presentation to a colonel in the Army that, before FutureTruck experience, would have made me very nervous and stressed out."*
>
> *Jeremy Forbes*

UI FutureTruck at Ford Headquarters

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UI Researchers Study Safety and Survivability of Transportation Control Systems

ITS Systems Vulnerable to Failures and Threats

The nation's surface transportation infrastructure has evolved to a level of complexity where Intelligent Transportation Systems (ITS) are essential for large urban environments. The ITS program has led to increased connectivity of components as transportation engineers strive to improve service in the face of ever worsening traffic congestion. A consequence of this increased connectivity is that transportation systems are more vulnerable to both physical and electronic threats, as well as cascading and network failures.

Under normal traffic conditions, ITS operation is optimized for system-wide objective functions (i.e., to minimize network-wide delay or maximize throughput), and travelers modify their behavior accordingly by modifying their departure time, travel route, or mode of travel. However, when the system is operating under extreme events (e.g., oversaturated, damaged, or impacted by accidents, malicious attack, or weather) system optimization and dynamics become much more complex due to the interaction between travelers, network controls, communication networks and the physical infrastructure.

Moscow ITS Project Provides Basis for Study

NIATT researchers are in a unique position to study the safety and survivability of ITS systems because of their ongoing work upgrading the signal system in the City of Moscow. They are able to use the City of Moscow ITS project as a basis to study its security and survivability. The Moscow ITS project is a $3 million, two-phase project funded by FHWA through the Idaho Transportation Department to upgrade the signal system in the city to improve long-term traffic growth management. The project tests the implementation of NTCIP standards in a small town- traffic control system.

Using a Modified SSA System

The standard approach for evaluating transportation systems has traditionally focused exclusively on operational and safety aspects, while ignoring issues of system security and survivability. Because infrastructures become increasingly interconnected under ITS systems, network vulnerabilities and survivability become issues. NIATT researchers suggest that a combination of traditional vulnerability assessment and the Survivable System Analysis (SSA) process is needed.

Interdisciplinary Approach

The networked nature of modern transportation systems suggests that their survivability can be evaluated in a manner similar to those employed to analyze computer networks. The University of Idaho is fortunate to have highly regarded computer security experts in its Computer Science Department. Working together with traffic faculty Ahmed Abdel-Rahim and civil engineering students and electrical engineering professor Brian Johnson, Paul Oman, Axel Krings and their computer science student researchers undertook a survivability analysis of the Moscow ITS system.

The survivability analysis determines the likelihood that a system will continue to operate at a given threshold, even in the face of individual component failure. A modified SSA study included both security and survivability analyses of options for: fiber optic cable routing, traffic controller network topologies, communications switchgear linking traffic controllers, computer server placement, and network connections to project stakeholders for access to data and signal control.

The analysis also includes the identification of essential components, the development of stakeholder/component responsibility and access matrix, the identification of project threats, and the development of a threats mitigation matrix to identify threat mitigation strategies for each threat identified, including suggestions for improved security and survivability. The analysis has been presented to the City of Moscow ITS system planners and, hopefully, is being used to influence their design decisions.

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Technology Transfer of Safety and Survivability Project

Peer Reviewed Publications

S. Butapati, R. Kalidindi, M. Benke, R. Erickson, G. Appanaitis, A. Abdel-Rahim, P. Oman, and B. Johnson, "Assessing Traffic Network Vulnerabilities Using Microscopic Simulation and Graph Based Tools," in preparation for the IEEE Transactions on Intelligent Transportation Systems, January 2005.

Conference Papers

A. Abdel-Rahim, P. Oman, J. Waite, M. Benke, and A. Krings, "Integrating Network Survivability Analysis in Traffic Systems Design," presented at the *Intelligent Transportation Systems Safety and Security Conference*, (March 24-25, Miami, Florida), 2004.

F. Sheldon, T. Potok, A. Loebl, A. Krings and P. Oman, "Management of Secure and Survivable Critical Infrastructures Toward Avoiding Vulnerabilities," presented at the *Eighth IEEE International Symposium on High Assurance Systems Engineering*, (Mar. 25-26, Tampa, FL), 2004.

P. Oman, "Critical Infrastructure Protection and Survivability," invited presentation, *ASME Homeland Security Symposium*, (May 14, Idaho Falls, ID), 2003.
P. Oman, A. Krings, D. Conte de Leon, and J. Alves-Foss, "Analyzing the Security and Survivability of Real Time Control Systems," *Proceedings from the Fifth IEEE Systems, Man and Cybernetics Information Assurance Workshop,* (June 10-11, West Point, NY), IEEE Press, 2004, pp. 342-349.

M. Benke, J. Waite, P. Oman and A. Abdel-Rahim, "Survivable Systems Analysis for Real Time Control Systems in Critical Infrastructures," *Proceedings of the International Conference on Security and Management,* (June 21-24, Las Vegas, NV), CSREA Press, 2004, pp. 278-283.

J. Schmidt and V. Nair (with P. Oman and B. Johnson, advising), "A Taxonomy of Security Standards for Real-time Control Systems," *Proceedings of the 36th Annual North American Power Symposium*, University of Idaho, (August 9-10, Moscow, Idaho), 2004, pp. 59-66.
J. Waite, J. Oman, M. Phillips, S. Melton, and V. Nair (with P. Oman and B. Johnson, advising), "A SCADA Testbed for Teaching and Learning," *Proceedings of the 36th Annual North American Power Symposium*, University of Idaho, (August 9-10, Moscow, Idaho), 2004, pp. 447-451.

J. Waite, M. Benke, N. Nguyen, M. Phillips, S. Melton, P. Oman, A. Abdel-Rahim, and B. Johnson, "A Combined Approach to ITS Vulnerability and Survivability Analyses," *Proceedings of the IEEE Intelligent Transportation Systems Council Symposium*, (October 3-6, Washington, DC), 2004.

Related Grant Awards

P. Oman and B. Johnson, *Applying Safety-Critical Fault Tolerant Avionics Principles to Electric Power Systems for Mobile Platforms Operating in Hostile Environments*, $4,000 seed grant from the NASA ISGC, 2004.

A. Abdel-Rahim, P. Oman, and B. Johnson, *Modeling Urban Surface Transportation Network Dependability and Security*, $58,466 grant from NIATT UTC, 2004.

P. Oman, *Summer Stipends for CyberCorps Students* (supplemental award), $39,000 grant from NSF SFS, 2004.

P. Oman, *RADICL: Reconfigurable Attack/Defend Instructional Computing Laboratory*, $120,941 grant from NSF SFS, 2004.

For more information, contact Paul Oman (oman@uidaho.edu).

NIATT Traffic Signal Work Meets National Priorities

UTC Project Serves as Impetus for Traffic Signal Training

The traffic signal is one of the most important devices in the nation's transportation system. Yet many of the traffic signals that are currently in use today are not timed properly, are not installed correctly, are not used to their fullest extent, and are often not maintained properly. While the traffic signal is intended to provide for effective and efficient intersection operations, it is the one device that can require the public to wait unnecessarily if not properly designed and operated.

Following NIATT's first Traffic Signal Summer "Camp" in 2001, Michael Kyte, NIATT's Director, Jim Pline, retired engineer and NIATT peer review panel member, and Darcy Bullock of Purdue, the holder of the patent for the Controller Interface Device, met to discuss the needs of the engineering community in the area of traffic signal planning.

What professionals lacked, they concluded, was a basic understanding of signal timing that could only be gained by designing and testing timing plans in realistic settings. Their ideas were presented to Pam Crenshaw and Jeffrey Lindley of the FHWA during the January 2002 TRB annual meeting.

FHWA Roadmap Developed

FHWA was separately developing a "roadmap" to direct the organization's plan to improve the signal-timing skills of the nation's traffic engineers and technicians.

According to FHWA , the plan was developed "to provide leadership in mainstreaming traffic signal timing/retiming and coordination as a fundamental and continuing part of any transportation improvement plan. It will develop the appropriate outreach, guidance, education, awareness and tools so that significant strides toward implementing and improving the traffic signal timing at different agency levels can be made."

The roadmap can be viewed at http://ops.fhwa.dot.gov/traffic_sig_timing/tst_progplan.htm

Kyte Serves on Peer Review Panel

FHWA first reviewed its signal timing roadmap with a panel of experts, including Michael Kyte, in January 2004. The hands-on signal timing training proposed by Kyte, Pline and Bullock in 2001 was included as a part of the roadmap.

Mobile (Hands-On Traffic) Signal Timing Training

In the 2004 Appropriation Bill, $750,000 in Surface Transportation Research funds was earmarked for the NIATT to develop and deliver training and education for transportation professionals in Idaho, Oregon and Washington. This project, known briefly as "MOST," will provide mobile, hands-on traffic signal timing training.

The training materials, which will emphasize the principals of traffic signal timing, will be in the form of laboratory exercises. The project's anticipated end date is January 2008.

UTC Grant Funds Complementary Work

As a complement to developing training directed primarily for technicians and engineers, Kyte began planning for a graduate textbook to each the principles of traffic signal timing. Early work focused on identifying topics, assembling case studies, and deciding on a format.

For three months of his 2005 sabbatical, Kyte worked with Tom Urbanik of the University of Tennessee on a UTC-funded NIATT project to write a textbook on actuated traffic control systems. During that period, they completed an outline and table of contents for the book, the first drafts of five chapters and designed a web site to host an electronic version of the book.

The audience for this text is graduate students. Both Kyte and Urbanik will be teaching similar courses on intersection traffic operations during the 2005 spring semester and will use their courses to test the chapters.

For more information, contact Michael Kyte (mkyte@uidaho.edu).

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Biodiesel Production Research Continues

Cost-Effective Method Researched

Most existing biodiesel production technologies are batch-type in nature, which are labor-intensive, time-consuming and less cost-effective than a continuous process. A continuous transesterification process is preferred over batch processes to lower the cost for quantity production.

In order to achieve a lower production cost, a shorter reaction time and/or greater production capacity are desirable. In ongoing NIATT research, a novel transesterification process using a reactive distillation technique is proposed to produce biodiesel from seed oils using less alcohol and thus less energy.

Capital Purchase to Further Research

For the second consecutive year, NIATT has placed overhead return funds into a pool and requested proposals from its research centers. Representing the Center for Clean Vehicle Technology, Brian He, John Van Gerpen, Charles Peterson, Dev Shrestha and Joseph Thompson submitted a proposal to purchase a gas chromatograph for biodiesel analysis and quality control.

NIATT approved $12,000 from its overhead return budget, which was matched by an additional $20,850 from the UI College of Engineering, the College of Agricultural and Life Sciences, and the Department of Biological and Agricultural Engineering for purchase of the equipment.

The gas chromatograph will complement the array of testing equipment and will be used on a routine basis for testing that is now being contracted out to other labs.

We believe that the rapid growth in the biodiesel industry and the University of Idaho's unique position as a leader in biodiesel technology can provide a multitude of opportunities for collaborative projects to support this industry. The chromatograph will allow us to provide testing services in this area and will greatly increase the analytical capabilities of the Biofuels Research Laboratory and its competitiveness in acquiring external funding in the future.

This is a prime example of the way NIATT "recycles" returned overhead funds from UTC grants to further our research and to secure matching funds from elsewhere in the university.

New Biodiesel Publications

The research of graduate student Arvinder Singh, who is working on the project, has generated two conference papers this year. A manuscript he coauthored with NIATT's Brian He and Joseph Thompson was submitted for peer-review (see below).

Conference papers:

Singh, A., J. Thompson, and B. He. 2004. "Function and Performance of Pre-Reactor in Biodiesel Production from Seed Oils using Reactive Distillation Column." Presented at the 2004 PNW ASAE meeting. Sept. 23-25, 2004. Baker City, Oregon. ASAE Paper No: PNW04-1011. ASAE, St. Joseph, Mich.

Singh, A., J. Thompson, and B. He. 2004. "A Continuous-Flow Reactive Distillation Column for Biodiesel Preparation from Seed Oils." Presented at the Annual International Conference of ASAE/CSAE. Paper No: 04-6071. August 1-4, 2004; Ottawa, Ontario, Canada.

Manuscripts submitted:

He, B., A. P. Singh, and J. C. Thompson. 2004. "A Novel Continuous-Flow Reactor Using a Reactive Distillation Technique for Biodiesel Production." *Trans. ASAE* (submitted manuscript # FPE-0562-2004).

Gas Chromatograph

For more information, contact Brian He (bhe@uidaho.edu).