UI Competition Snowmobile Cleanest Around!

UI Snowmobile Both Clean and Quiet

Following the 2002 Clean Snowmobile Challenge (CSC), the top five finishers in the emissions portion of the competition were invited to bring their snowmobiles to the Southwest Research Institute (SwRI) in San Antonio, Texas, for more detailed emissions testing. The UI snowmobile captured first place overall in the Society of Automotive Engineers (SAE) student design competition.

The University of Idaho was one of two student teams who attended. (The Kettering University team, who came in only two points below UI in the CSC, also brought their sled to SwRI.) Detailed emissions testing were performed on the student-built sleds, and on the two commercially available four-stroke snowmobiles.

The report, released by the Montana Department of Environmental Quality, showed that the University of Idaho 2002 competition snowmobile was the cleanest one tested.

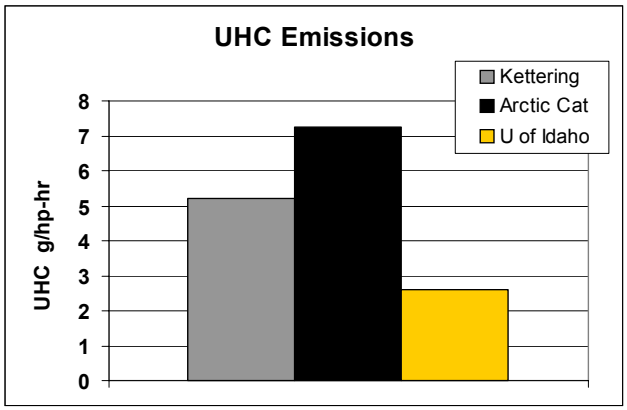
Emissions Testing Validifies Design Success

The graphs to the right show the results of the testing for carbon monoxide (CO) and unburned hydrocarbons (UHC) on the UI and Kettering snowmobiles and a commercial Arctic Cat.

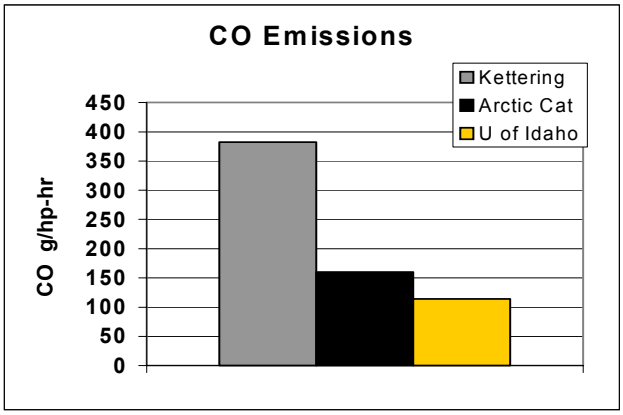
Our snowmobile had lower hydrocarbon and carbon dioxide emissions than the other student sled and both of the commercial ones, even when we were running on 90 percent gasoline and 10 percent ethanol.

The snowmobile also had lower NOx and particulates than all sleds tested.

Results of the SwRI testing on the UI snowmobile suggests that a high-quality, well-running, properly tuned engine with a catalytic converter can go a long way toward cleaning up snowmobile emissions.



Results from Unburned Hydrocarbons (UHC) Testing



Results from Carbon Monoxide (CO) Testing

> "The bottom line is that UI's sled was the cleanest one tested. "
>
> Dr. Karen Den Braven
> Professor, Mechanical Engineering
> Clean Snowmobile Team Advisor

National Institute for Advanced Transportation Technology

For more information, contact Dr. Karen Den Braven
kdenb@uidaho.edu
or visit http://www.uidaho.edu/~uicsc/

Plans to Expand Traffic Controller Lab Underway

NIATT's Traffic Controller Lab to be State-of-the-Art

NIATT's Traffic Controller Lab is poised to become a world-class research and training center where practicing engineers, researchers and students can develop and test traffic signal timing plans using state-of-the art equipment. The heart of the lab will be hardware and software infrastructure for testing timing plans, using hardware-in-the-loop simulation with NIATT's new Controller Interface Device (CID).

The current lab, which has been upgraded over the past two years, is already one of the most advanced traffic control labs in the nation. Each of the seven workstations is equipped with a traffic controller, video detection equipment, CID, host computer and advanced software. The existing Controller Lab is used for NIATT research, classroom teaching, and for conducting NIATT's annual Traffic Signal Summer Workshop.

A second adjoining room, doubling the square footage of the existing lab, will be equipped with controllers, CIDs, personal computers and a communication system that will allow users to test traffic networks with up to 20 signalized intersections. The lab will include

- √ Four racks, each housing five CIDs, five traffic controllers and cabinets, and a laptop computer to run the traffic controller software.
- √ Five dedicated personal computers running industry-standard simulation software such as CORSIM and VISSIM and the CID Software Suite.

The lab's modular architecture will allow reconfiguration of traffic control systems and allow users to run simulations with a variety of traffic controllers (NEMA TS1, TS2, 170s, or 2070s).

Funding for the Traffic Controller Lab expansion comes from the Federal Highway Administration, the University Transportation Centers Program of the US DOT's Research and Special Programs Administration, the Idaho Transportation Department, the University of Idaho, and donations from the traffic control industry.

> "Not only will this lab bring the benefits of the CID and hardware-in-the-loop to the engineering community worldwide, it will also provide a state-of-the-art facility for further research and training in advanced ITS Technologies."
>
> Michael Kyte
> NIATT Director

Key to Success is Cooperative Planning

The improvement of the Traffic Controller Lab extends NIATT's successful collaboration between education, government, and industry that began with the development of the CID. The project team again consists of product development experts, practicing engineers, faculty, undergraduate and graduate students, and researchers from NIATT, Purdue University, FHWA, and the traffic control industry.

The collaborative process insures that the project meets real-world engineering needs.

The effort is multidisciplinary as well. A current senior design project involves computer science and electrical engineering undergraduate students working with a graduate civil engineering student and faculty from civil and electrical engineering.

First Large-Scale Testing of Hardware-in-the-Loop Simulation

The Traffic Controller Lab will initially be used to develop and test signal control strategies for the traffic signal network in Moscow, Idaho. The $1.5 million Moscow ITS Project includes developing new signal timing strategies and testing them in the lab. This is the first time that a system of this size will be modeled prior to deployment using hardware-in-the-loop simulation and the CID.

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

Traffic Signal Technology Challenges Students

Third Traffic Signal Summer Workshop Successful

Twelve students representing five countries met in Moscow, Idaho, from August 11-17, 2002, to learn how to use traffic signal controller equipment, video detection, loop detectors, and NIATT's Controller Interface Device (CID). Using UTC funds, we have continued to take a leadership role in establishing training methods and materials for new traffic signal controller technology.

On the first day, participants in the Traffic Signal Summer Workshop (TSSW III) were grouped in teams of two. The teams serve a social function, providing a way for the participants to become familiar with each other and more at ease. Working at the six stations, they help and challenge each other. Each member of the team also has the opportunity to try things independently. Working in groups also reflects the multidisciplinary nature of the current work environment.

Refinements in the activities made with the hindsight of the first two years made this year's experience the best yet. Instructors observed that the students developed a special camaraderie, which was quite evident in the Traffic Signal--Jeopardy-like game played during the closing banquet. Questions for the game, developed by graduate student Andrew Nichols of Purdue, an assistant instructor, were based on the materials from the week.

During the workshop, students visited signalized intersections in the field, developed timing plans for the intersections and tested loop detectors, learned to use video detection systems, and tested their timing plans using the CID.

"Traffic Signal Summer Workshop will give me skills that I would normally have to learn from an employer. By learning these things now, I make myself that much more valuable to a future employer."

Andrew Staples
TSSW III Participant

UTC Funds Provide Fellowships

This year, fellowships enabled three UI undergraduates to participate in the summer workshop. William Webb, civil engineering junior, worked on a UTC project with Dr. Michael Dixon to develop project a suite of training modules and supporting tutorials that focus on case studies using hardware-in-the-loop simulation to help students internalize the concepts of traffic signal timing (see Training Materials Enhance Transportation Curriculum).

Andrew Staples, also a civil engineering junior, interned in previous summers for a construction engineering and civil engineering firms. In the summer of '01, Andrew worked with Dr. Ahmed Abdel Rahim with simulation models for the Treasure Valley corridor, using CORSIM and SYNCHRO.

Eugene Bordenkircher, who received his BS in computer engineering in June 2002 and is continuing work toward his MS degree, has been a key member of the CID development team. He is the first computer engineering student to participate in the Traffic Signal Summer workshops.

Other participants in the Traffic Signal Summer Workshop pay a fee of $250 each. For that amount, they receive room and board, all materials, and participation in several social events. Students are eligible for three continuing education credits, as well.

"Traffic Signal Operations Education through Hands-On Experience: Lessons Learned from a Workshop Prototype," a paper written by Michael Kyte, Ahmed Abdel-Rahim, and Melissa Lines, will be presented at the annual Transportation Research Board meeting in January 2003.

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

NIATT
National Institute for Advanced Transportation Technology

Semi-Annual Report—July 2002—December 2002

Practitioners and Educators Identify Curriculum Needs

Focus on Traffic Signal Design and Operations

Nearly 40 educators and practitioners met for two days in September 2002 at the Oregon Department of Transportation, Region 1 office, in Portland to identify curriculum needs for traffic signal design and operations. The retreat was sponsored by the Northwest Transportation and Education Alliance (NWTTEA). NIATT funds from the UTC program helped support the event.

The objectives of the retreat, organized by NIATT director Michael Kyte, were to

- √ develop a document (electronic report or web site) that identifies the skills or competencies that a professional (engineer or technician) needs to have in order to work in the area of traffic signal planning, design, and operations
- √ develop a process necessary to produce educational and training materials and course delivery mechanisms so that university students and practicing professionals will gain these skills and competencies.

The group considered training and educational needs of university students as well as practicing engineers and technicians. The group considered NIATT's Traffic Signal Summer Workshop as a model for how new courses might be delivered. The group identified a variety of possible means to delivering training and education on traffic signal design and operations, including universities and T2 centers.

The final report summarizing the work of the retreat will be completed in January 2003.

NWTTEA is an alliance of transportation organizations and educational institutions working to broaden lifelong learning opportunities for the transportation industry and professional transportation practitioners of the Pacific Northwest. The alliance is a cooperative effort among transportation educators and practitioners seeking to provide education and training for current and future transportation practitioners and students.

Retreat Participants Bring Broad Perspective

Representatives from the following organizations brought a broad prospective to the process:

Ada County Highway District
City of Portland
City of Vancouver
Clackamas County
Clark County
DKS Associates
Federal Highway Administration
Gardner Systems
Idaho Transportation Department
Innovative Transportation Concepts, Inc.
Kittelson and Associates
Northwest Signal Supply, Inc.
Oregon Department of Transportation
Oregon Institute of Technology
Pline Engineering
Portland State University
Purdue University
University of Idaho
University of Washington
Washington County
Washington Department of Transportation
Washington Technology Transfer Center

These participants reflect the array of practitioners and students that need access to transportation training, including federal, state and local agencies; private and public universities; vocational training centers and community colleges; and private business.

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

A Different Kind of Energy!

Peterson Named Innovator of the Year

Charles Peterson, NIATT researcher in biofuels, was one of 12 recipients of the *Idaho Business Review*'s Innovator of the Year Award.

The *Idaho Business Review* provides business news and information affecting Idaho's business marketplace. Believing that innovation is the key to business growth and is vital to Idaho's long-term well-being, IBR spotlights individuals who are advancement pioneers. Peterson's work in developing biodiesel as an alternative fuel earned him and the UI this year's innovator award, which was presented August 27 in Boise, ID.

Peterson's biodiesel research began in 1979 when he walked into a local grocery store and purchased a bottle of sunflower oil. The oil was used to run an agricultural tractor owned by UI. A switch to safflower oil and 100 hours of operation ruined the tractor engine, but launched the biodiesel research program.

Biodiesel is a substitute diesel fuel made from any vegetable oil or animal fat and alcohol. Peterson and fellow UI researcher Jack Brown have used the oils from rapeseed, canola, soybean and yellow mustard to create biodiesel.

Biodiesel collaborators have included Yellowstone National Park and the Truck-in-the-Park project, the J. R. Simplot Co. running one of its Kenworth trucks over 200,000 miles on a 50 percent biodiesel fuel, and Albertsons, Inc., running a blend of used deli fryer oil to power one of its transport refrigeration units.

International Recognition for Bioenergy

Response to the Tenth Biennial Bioenergy Conference, "Bioenergy 2002," held September 22-26, 2002 in Boise, Idaho, was enthusiastic. NIATT used UTC funds to help support this national conference, cosponsored as well by the Bioenergy Program of the Department of Energy and the National Park Service and the Idaho Department of Water Resources.

The conference highlighted the latest in biomass energy technology from around the world. Over 200 presenters, both oral and posters, were scheduled with 20 percent of those from non-USA locations. Papers were submitted from the USA and 33 additional countries. Over 500 individuals attended the conference. Exhibitors included 32 different companies and organizations. The conference represented the latest, best, and brightest state-of-the-art concepts for making biomass energy sustainable, environmentally friendly, and economically competitive.

Bioenergy has exploded into one of the most exciting segments of the international economic and industrial arenas. From national energy security strategies to environmental protection techniques to an engine for economic development, bioenergy now combines all these and other critical elements to make it a front burner issue in nearly every country. There's no doubt about it: bioenergy has come of age, it's been "discovered."

Bioenergy 2002 emphasized using biomass to reduce our dependence on fossil fuels and supplement our regional energy resources while benefiting the environment. It provided a forum to share and develop new ideas that will improve our knowledge of bioenergy as an energy resource. It highlighted successful commercialization efforts and emphasized the biomass renewable resource base.

> "We did something different for a technical conference. We invited the public to attend an evening of posters and exhibits because of the amount of interest in these topics."
>
> Charles Peterson
> UTC/NIATT Researcher in
> Biodiesel Fuels

Proceedings for Bioenergy 2002 are available from the UI's Department of Biological and Agricultural Engineering, baengr@uidaho.edu.

Training Materials Enhance Transportation Curriculum

On-Line Interactive Material Facilitates Learning

A NIATT website, created with UTC funds by Dr. Michael Dixon and undergraduate civil engineering student, William Webb, provides transportation engineering students with more than a theoretical base of knowledge about traffic signal control or work with simple models. It also gives users an opportunity to interact with a traffic control system called hardware-in-the-loop simulation (HILS). A suite of training modules and supporting tutorials provide an interactive medium whereby users are introduced to the primary topics in traffic signal timing.

The materials incorporate complex simulation models and real traffic control hardware. Complex case studies using HILS help users internalize the concepts of traffic signal timing. Sufficient supporting information is provided with the training materials so that users have all the information necessary to complete the case studies. Links within the website can be accessed with minimal effort, making the learning process enjoyable and more efficient.

Students learn in an environment in which they interact with a traffic control system comprised of a traffic controller, a computer running a traffic simulation model, and NIATT's controller interface device that allows the traffic controller and computer to communicate with each other.

Four Training Modules Include Tutorials

Four basic modules were created:

- √ Basic signal timing
- √ Actuated signals
- √ Coordinated signals
- √ Hardware-in-the-Loop simulation

Tutorials on traffic simulation software and traffic signal optimization packages, such as CORSIM and SYNCHRO, provide the level of information necessary for users to complete and understand the exercises in the modules.

> "These training materials enhance the transportation curriculum by making teaching methods more efficient, realistic, flexible and engaging. "
>
> Dr. Michael Dixon
> Assistant Professor, Civil Engineering

A Break from Traditional Learning

Traditionally, students learn about traffic signal operations in the classroom. Faculty generally base the curriculum on a combination of classroom lecture and lab exercises, where models, such as HCS or Synchro, are used.

In this setting, students do learn the basic concepts of signalized intersection operations and understand how signals can be timed using some fairly simple equations. They typically know how to apply the equations to develop signal timing plans. However, they still have great difficulty in understanding the cause and effect relationships that are represented by the equations. Nor do they grasp the way signal timing plans are implemented in actual traffic controllers.

The on-line materials augment the traditional learning environment. Each module gives users the background material and lab exercises that they need to make important connections between key intersection design parameters and constraints, such as signal timing plans, intersection configuration, and controller operations. Furthermore, once an instructor is comfortable with this training material, they can develop their own exercises and projects to better satisfy individual educational objectives.

Beta Testing and Feedback

The website underwent continual improvement following feedback from students in an undergraduate lab in the spring 2002 semester and student interns. In both cases, students were new to the subject and representative of the target audience. Traffic Signal Summer Workshop participants 2002 who used the material in 2002 were enthusiastic.

Dr. Dixon shared this website with other university faculty who attended at NWTTEA retreat (see "Practitioners and Educators Attend Traffic Operations Retreat"), many of whom have shown an interest in using this material in their own courses.

For more information, contact mdixon@uidaho.edu or visit http://www.its.uidaho.edu/niattproject/

National Institute for Advanced Transportation Technology

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Transfer of Catalytic Igniter Work Continues

Three Papers for Presentation in March

Mechanical engineering professors Judi Steciak and Steve Beyerlein and their graduate students will be presented at the Third Joint Meeting of the US Sections of the Combustion Institute, March 16-19, 2003 in Chicago, Illinois. The Combustion Institute is an educational nonprofit, international, scientific society whose purpose is to promote and disseminate research in combustion science. The papers concern JP-8 conversion, van conversion, and the catalytic reactor work. Detailed chemical kinetics mechanisms developed for homogeneous ethanol oxidation will be the subject of a poster session. All work was supported with UTC funding.

"Conversion and Testing of a Flexible-Fuel Vehicle with Aqueous Ethanol and Gasoline," reports the progress of the project in which catalytic igniters were implemented in a transit van to explore igniter performance and engine emissions under on-road conditions. This paper documents design features that support flexible fuel operation--the van can run on either aqueous ethanol or gasoline. Data from chassis dynamometer tests conducted with both fuels are given.

Results to date show comparable thermal efficiency, slight reductions in hydrocarbon emissions and dramatic reductions in NOx. Further increases in thermal efficiency are possible by optimizing fuel injection mapping. In addition, reductions in emissions are possible by optimizing downstream exhaust clean-up systems. Recommendations are also provided for improving vehicle conversion simplicity, alleviating cold start problems, and increasing platform robustness.

Enhancing Cold Starts with JP-8 Fuel

Another paper, "Genset Operation Using JP-8 Fuel under Cold Chamber Conditions," details the successful conversion for operation on JP-8 fuel of a 1-kW, 4-stroke, gasoline generator.

Catalytic ignition technology combines the best of Otto cycle and diesel cycle engines and holds promise for helping our Armed Forces achieve their goal of a single fuel military. To better assist field operations, man-portable power is required that will reliably operate down to -32°C, while meeting this single-fuel mandate.

The paper details modifications to the carburetion system necessary to accommodate JP-8 fuel, to enhance cold starting, and to facilitate engine shutdown. Performance data for both gasoline and JP-8 operation reveals performance under environmental conditions of 21 °C, 4 °C, -18 °C, and –29 °C. Results of this experimentation are being used to design a second generation prototype that has better cold starting capability.

Plug Flow Reactor Used in Research

The third paper to be presented at the Combustion Institute, "Plug Flow Combustion of Aqueous Ethanol-Air Mixtures through Catalytic Ignition," reports operational characteristics of the catalytic plug flow reactor built with UTC funds. The reactor facilitates exploring the relationship between catalyst temperature, fuel-water-air temperature, water concentration, and equivalence ratio.

The characteristics described include the flowfield downstream of a specially designed mixing nozzle, platinum catalyst configuration, and instrumentation for microcalorimetry experiments. Considerable attention is given to defining the optimum region for platinum catalyst placement so that results can be best translated to cold starting conditions in a catalytic igniter.

My Thesis Doesn't Just Sit on the Shelf !

Continuity of Funding = Continuity of Research

NIATT has provided UTC funding for research in the area of catalytic ignition and alternative fuels for five years, supporting the following projects: Spark Ignition Engine Conversion to Aqualytic Fuel; Diesel Engine Conversion to Aqualytic Fuel; and Reactor Studies of Alcohol-Water Catalysis; Engine and Vehicle Demonstrations on Aquanol Fuel; Catalytic Ignition of Aquanol in Reactor, Engine, and Vehicle Environments; and Modeling and Application of Catalytic Ignition in Internal Combustion Engines.

The success of the research has been made possible in part by NIATT's ability to provide financial support to a continuing number of graduate students in mechanical engineering:

Andron Morton (MSME '99)
Eric Clarke (MSME '01)
Matthew Walker (BSME '01; now MS candidate)
Jeff Williams (BSME '01; now MS candidate)
Amit Patel (MS candidate)
Xiangyang Wang (PhD candidate)
Dan Gerbus (MS '99; PhD '02)
Robert Drew (BSME '01; now MS candidate)
Michael Klein (BSME '01; now MS candidate)
Dan Cordon (MSME '02; now PhD candidate)
Nathaniel Allen (MSME '02)

One result of the continuation of this work is that students learn that research--their hard work to research and write theses and dissertations--doesn't just end up sitting on a library shelf. The completed work of one student is the starting point for the next. They are spurred on by the knowledge that they are using the work of their peers and know that what they do will be used by students who come into the program after they leave.

This collegiality also encourages students to value graduate degrees. Students who, at first, plan only to earn bachelor's degrees, often decide to work towards advanced degrees.

Collegiality Encouraged by IEWorks

Idaho Engineering Works (IEWorks), the UI's unique mentoring program, helps foster this collegiality. Working together in an environment that emphasizes human dynamics, engineering leadership, creativity and innovation, graduate and undergraduate students encourage each other in both personal and professional development.

Catalytic Igniter Work Attracts Additional Funding

UTC funds have been supplemented by support for the catalytic ignition/alternative fuels research from the Idaho Transportation Department (ITD) and the U. S. Department of Defense.

The two-year complementary project funded by ITD is helping develop infrastructure for integrating alternatively fueled vehicles into the state fleets and supports emissions screening efforts.

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.

The partnership with Aqualytic Technologies, Inc., of Sandpoint, Idaho, has helped NIATT respond to national needs. Mark Cherry, CEO of Aqualytic Technologies, recently received a Phase II SBIR grant to continue to work with cold starting (see next page). An Army Research contract monitor told NIATT researcher Judi Steciak that "This is how the system should work."

The research has been well-reported to industry at a variety of conferences and through the publication of papers. The papers mentioned on the next page and in the "Bits and Pieces" section of this report are the most recent.

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

SAE Formula Car Competition Provides Real Design Experience

Not a Race--An Engineering Competition

Undergraduate students from the University of Idaho will join 134 teams from across the world May 14--18, 2003 in Pontiac, Michigan, for the Formula SAE Competition. Established in 1981, the competition is for student teams to conceive, design, fabricate, and compete with small formula-style racing cars.

The University of Idaho has been participating in the SAE Collegiate Design Series for the last two years. For the last two years UI's formula car has been a group project activity. This year, the car is being done as a senior design Project. Nine seniors, eight graduate students, and up to six undergrads have formed a team to participate in this high octane project.

Providing Real-Life Engineering Experiences

Using UTC funds for this student competition supports NIATT's goal to provide practical and real-life engineering experiences for our students. The Senior Design courses in the UI mechanical engineering department continue to be based on the Idaho Engineer Works (IEWorks) model that teaches engineering, teamwork and leadership skills.

Dan Gerbus, who just defended his PhD dissertation in December 2002, is the mentor for the UI Formula SAE team. Dan was the primary author of the NIATT report, "Improving the Professional Skills of Graduate Students through Capstone Project Mentoring in Idaho Engineering Works" and NIATT's outstanding student of the year in 2000.

> "The competition provides a hands-on learning experience and promotes great academia/ industry interaction. "
>
> "Competition History"
> SAE Technical Paper 962509
> Dean Case

> "Formula SAE design judging is meant to be a cooperative experience between the students and the judges. The judging experience is an opportunity for the students to explain their concepts and to show the results of their efforts to a group of practicing engineers experienced in both passenger and race car engineering and development."
>
> "All You Ever Wanted to Know about Design Judging and Waited until Too Late to Ask"
> http://www.sae.org/students/fsae-judge.doc

Designing a Prototype Car for Evaluation

For the purpose of this competition, the students assume that a manufacturing firm has engaged them to produce a prototype car for evaluation as a production item. The intended sales market is the nonprofessional weekend autocross racer. Therefore, the car must have very high performance in terms of its acceleration, braking, and handling qualities. The car must be low in cost, easy to maintain, and reliable. In addition, the car's marketability is enhanced by other factors such as aesthetics, comfort and use of common parts. The hypothetical firm is planning to produce four cars per day for a limited production run and the prototype vehicle should actually cost below $25,000. The challenge to the design team is to design and fabricate a prototype car that best meets these goals and intents. Each design will be compared and judged with other competing designs to determine the best overall car.

The restrictions on the car frame and engine are limited so that the knowledge, creativity, and imagination of the students are challenged. Four cycle engines up to 610cc can be turbocharged or supercharged to add a new dimension to the challenge of engine design. The vehicles are judged in three different categories: static inspection and engineering design, solo performance trails, and high-performance track endurance.

The end result is a great experience for young engineers in a meaningful engineering project as well as the opportunity of working in a dedicated team effort.

For more information, contact Dr. Edwin Odom or Daniel Gerbus or visit the team website: http://www.uidaho.edu/~racing/FormulaSAE.htm

NIATT Internship Program Expanded--

Twenty Undergraduate Internships Awarded

In our proposal for '03-'04 UTC funding, we listed the expansion of our internship program as a planned enhancement. In the '02 academic year, eleven undergraduates received internships. This year, twenty-one undergraduates are working on a variety of transportation projects, an increase of 80 percent (or nearly doubling).

These internships are evidence of our commitment to education and to providing the workforce necessary for the advancement of transportation in the future. We believe that involving undergraduates in research projects where they can apply their classroom knowledge increases the possibility that they will enter graduate school.

Of the 20, freshman mechanical engineering student, Steven Corrao, applied to the internship program because of his interest in machines. He is exploring the possibility of a hybrid- or turbo-charged engine for off-road and recreational vehicles.

Sophomore electrical engineering student Samuel Young will join the Controller Interface Device team. He is assisting with design and building of a beta-test prototype of the SDLC version of the CID.

The remaining 6 juniors and 12 seniors in mechanical, civil, materials science, chemical, agricultural and computer engineering are working on a variety of projects financed with UTC funds, involving the snowmobile, the FutureTruck, biofuels, traffic control and incident detection.

> "I am very eager to learn about engineering practices in my field through an actual project in an area of research of such importance and practical application as transportation. "
>
> Samuel Young
> Electrical Engineering undergraduate
> and NIATT Internship applicant

UI NSF-Idaho EPSCoR Funds Two Interns

A NIATT internship provides up to $1000 plus fringe benefits for each intern. This year, NIATT competed for and was awarded additional funding for two interns from the NSF-Idaho EPSCoR Research Experiences for Undergraduates (REU) program. Two interns, one from the Center for Traffic Operations and Control and one from the Center for Clean Vehicle Technology, received $1000 each from the REU program that was matched by their NIATT internships.

The purpose of the REU program is to expand opportunities for UI undergraduates in the sciences and engineering to gain hands-on research experiences during the Fall 2002 semester. An additional $500 assisted with the purchase of research supplies for use in their projects.

√ Erik Cegnar, a senior in electrical engineering, was a NIATT summer intern and contributed to the designing of the hybrid drive configuration for the 2003 FutureTruck. Working on an EE senior design project last academic year, he built the control system for the 2002 FutureTruck's hybrid-electric feature, which performed flawlessly at the June competition. Part of the revised design requires another control system for optimizing power flow between ultra-capacitors and batteries. This project requires personal ambition and knowledge about power electronics and digital control, qualities which Erik has already demonstrated.

√ Troy Cuff, a senior in computer engineering, was awarded the second EPSCoR internship. Troy was also a summer intern. He is continuing his work with NIATT's Next Generation Controller Interface Device to extend and utilize the Real-Time Playback system developed by John Fisher for his EE Master's Thesis last summer to characterize the hardware-in-the-loop performance of the CID. Troy will also assist Manjunath Reddy (MS Student in Computer Engineering) in the development of a custom USB driver for the Controller Interface Device.

FutureTruck Uses Innovative Passive Cooling System

Innovative Use of Aluminum

One of the awards won by NIATT's entry in the Department of Energy's FutureTruck 2001 competition recognized the Advanced Vehicle Concept Team's (AVCT) innovative use of aluminum. The team used aluminum to fabricate special panels for passive cooling and mounts for the hybrid components.

The team's passive cooling system design placed the radiator on the 2002 Ford Explorer Sport Utility, nicknamed "Summit." Its purpose was to reduce the cooling load on the engine. The less the engine has to work to stay cool, the less fuel it consumes. Testing on the dynomomenter during the FutureTruck competition showed a 25 percent decrease in fuel consumption.

Testing the Concept

Prior to design and installation of the cooling system, AVCT members performed tests on a Honda Civic and a Ford Econoline van to prove the concept and size the components. Results of the test indicated that thermal siphoning in a passive cooling system would produce adequate cooling for the vehicle's V6 internal combustion engine..

Mathematical models showed that a grid of tubes on the roof would not provide enough cooling capacity without a substantial number of fins; therefore, a radiator was needed. Using aluminim for the construction would maximize heat transfer and reduce weight.

How the System Works

The system operates on the thermal siphoning principle, which eliminated the need for a continuously running coolant pump. By locating the heat generating engine below the head level of the radiator, the less dense coolant would flow upward, displacing the denser, cooler fluid in the radiator without the need of a pump. The supply and return tubes provide approximately 10 percent of the total cooling capacity. The air conditioning condenser was also mounted on the roof in front of the engine's heat exchanger.

An auxiliary, centrifugal electric pump initates flow after engine start and augments the thermal siphon during heavy engine loads when heat generation is greatest. When the engine is cold, the pump removes air pockets in the system, which would restrict thermal siphoning.

Results of the FutureTruck Competition

The Summit vehicle placed seventh overall among the 15 universities competing at Ford's Arizona Proving Ground in June 2002. It was one of only three vehicles to attain ultra-low emissions vehicle (ULEV) standards, placed second in the acceleration event, and first in the trailer tow event. It was one of the few vehicles that did not overheat at For'ds Arizona Proving Grounds where daily temperatures exceeded 100°F.

AVCT team members took pride in the reliability of Summit--the vehicle was able to complete all test events. Using a design-build-test methodology and all available resources, the team developed a feasible, mild-hybrid electric configuration that reduced emissions and improved vehicle acceleration and passenger comfort.

The students' satisfaction from receiving awards can not be underestimated. However, as a teaching and research center, NIATT takes special pride in the multi-disciplinary nature of the team, the knowledge and experience gained by those students who participated, and the transfer of their enthusiasm to the public.

For more information, contact Frank Albrecht (falbrecht@uidaho.edu) or visit the team website: http://www.idahofuturetruck.org

Bits and Pieces

Innovations in Engineering Education

NIATT graduate student Dan Cordon presented the paper, "Shop Orientation to Enhance Design for Manufacturing in Capstone Projects," at the Frontiers in Education Conference held November 2002 in Boston, Massachusetts.

The paper describes the mentor-based design process that takes projects from the conceptual stage through creation of functional prototypes. Graduate student mentors in the Idaho Engineering Works (IEWorks) have created a three-session orientation that teaches fundamentals of machining associated with the construction of a small multitool. Student feedback recorded in their design journals underscores the benefits of this shop orientation in promoting machine design skills that result in high quality prototypes delivered to industry customers at the end of the course and in fostering a close relationship between mentors and students.

The paper was written by a group of graduate students, including Dan Cordon, who are supported with UTC funding, and instructors Edwin Odom, Karl Rink and Steven Beyerlein. outcomes gained from experiences with the IEWorks program.

The Frontiers in Education Conference one of the two most important, annual, international conferences totally devoted to improvements in engineering education. NIATT uses UTC funds to support the travel of graduate students and researchers to conferences, where they not only learn from others but also disseminate the work being done at the University of Idaho.

NIATT Researchers Receive Best Paper Award

Richard Wall and Brian Johnson, NIATT researchers in electrical and computer engineering, were recognized for the "Best Paper" delivered at the 28th Conference on the Institute of Electrical and Electronics Engineers (IEEE) Industrial Electronics Society held in November 2002 in Sevilla, Spain. The paper is entitled "Regenerative Train Control Networks for Gas Turbine Powered High-Speed Rail Locomotive with Flywheel Energy Storage."

FutureTruck Team Holds Open House

The FutureTruck team hosted a special open house on November 12 at the vehicle shop on the UI campus. Members of the community, including the Palouse-Clearwater Environmental Institute, were invited to view the 2002 For Explorer and learn about hybrid-electrics and hybrid-hydraulics. Attendees were asked: "What type of controls, instrumentation, and information does the customer prefer for the next generation vehicle?"

Students Market Graduate School

Under the direction of Michael Kyte, a group of civil engineering students designed a new brochure for use in student recruiting. "Why Should I Consider Graduate School in Civil Engineering," a tri-fold color brochure, was designed and written by graduate students Melissa Hanenburg, Phil Rust, and Ravi Sabbisetti, and undergraduates William Webb, Michael Conn, and Katie Shamberg. The brochure includes perspectives from professional engineers and current graduate students, answers some frequently asked questions, and outlines the graduate program.

Students Intern Off-Campus

Several students associated with NIATT served interesting internships during the summer of '02 to enhance their educational experiences. Andrew Findlay and Phil Rust were two of those students.

Findlay, mechanical engineering junior, felt fortunate to work for Polaris in Roseau, Minnesota, this past summer. Andrew, a member of the Clean Snowmobile Team, said that working for Polaris has been a desire since he was a young child. His experience in the Northwest made him valuable to the RMK (deep snow) group.

Rust, who will be receiving his MSCE this coming spring, worked as part of the FHWA Traffic Operations Office of Travel Management during the summer. There, he wrote a paper on travel supply and demand management, contributed to two guidebooks on the use of simulation modeling, and drafted an outline for a manual on freeway ramp management and control. He reports learning a great deal about freeway ramp management and control and travel demand management, learned how the field of transportation is structured at the federal level, and gained insight into what it is like to work for the government sector in transportation.