Michigan Ohio

University Transportation Center

Annual Report 2007-2008, Year Two

Grand Valley State University

Wayne State University

University of Detroit Mercy

The University of Toledo
1872
Intermodal Transportation Institute
UT-University Transportation Center

BGSU
Bowling Green State University

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I. Center Director's Vision Statement

The MIOH UTC serves the needs of the nation and region by completing specific educational, research, outreach and technology transfer projects. It identifies and selects such projects through processes that directly involve leaders from US DOT, MDOT, ODOT, regional agencies, and a variety of leaders from industry and academia.

MIOH is much more than a consortium of five universities. Rather, it is a full partnership of industry, government, and academia. In fact, no "advisory committee" exists; rather, industry and government leaders are participants in the MIOH Operating Committee and its three "Interest Groups" that focus on alternative energy, transportation system efficiency, and supply chains. This partnership began through three intense "focused forums" that involved over 75 leaders from industry, government, and academia. These forums yielded the initial "cut" of broad themes and recommended projects for MIOH. Separate meetings with MDOT, ODOT, FHWA and many other organizations have also created great potential for collaboration on top priorities.

As a result of these inclusive processes, as of 2007-2008 MIOH has selected 18 research, education and outreach projects many of which were initiated in 2006-07. These processes and the criteria described herein, will continue to assure that all MIOH projects are of the highest quality and well focused to meet a variety of objectives:

- national impact;
- regional economic development;
- professional education;
- attraction of a larger and more diverse cohort of transportation professionals; and
- direct impact on the congestion, the environment, energy efficiency, the competitive position, and overall transportation system efficiencies in our region.

One additional aspect of MIOH that may be different than many other UTC's is the real, substantive outreach into the K-12 educational system to directly impact pre-college students' awareness, interest and preparation for careers as professionals in transportation. This program involves a partnership between faculty at the University of Detroit Mercy, high school teachers, the Ford Motor Company, and the Educational Development Corporation. This partnership is yielding content, courseware, and methods that will be disseminated to over 80 high schools nationally. Additional K-12 outreach will continue to occur through MIOH's innovative Saturday classes and summer camps.

By the end of this four-year grant period, the MIOH UTC will be:

- a partnership of academia, government, and industry marked by uniquely open and active dialogues on challenges and opportunities leading to substantive collaborations in response to them;
- a widely recognized source of knowledge and expertise in the three MIOH focal areas *(In our first two years, MIOH research was reported in 19 papers and at 11 conferences)*;
- a pipeline providing a large, diverse supply of transportation professionals who, by studying at the five MIOH universities, or in joint programs provided by multiple universities, possess exceptional competencies related to transportation systems, supply chains, and alternative fuels *(In our first two years, over 100 university students participated in MIOH transportation research/education/outreach projects. In addition, 156 high school students have participated in transportation classes and summer camps.)*;
- a highly regarded source of continuing education for working professionals; and
- a catalyst for the generation of new products, services and systems that improve the economies of the MIOH region and its companies to partner and compete in the global marketplace.

When this vision is achieved, the MIOH University Transportation Center will be sustainable through continued government and foundation grants, corporate investment, tuition and fee income, and sale of intellectual property. In fact, during its first two years, MIOH achieved a 195 percent match of the US DOT funds, leveraging the DOT funds to multiply the impact of the UTC. The Year 2 match rate alone is 218 percent.

For over two years, the MIOH partners from academia, government and industry have collaborated effectively in the development of this enterprise -- and it is clearly achieving its promise. As we move forward together, we can and will create new knowledge and impact the efficiencies and effectiveness of our transportation systems thereby creating a positive economic impact. We can and will attract and educate a cadre of transportation professionals who are more able to address the opportunities of our region and the nation than their predecessors. In doing so, we can and will support the sustained and increased strength of our region and our nation.

Dr. Leo E. Hanifin
Director – MIOH University Transportation Center

II. Center Theme, Mission, and Focal Areas

MIOH UTC's Theme

Alternate energy and system mobility to stimulate economic development

MIOH'S Mission

MIOH will work to significantly improve transportation efficiency, safety, and security in Michigan and Ohio, as well as, across the nation by increasing the effective capacity of existing transportation infrastructure, reducing transportation energy dependence through alternative fuels, and enhancing supply chain performance.

This will be accomplished through:

1. the development and organization of new knowledge, technology and management systems;
2. the effective transfer of new and existing knowledge to commercial enterprises and educational communities; and
3. the development of a cadre of transportation professionals that is larger, more diverse, and better prepared to address the challenges and opportunities of 21st century transportation systems.

MIOH Focal Areas

Transportation System Efficiency and Utilization

MIOH will develop methods that meet future transportation system capacity requirements at minimum costs. To maximize the effectiveness/utilization of the current transportation infrastructure, and thereby minimize future expansion and related costs to taxpayers, MIOH will perform research, education and technology transfer to:

1. increase the utilization of existing assets through the application of technology and innovative management practices;
2. identify innovative design and operational/administrative solutions to bottlenecks and safety/security in transportation systems; and
3. improve the management and planning of maintenance and repair.

Supply Chains

MIOH will focus on the transportation, logistics and distribution aspects of the supply chain and the interactions between supply chain participants through improved inter-modal connectivity and system-wide efficiency. These efforts will enhance our region's competitive position in the global economy and expand job opportunities. Efforts will:

1. improve supply chain performance through the application of technology and innovative management practices;
2. identify innovative design and operational/administrative solutions to transportation system bottlenecks as they impact supply chains; and
3. improve the security and reliability of the supply chain.

Alternative Fuels

MIOH will develop affordable alternate sources of energy for vehicles and methods to distribute fuels throughout the transportation network, yielding improvements in both security and the efficiency of transportation.

III. Partner Universities

University of Detroit Mercy
Detroit, Michigan
(Lead Institution)
www.udmercy.edu

Bowling Green State University
Bowling Green, Ohio
www.bgsu.edu

Grand Valley State University
Grand Rapids, Michigan
www.gvsu.edu

University of Toledo
Toledo, Ohio
www.utoledo.edu

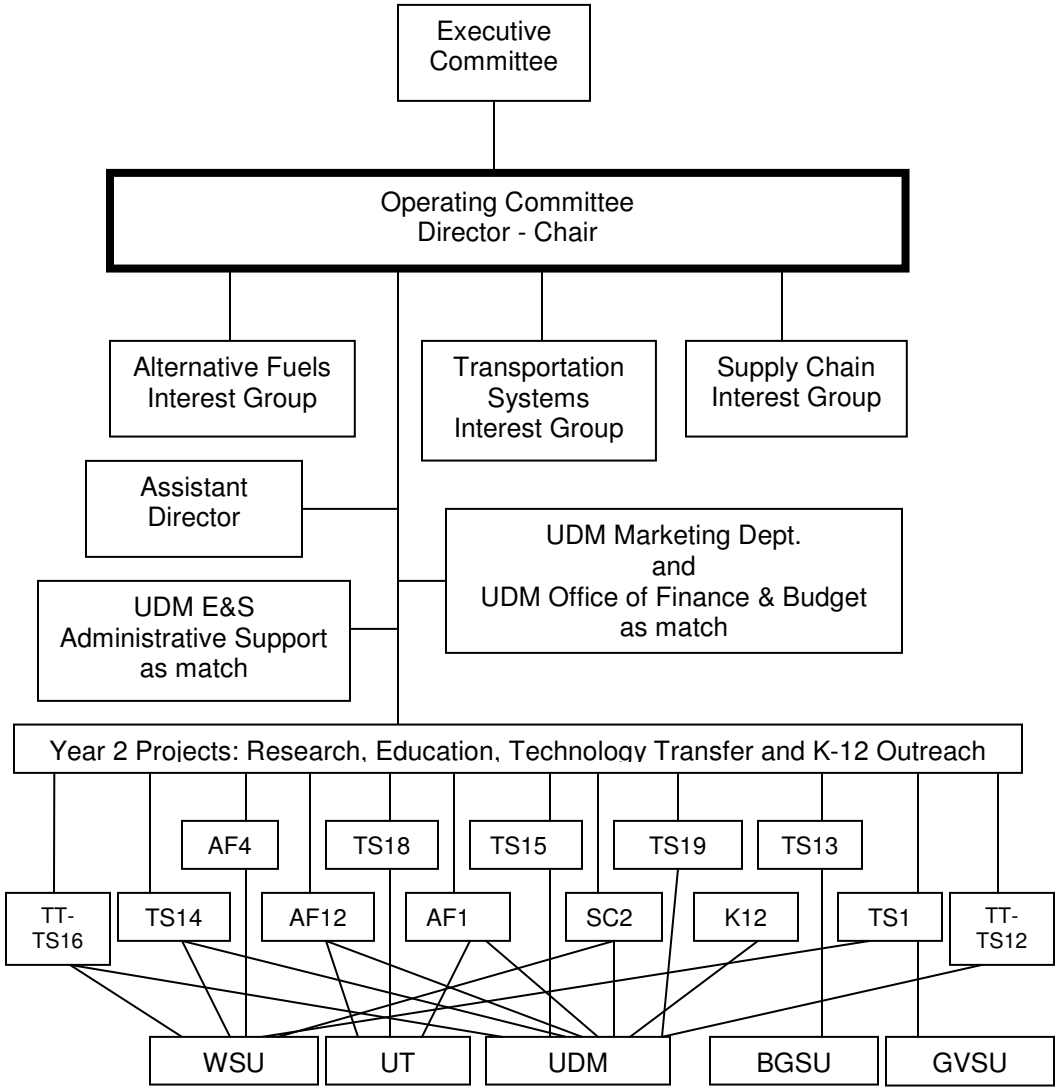
Intermodal Transportation Institute
UT-University Transportation Center

Wayne State University
Detroit, Michigan
www.wayne.edu

IV. Management Structure

The MIOH UTC's management approach is one that is open and inclusive of all partners, both at the five MIOH universities and its partner corporations and government agencies. The MIOH organization, summarized in the graphic below, reflects that approach. It does not have an "advisory committee" that is separate from the decision-making groups of the UTC. Rather, all university, corporate, and government representatives serve on interest groups and/or the MIOH Operating Committee to stimulate, identify, and review project proposals in addition to developing and approving the MIOH annual program plan and budget.

A. Organizational Chart



B. Principal Center Staff

Dr. Leo E. Hanifin, Dean of the College of Engineering and Science, was selected as Director of the MIOH UTC. In addition to considerable industrial experience, Dr. Hanifin has extensive experience leading research centers, research and educational coalitions and engineering education.
Contact: hanifinl@udmercy.edu, Ph: 313-993-1216, Fax: 313-993-1187.

Patricia Martinico joined the UTC in the fall of 2006 as Assistant Director. Ms. Martinico's background includes administrative experience as Asst. Dean of Architecture at UDM, as well as corporate event planning for a Michigan destination management company. In addition, she holds graduate degrees in business and economics.
Contact: martinpa@udmercy.edu, Ph: 313-993-1510, Fax: 313-993-1187.

C. Executive Committee, Operating Committee, and Interest Groups

Executive Committee, Year 2 as of August 31, 2008

University	Member
BGSU	**Deanne Snavely**, Interim Vice Provost for Research and Dean of the Graduate College
GVSU	**Paul Plotkowski**, Dean of Engineering and Computing (alt. H. James Williams, Dean, Business)
UDM	**Pamela Zarkowski**, Interim Academic Vice President and Provost
UT	**Frank Calzonetti**, Vice President for Research Development
WSU	**Ralph Kummler**, Dean of Engineering (alt. M. Usmen, Associate Dean for Research, College of Engineering)
MIOH UTC	**Leo Hanifin** – UTC Director and Dean of Engineering and Science, UDM (ex officio)

Operating Committee, Year 2 as of August 31, 2008

Leo Hanifin	UTC Director
Hokey Min	Faculty Representative BGSU
Charles Standridge or John Taylor	Faculty Representative GVSU
Utpal Dutta	Faculty Representative UDM
Rich Martinko	Faculty Representative UT
Snehamay Khasnabis or Mumtaz Usmen	Faculty Representative WSU
James Merritt	US DOT
Kirk Steudle or Tim Heoffner or Niles Annelin	MDOT – Director
Howard Wood	ODOT - Deputy Director of Planning
Jim Saber or Roland Kibler	NextEnergy
Carmine Palombo	SEMCOG, Director – Transportation
Warren Henry	TMACOG, Vice President for Transportation

Alternate energy and system mobility to stimulate economic development.

Interest Groups, Year 2 as of August 31, 2008 (7-12 members each)
Operating Committee Members may also participate in interest group(s).

Alternative Energy

Roland Kibler	Manager, Technology Development, NextEnergy
Mark Schumack	Faculty, Mechanical Engineering, UDM
Snehamay Khasnabis	Faculty, Civil Engineering, WSU
Barry Piersol	Assistant to the Dean, College of Technology, BGSU
John Wilson	Energy Tech Consultant, TMG / Energy
Scott Staley	Director, Hybrid and Fuel Cell, Ford Motor Company
Patsy Muzzell	Team Lead (Acting), Assured Fuels Initiative U.S. Army TARDEC, National Automotive Center

Transportation Systems

Carmine Palombo	Director of Transportation, SEMCOG
Ralph Robinson	Co-Lead UMTRI's Transportation Systems Group
Charlie Standridge	Professor, College of Engineering and Computing, GVSU
Utpal Dutta	Professor, Dept. of Civil Engineering, UDM
Mumtaz Usmen	Chair, Dept. of Civil Engineering, WSU
Barry Piersol	Asst. to the Dean, College of Technology, BGSU
Pete Lindquist	Chair, Dept. of Geography & Planning, UT
Greg Krueger	MDOT, Director – Intelligent Transportation Systems
Lou Lambert	Consultant
Steve Underwood	Center for Automotive Research and President, ITS Michigan
Richard Beaubien	Associate, Hubbell, Roth & Clark, Inc.

Supply Chain

Tim Hoeffner	Administrator, Intermodal Policy Division, MDOT
Chip Napier	Metro Detroit District Engineering Manager, UPS
Thomas Madden	Supply Chain Management, General Motors
John Drury	Leader – Supply Chain Network Optimization Team, IBM
John Taylor	Faculty, Business, GVSU
Hokey Min	Faculty, BGSU
Shahram Taj	Faculty, Business, UDM
Ratna Chinnam	Faculty, WSU
Paul Hong	Faculty, UT
Tim Buckel	Metro Detroit Engineering Manager, UPS
Niles Annelin	MDOT – Transportation Planning
Gene Robinson	Director of Automotive Glass Technology, Libby-Owens-Ford
S. Manivannan	Supplier Development Leader - Black Belt, Rolls-Royce N. America
Terry Onica	Director, Automotive Marketing, QAD
John Daly	Manager – Director, Genesee County Road Commission

V. Overview of Education, Research, and Technology Transfer Programs

A. MIOH Education Program

During its second year, the MIOH UTC initiated education projects in five areas. Of these one was at the university level and four were at the pre-college level:

1. Multi-purpose Educational Modules to Teach Hydraulic Hybrid Vehicle Technologies to Undergraduate Engineering Students (AF1, Project 3, Yr2)

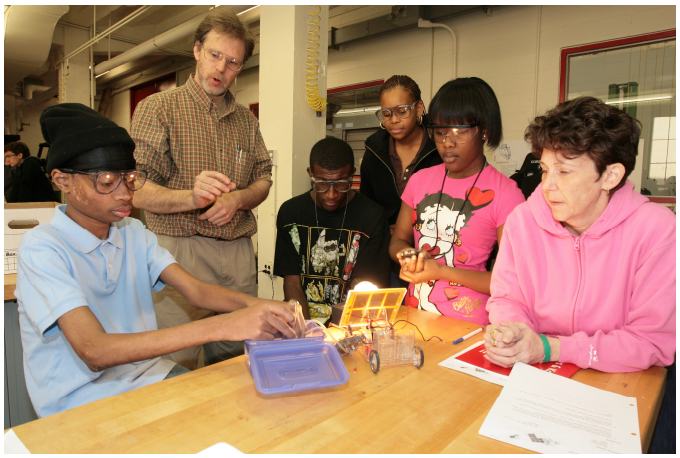
Proceeding into the second and final year, the project team including four faculty and three students from The University of Toledo (lead) and the University of Detroit Mercy are developing education modules and educational simulations that employ a dual-function hydraulic pump/motor test stand. The resulting experiments and simulations will form complete modules to teach engineering students fundamental concepts of the hydraulic hybrid vehicle technology. These modules can be employed in core courses of the mechanical engineering curriculum. As such, these modules will be used to enhance the students' learning in fluid dynamics, hydraulics, energy systems, vibrations, mechatronics and controls. This simulation will also enable students to compare the performance of various hybrid configurations with conventional IC engines. The University of Toledo team is building the physical test stand. The UDM team is creating a virtual replica of the physical test stand. The educational modules and computer simulation software developed throughout this project will become available on the internet for other universities to adopt. Additionally, the investigators have presented and published their educational findings at conferences and in educational journals.

2. Ford PAS Alternate Fuels Module for High School Students (K12-1, project 3, Yr2)

This project was undertaken by five UDM faculty members (2 mechanical engineering, 2 biology, and 1 chemistry) to develop hands-on alternative fuels modules that will be integrated into high school curricula across the nation as part of the Ford Partnership for Advanced Studies (PAS). In all, sixteen activities involve a wide variety of experiences for students: making biodiesel, comparing parameters of biodiesel and ethanol, operating a simulation model to examine fuel economy, and learning basic chemistry and/or biology related to combustion, greenhouse gas production, production of biofuels and hydrogen, and alternatives for vehicular propulsion. All materials have been piloted at two Detroit area high schools. The results of the pilot testing allowed the faculty authors to edit the module content to be more effective. The next step is preparation for publication. The modules will then be provided to the Ford PAS Program and be posted on the UDM and Ford PAS websites for free download and use by any high school nationally.

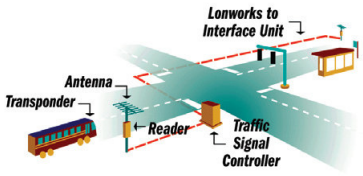
3. Alternative Fuels DAPCEP Class for High School Students (K12-2, project 2, Yr2)

For a second year, Mechanical Engineering faculty offered a five-week Saturday class through Detroit Area Pre-College Engineering Program (DAPCEP). The course, *Powering the Car of Tomorrow,* was developed by members of Chemistry, Biology and Mechanical Engineering. Activities covered Internal Combustion Engines, Making Biodiesel, Testing Biodiesel, Measuring Energy Content, Building a Fuel Cell Car, and Comparing Fuel Alternatives. This course also allowed faculty members to refine educational content incorporation in the Ford PAS modules nearing completion (described above). Twenty students participated in this course.



Pictures Right Column: Students in the Spring 2008 Saturday DAPCEP class convert light into electricity to provide hydrogen to power a fuel cell under the supervision of Dr. Mark Schumack, UDM Mechanical Engineering Dept. and Beth Dalrymple, Master of Mechanical Engineering degree candidate.

4. Transportation Summer Camp for High School Students (K12-3, project 2, Yr2)

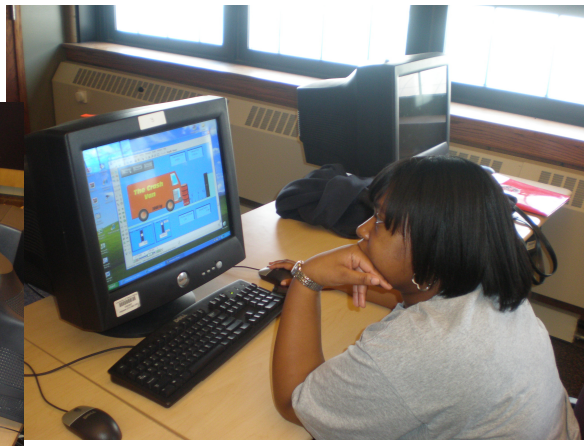


A one week summer camp named TRANSIT was conducted for the second year by Civil and Environmental Engineering faculty members from UDM.

It included presentations and hands-on activities by professionals from the following organizations:

- Southeastern Michigan Council of Governments, Traffic Division
- The Road Commission of Oakland County
- The Detroit Collaborative Design Center (UDM, School of Architecture)
- Michigan Department of Transportation
- Ford Motor Company
- Spalding DeDecker

Activities focused on intelligent transportation systems, paving systems, urban planning/transportation, Vehicle Infrastructure Integration, traffic signals/controls, and regional transit systems. Seventeen students participated in the camp.



Modeling Transportation Systems

5. STEPS Camp (Science Technology and Engineering Preview Summer Camp for Girls) (K12-14, project 1, Yr2)

The STEPS Camp at UDM is a five-day residential program for high school girls designed to:

- introduce young women to manufacturing, engineering, science, math and robotics;
- increase their interest in a career in one of these areas;
- provide them with a positive university experience;
- provide exposure to college professors and students, and professional engineers;

- improve their perception of engineering; and
- inspire young women to consider a career in manufacturing, engineering or science.

Activities included academic, social and personal reflection. The main project included a *Robotics Challenge* based on the LEGO Mindstorm NXT system, that was revised in 2008 to include a transportation theme thanks to financial support from the UTC. The campers also participated in academic labs such as Batteries, Programming, Sensors, Circuits, Welding, Fuel Cells, Motors, and Engineering Math. STEPS 2008 was the camp's seventh year. It was the first to have a transportation theme integrated into its activities. Two sequential sessions of the camp were conducted with a total of 76 girls participating.

B. MIOH Research Program

During its second year, the MIOH UTC defined and launched six new research projects and funded three projects to continue. Of the new projects, one involves alternative fuels and five involve transportation systems. All focus on important national priorities including independence from foreign oil, efficient freight delivery, and congestion mitigation.

1. Improved Oxidative Stability of Biodiesel Fuels (AF4, project 3, Yr2)

Building on their first year of research, a team of two faculty members and their graduate students from Wayne State University, in cooperation with the National Biofuels Energy Laboratory at NextEnergy in Detroit, are investigating the effect of antioxidants on the stability of different types of biodiesel; additionally, they are studying the long-term stability of biodiesel with synthetic/natural antioxidants. Results indicate that the effect of different antioxidants on biodiesel varies significantly depending on biodiesel feedstock and content of minor components. A goal is to develop/evaluate commercial antioxidants to improve the oxidative stability of biodiesel and make it a viable alternative fuel. Additional research phases are anticipated to continue through 2010.

As of summer 2008, researchers are determining that binary mixtures of antioxidants are more effective in improving oxidative stability of biodiesel than individual ones, suggesting a synergistic interaction which may be important in the development of suitable blends for long-term storage. The effect of metal chelator and oxygen quencher on the antioxidant activity will be further investigated. The selected binary antioxidants on biodiesel oxidative stability under long-term storage conditions are also being studied as a function of time. The results are being reported through scholarly publications.

2. Enabling Congestion Avoidance and Reduction in the Michigan-Ohio Transportation Network to Improve Supply Chain Efficiency (SC2, project 3, Yr2)

Continuing in 2007-08, a three faculty members and six students from Wayne State University (lead) and the University of Detroit Mercy is developing efficient dynamic freight routing algorithms under both recurring congestion and non-recurring incidents by using real-time ITS traffic information. These routing models include anticipatory modeling of recurring congestion and modeling of reactive and anticipatory traffic flow behavior in response to non-recurrent congestion. One of the key aspects of this work is that its scalability enables implementation in real highway systems for dynamic rerouting of freight. In today's automotive plants, 80 prcent of all parts are delivered to assembly plants JIT (just in time) with only three hours of inventory on site. Targets for supply chain efficiencies are becoming even more aggressive. As such, these plants' operations have become susceptible to traffic congestion delaying delivery trucks causing part shortages and shutdowns of assembly operation. In the future, the routing methods will be field tested with real data for a complex system. Additional phases of this research will be completed through 2010. This team also includes active participation from UPS, Ford Material and Logistics, C.H. Robinson, the Michigan Department of Transportation (MDOT) ITS Office, and Michigan Intelligent Transportation Systems (MITS) Center.

3. Congestion Relief by Travel Time Minimization in Near Real Time (TS1, project 3, Yr2)

For a second year, a team from Grand Valley State University (lead) and Wayne State University composed of four faculty members and seven students (five graduate and two undergraduate) is collaborating to describe, explain, and predict the flow of traffic in a corridor with respect to time and space in order to apply these results in the routing of traffic. Their work involves developing a hardware based (analog) solver providing very rapid determination of an "optimal" route solution for sending vehicles around congestion. Eventually this hardware solver will be placed on a chip. This team also developed a valuable data set that other researchers can employ. The data set captures the traffic data from 24 sensors for one full year (Nov 2005 through 2006). This data is available on the GVSU website (utc.egr.gvsu.edu.mdot). Researchers on this project have produced four articles for conference submittal. A student researcher from WSU has won a Student Paper Award from ITE announced in June 2008. This project concludes in November 2008.

4. Improving the Energy Density of Hydraulic Hybrid Vehicles (HHVs) and Evaluating Plug-In HHVs (AF12, project 1, Yr2)

The premise of a research team from The UT and UDM is that hydraulics (often called fluid power) offers the best solution for hybridizing heavier vehicles such as SUV's, trucks, and buses to improve fuel economy especially during duty cycles with frequent stops. Using conventional gasoline engines under a parallel hybrid, US EPA/NVFEL testing and modeling programs project a 34 percent fuel economy improvement for a large 4WD SUV. This research project aims to address one of the main limitations of hydraulic hybrid vehicles (HHVs). These hybrid vehicles capture the otherwise-wasted energy in "mechanical batteries" (hydraulic accumulators). The hydraulic accumulators

allow for rapid charging and discharging, which translates to very high power density in hydraulic hybrid vehicles. This feature is the main benefit of these vehicles over electric hybrids. On the other hand, the energy density of the HHVs is limited by the amount of fluid that can be stored in the high pressure accumulators. In this project, a new concept will be evaluated through analysis, simulation, and experimentation to address this energy density limitation of the hydraulic hybrid vehicles. A compressed air reservoir will be integrated into the hydraulic hybrid system. In addition to improving the energy density and providing longer operation for the vehicle, this new system will provide the electric plug-in capability for HHVs.

5. Improving Paratransit Services in the Toledo Metropolitan Area (TS13, project 1, Yr2)

The BGSU researchers envision this activity as the first project of a two project sequence. The Americans with Disabilities Act (ADA) of 1990 pressured the public transit authority to reassess the way that it serves aging populations and physically-handicapped individuals requiring door-to-door services with a fare scheme comparable to regular transit. Due to the rapid growth of aging baby boomers and disabled Iraq War veterans, the demand for paratransit services is expected to double over the next decades. In response to the increased demand for paratransit services, the public transit authority has attempted to incorporate paratransit services into an integral part of the mass-transit system. However, in contrast with the fixed route/schedule based public transportation system, paratransit is more expensive on a per-passenger basis due to its customized service requirement for user-specified origin/destination and time. According to the American Public Transit Association, the total operating expense of paratransit services in the United States surpasses $1.2 billion with a meager $173 million collected in fares. To bail out cost overruns for paratransit service providers, the public transit authority often subsidizes the greater portions of paratransit services. In the era of budget shortfalls, the public transit authority is faced with the dilemma of controlling paratransit costs without deteriorating paratransit services. To better cope with such a dilemma, this project identifies a host of factors such as on-time door-to-door or curb-to-curb service, flexible pickup-/drop-off windows, handling of late-cancellations and no-shows, shared rides, short-notice service, peak-hour feeder service, and overnight service that influence the overall service quality of paratransit in the metro Toledo area. The future project will develop a paratransit vehicle routing/scheduling model that can aid the public transit authority.

6. Modeling Metropolitan Detroit Transit (TS14, project 1, Yr2)

In response to transit issues in MetroDetroit, WSU and UDM researchers undertook a project to develop a quick response, computer based model that will efficiently analyze and capture the effect of transit vehicular changes (speed, capacity, acceleration, deceleration, etc.) and corridor/station parameters (BRT, LRT, station-spacing, station-length, etc.) upon the operation and cost of the system. The project has two components: model development and model demonstration. The proposed model is intended for planners and engineers for testing the operating and cost implication of changes in parameters in transit vehicles, transit corridors and stations. Currently the research team is developing a demand model in consultation with SEMCOG and has been exploring different avenues of estimating transit demand along the Woodward Avenue corridor in the Detroit metro area. This project will continue through spring 2009.

7. New Approach to Enhance and Evaluate the Performance of VII and ITS Communication Systems (TS15, project 1, Yr2)

Partnering with the Center for Advanced Research (CAR) in spring 2008, a team of one faculty member and two graduate students at the University of Detroit Mercy began to undertake development of a test bed that allows the testing of different inter-vehicle communication protocols. The test bed will provide a tool to evaluate message delay and channel throughput. Additionally, it will facilitate investigation of real-world, inter-vehicle communication scenarios with actual vehicles.

The test bed has been developed to evaluate the performance of the most commonly used protocols, which are the IEEE 802.11b and IEEE 802.11g. The performance of the IEEE 802.11b/g protocols have been evaluated in both indoor and outdoor environments. The researchers plan to disseminate results through papers and conference presentations both nationally and internationally. Based on an agreement with the Center for Automotive Research, UDM's researchers will participate in CAR's Connected Vehicle Proving Center's developers program. In particular, the researchers are planning to use VII LAB that provides a powerful development tool that allows the researchers to design and simulate different traffic scenarios.

8. A Novel Image Database Analysis System for Maintenance of Transportation Facility (TS18, project 1, Yr2)

A group of UT faculty members with diverse expertise related to transportation informatics is collaborating on research focused on "image analysis", "pattern recognition" and "decision making" for transportation applications. Several members have been engaging in research using imaging technologies including applications for transportation facilities inspection purposes. The demands for automated inspection, monitoring and pattern recognition for transportation applications are ever increasing partly driven by homeland security concerns. Simultaneously, the costs of imaging technologies have become more affordable. Some technologies developed for military or medical applications could be suitable for civilian transportation use. The research group's intent is to develop a functioning prototype system to automatically process, store, analyze and extract information from images for the purpose of inspection, monitoring, and detection of transportation facility.

9. The Woodward Transit Catalyst Project (TS19, project 1, Yr2)

With support solely from private sources, the MIOH UTC managed a UDM-Deloitte team that developed a plan for a light rail system in Detroit. This plan has been further developed ,and the acquisition of private funding has proceeded during the latter half of MIOH's second year. Director Hanifin continues to advise the project on a pro bono basis and to serve on the Board of Directors of the organization that will develop this transit system. A project manager has been appointed, and he is working with construction and vehicle consultants to further refine the plan.

C. MIOH Technology Transfer Program

The MIOH UTC has developed a three-tier strategy for technology transfer that involves direct transfer, UTC-wide activities, and partnering with established organizations.

1. Direct Transfer

The MIOH UTC is engaged in technology transfer on a direct basis. That is, all projects involve direct participation of corporations and/or government agencies that can directly benefit from and employ the results of the project. Some of the participants are the Michigan Department of Transportation, Ford Motor Company, NextEnergy, UPS, Michigan Intelligent Transportation System (MITS) Center, Detroit Area Pre-College Engineering Program, the Road Commission for Oakland County, the Toledo Metropolitan Area Council of Governments, Ryder, Deloitte Consulting and the Southeast Michigan Council of Governments. Through direct participation in projects, these organizations not only influence the efforts but also prepare themselves to quickly transfer results into improved transportation systems and transportation education.

2. UTC Activities

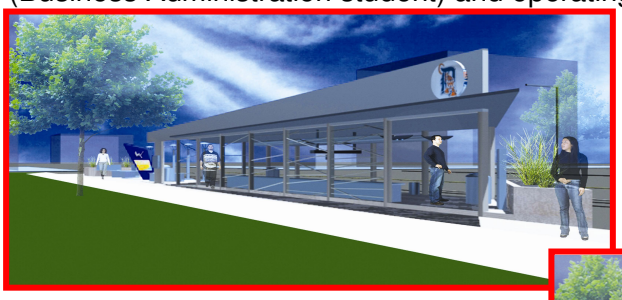
As first year projects moved forward, the MIOH UTC created a “technology transfer tour” in February and March of 2008. Members of the Operating Committee and stakeholders identified by the PIs were invited to presentations of "research in progress" at each of the

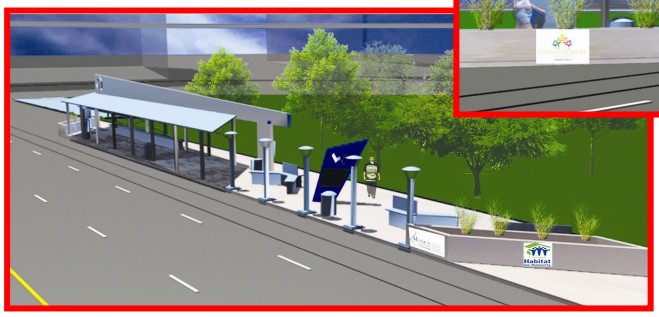
partner universities. These events were reported in the MIOH UTC newsletters of 2007-08. The Technology Transfer Tour, as it became known, was so successful that it will again be conducted in spring 2009. The invitee list will be extended to include all members of the Interest Groups who review proposals, government officials, and substantially more stakeholders from partner corporations.

An additional technology transfer activity included the construction of a Vehicle Infrastructure Integration (VII) course entitled "VII 101". This course is a collaborative effort by faculty at Wayne State University and the University of Detroit Mercy. It will educate potential stakeholders including public agencies, elected officials, private corporations and the traveling public. Thus, it will facilitate their participation in the future of VII. A number of test bed activities are currently taking place throughout the country, including several in Michigan, to examine VII feasibility in terms of application, communication and approaches to integration. Within this context, major investments and the cooperation of numerous public and private agencies are required. However, as VII activities have emerged only recently and much of the activity is of a proprietary

nature, documentation is not easily available: there are no authoritative resource texts. In order to encourage investment and participation in VII activities by the transportation community, as well as public buy-in, a clear understanding of VII is required. An introductory VII course can play a significant role in this context. A beta test of this course is planned and will be conducted using an audience participating in the Southeast Michigan Council of Governtments (SEMCOG) educational presentation series in spring 2009.

Also funded were activities in a university undergraduate level course at UDM in the IDEAS (Interdisciplinary Design, Entrepreneurship and Service) sequence. An interdisciplinary team of four Architecture students, one Business Administration student, three Engineering students, and one Psychology student were tasked with developing a light-rail transit station for the proposed system along Woodward Avenue. The design work proceeded along established methodologies centered on market research and collection of customer feedback with fieldtrips to Chicago and Cleveland, and face-to-face meetings with transportation, public and business leaders. The design included the physical structure (Architecture and Civil Engineering students) as well as the business (Business Administration student) and operating procedures (Mechanical Engineering and Psychology students) of the station. The renderings below were produced by the Architecture students. Funding from the MIOH UTC was used for the field trips.





3. Partnered Technology Transfer Events

Planned in 2009, the MIOH UTC will partner with NextEnergy to co-sponsor technology transfer project presentations at those facilities focused on alternative fuels. Also meetings of Michigan ITS and Institute of Transportation Engineers are planned to be hosted on the UDM campus. These events will be promoted by the MIOH UTC, partnering organizations, and the Engineering Society of Detroit.

VI. Examples of Specific Accomplishments

The following are some examples of specific accomplishments that support the national strategy for surface transportation research and/or respond to DOT priorities.

A. Two laboratory experiments have been developed around the hydraulic hybrid test stands. Faculty from The University of Toledo and the University of Detroit Mercy employed an innovative problem-solving approach to improve students' learning and to ensure achievement of course objectives. A memorandum from a "supervisor" to the student describes each of the two problems that the students must solve by performing the experiment. The memorandum defines the problem and the audience for the report. Students are not given a procedure to follow for conducting the experiment in the lab, so they must design the experimental procedure based on their engineering judgments. These experiences support the development of transportation professionals; and through their career efforts, ultimately, support the reduction of our nation's dependence on foreign oil, improvement of the environment, and enhanced competitiveness of U.S. automakers.

B. Extensive K-12 educational models and courseware has been developed and piloted at the University of Detroit Mercy and made available for transfer to high schools. These materials focus on transportation systems and alternative fuels and include 17 activities that can be incorporated into high school courses, a five-Saturday course, and a one-week summer camp. These experiences directly develop student competencies in many areas including science, mathematics, oral and written communications, critical thinking, and teamwork. By engaging participants in the excitement of such areas as intelligent transportation systems and biofuels, these materials and programs will attract a larger and more diverse group of students into studies and careers as transportation professionals.

C. A team of researchers at Wayne State University has investigated the oxidative stability of different types of biodiesels and blends and the results of long-term indoor and outdoor storage. Results indicate that the effect of different antioxidants on biodiesel varies significantly depending on biodiesel feedstock and the content of minor components. A goal is to develop/evaluate commercial antioxidants to improve the oxidative stability of biodiesel and thus make it a viable alternative fuel. As of summer 2008, researchers were determining that binary mixtures of antioxidants are more effective in improving oxidative stability of biodiesel than individual ones. This suggests a synergistic interaction which may be important in the development of suitable blends for long-term storage. The effect of metal chelator and oxygen quencher on the antioxidant activity will be further investigated. The selected binary antioxidants on bioliesel oxidative stability under long-term storage conditions are also being studied as a function of time. Additional phases of this research are anticipated to continue through 2010. This year, the research has resulted in both one current and one future conference presentation as well as two articles.

D. A team of MIOH researchers, predominantly from Wayne State University, has made great progress in the development of dynamic routing algorithms and models that will be linked to ITS systems to be responsive to the occurrence of incidents (especially accidents) that currently cause 25 percent of traffic

congestion. They have developed not just static but also dynamic routing algorithms based on Stochastic Dynamic Programming. In its second year, the team improved the efficiency of the exact dynamic routing algorithm and developed heuristic algorithms (AO*algorithms). In addition to routing, the team also developed preliminary incident delay models which are extended and refined by calibrating in accordance with the incident data obtained from MITS Center and Traffic.com. This incident model is currently integrated within the recurring congestion modeling and algorithmic framework and further improvements (shockwave propagation, traffic behavior) are in the team's current and future project plan. This effort is specifically focused on improvement of supply chain (freight) performance, and it is directly responsive to two of DOT's six strategic RD&T priorities. The second year research has resulted in three conference presentations and two conference presentations accepted for the *INFORMS 2008 Annual Meeting*.

E. Researchers from Grand Valley and Wayne State Universities have made great progress in their efforts to describe, explain and predict the flow of traffic in a corridor with respect to time and space, and to apply these results in the routing of traffic. Specifically, they have implemented a database management system (DBMS) in MySQL to properly organize and control the data and performed an initial data mining assessment of the data. They have also designed and implemented a traffic routing algorithm for re-routing all traffic around an incident in a corridor. This algorithm is believed to be unique since existing routing algorithms are designed for routing a single vehicle and do not consider the consequences of re-routing a large number of vehicles in a relatively short span of time. The algorithm is also dynamic as it allows metrics of congestion to be re-computed over time.

F. A University of Detroit Mercy project developed specifically at the request of the Michigan Department of Transportation conducted research to determine the effectiveness of the SCATS (Sydney Coordinated Adaptive Traffic System) signal system as compared to a pre-timed signal system in terms of traffic flow, delay and other selected measures of effectiveness. The research was conducted through a field experiment along a four-mile segment consisting of seven signalized intersections. This corridor is located in Oakland County, Michigan. The data for the corridor was collected for the two signal system scenarios on a typical weekday, a Friday for the mid-day (12 PM to 1 PM), a late afternoon peak period (4 PM to 6PM), and a Saturday peak (9 AM to 11 AM). When comparing the mean values for the various measures of effectiveness, the SCATS signal system outperformed the pre-timed signal system based upon the percentage differences between the two systems. This project employed 20 students in the data collection and evaluation process.

As many MIOH UTC projects are in the final stages of completing the research begun under year one funding, even more significant accomplishments are expected in the near future. The following page provides excerpts from DOT strategic documents that are directly related to MIOH UTC focal areas and projects. This is followed by a table that maps the sponsored projects against these top priorities of the DOT.

DOT Priorities

Mobility Strategic Objective:
"Advance accessible, efficient, intermodal transportation for the movement of people and goods."

Toward this end, DOT RD&T (e.g. Intelligent Transportation Systems) addresses the following priorities:

1. Exploiting web-enabled and other secure information technologies to share information on best practices in all modes
2. Examining ways to encourage cargo transport by water to improve the capacity of the intermodal transportation system
3. **In consultation with public and private sector partners, conducting research and expediting the deployment of technologies that improve system efficiency** and infrastructure durability
4. **Providing technical assistance and training to improve intermodal transportation planning and effective system management and operation**

Global Connectivity Strategic Objective:
"Facilitate a more efficient domestic and global transportation system that enables economic growth and development."

The increasingly global economy hinges on smooth supply chains and just-in-time manufacturing. Transportation is critical to both. An intermodal approach is central to DOT's role in promoting global connectivity. The following are the Department's RD&T (e.g. National Freight Action Agenda) priorities:

1. Encouraging and facilitating intermodal transportation planning worldwide
2. **Supporting and conducting research on issues concerning the intersection of passenger and freight transportation**
3. **Accelerating the use of ITS and other technologies that reduce delays at key intermodal transfer points, in significant freight corridors, and at international border crossings**

Environmental Stewardship Strategic Objective:
"Promote transportation solutions that enhance communities and protect the natural and built environment."

Transportation exerts pressure on environmental resources worldwide. The *DOT Strategic Plan* calls for a balance between environmental challenges and the need for a safe and efficient transportation network. Among the RD&T (e.g. Crossmodal Initiatives) priorities for achieving this vision are:

1. Supporting the President's Hydrogen Fuel Initiative through research on fuel distribution and delivery infrastructure, transportation of associated hazardous materials, and vehicle safety
2. **Supporting interdisciplinary research on connections among transportation, energy, and the environment**
3. Adopting transportation policies and promoting technologies that reduce or eliminate environmental degradation

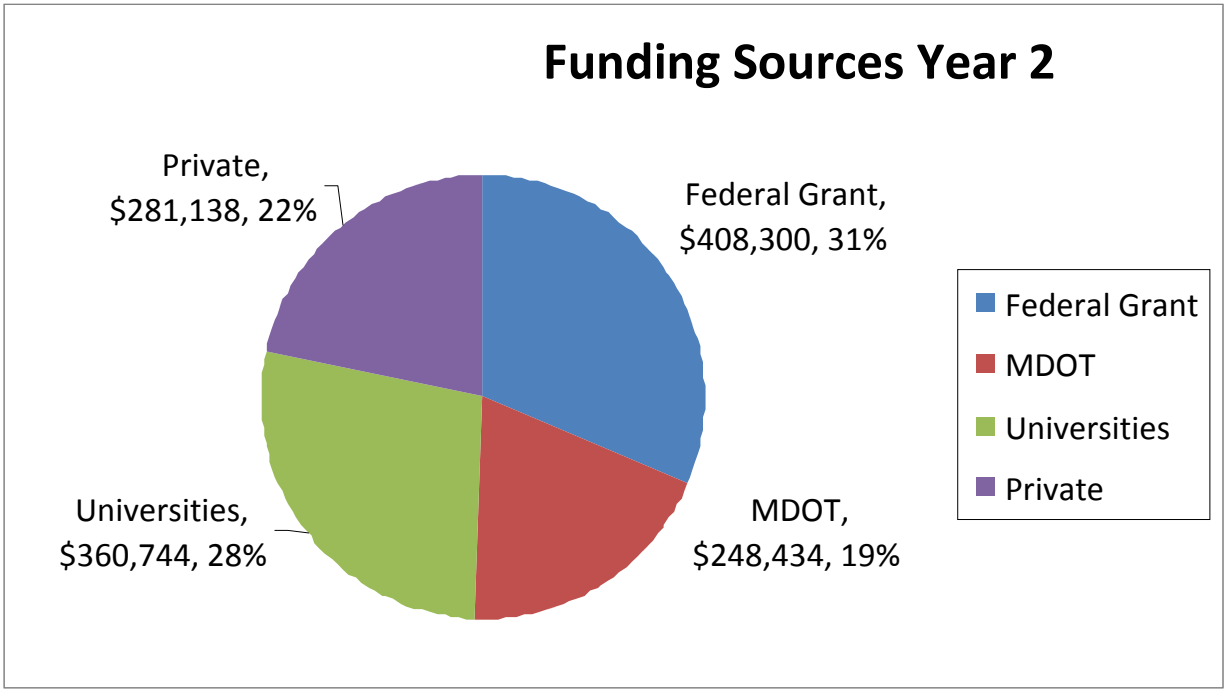
4. Collaborating with Federal agencies, academic institutions, and the private sector to support and conduct **research on technologies that improve energy efficiency, foster the use of alternative fuels, and reduce vehicle emissions**
5. **Working with transportation partners to mitigate the adverse environmental effects of existing transportation systems**

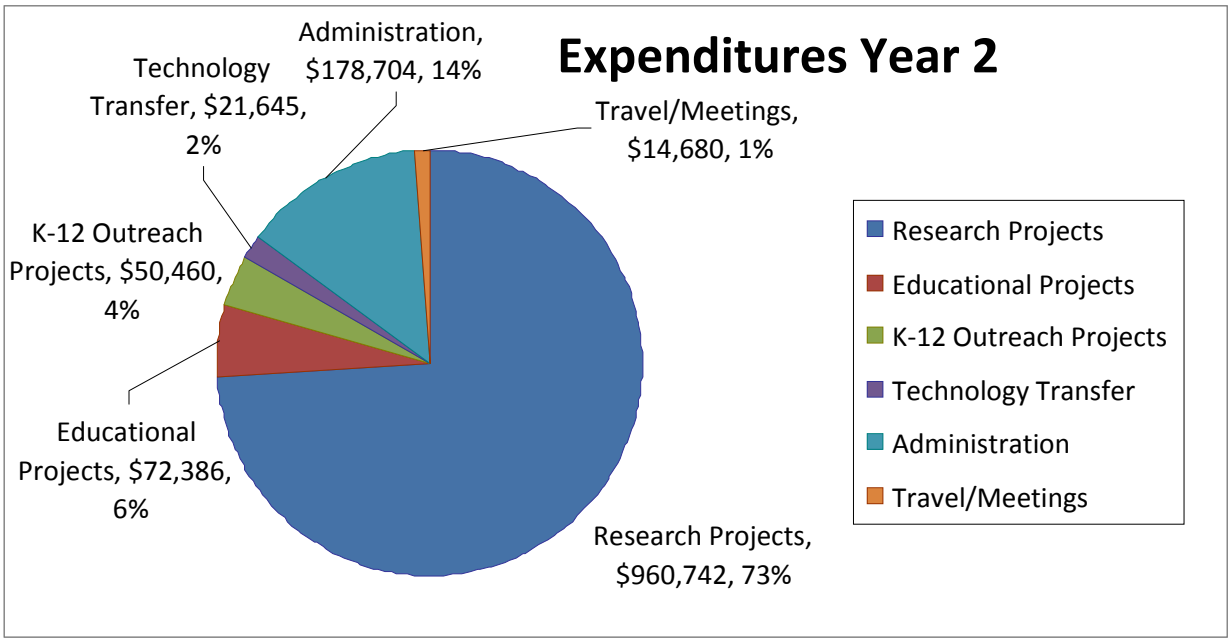
Education and Workforce Development Strategic Objective:

RITA will work with **partners in academia and industry to build the professional capacity of the transportation workforce.** RITA's activities will complement the efforts of DOT's operating administrations by reaching out to the broader transportation and education communities. In addition, the Administration's proposal for reauthorization of surface transportation programs—the Safe, Accountable, Flexible, and Efficient Transportation Equity Act—includes a provision for a new Transportation Scholarship Opportunities Program that RITA will administer.

DOT Strategic Objectives								
	Mobility		Global Connectivity		Environmental			Education & Workforce Development
Funded Projects	**Improve System Efficiency**	**Technical Assistance & Training**	**Intersection of passenger & freight transport'n**	**Accelerating Technologies reducing delays**	**Interdiscipl. research transport'n energy & environm't**	**Improve energy alt. fuels**	**Mitigate adverse environ. Impacts**	
AF1, series 1-3					x	x	x	x
AF3, series 1-2					x	x	x	
AF4, series 1-3					x	x	x	
AF12, project 1					x	x	x	
SC1, series 1-2	x	x	x					x
SC2, series 1-3	x		x	x				
TS1, series 1-3	x		x	x				
TS2, project 1	x							
TS4, series 1-2	x		x	x				
TS13, project 1	x							
TS14, project 1	x							
TS15, project 1	x			x				
TS18, project 1	x							
TS19, project 1	x							
K12-1,series1-3					x			x
K12-2,series1-2					x			x
K12-3,series1-2					x			x
K12-14,proj.1								x

VII. Illustrations of Funding Sources
Planned Funding Sources and Expenditures Year 2, 2007-2008





VIII. Research Project Status Report

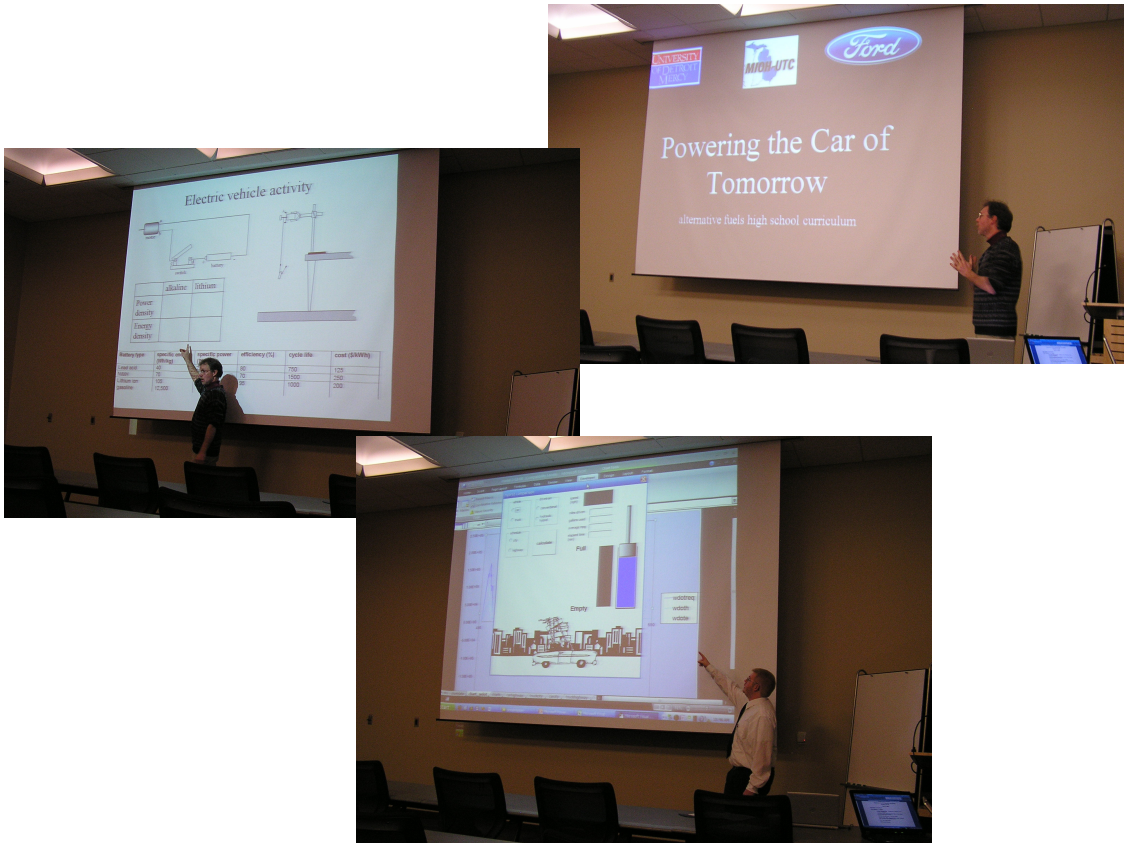
In many cases there are distinct sequential projects in research or educational areas. As such, the list below identifies sequences of continuing projects under the same title, i.e. AF3, project 1 and project 2, etc.

2007-2008 Year 2 New Projects

Research Projects	**Titles**
AF4, project 3	Improved Oxidative Stability of Biodiesel Fuels: Antioxidant Research and Development
AF12, project 1	Improving the Energy Density of Hydraulic Hybrid Vehicles (HHVs) and Evaluating Plug-In HHVs
SC 2, project 3	Enabling Congestion Avoidance and Reduction in the Michigan-Ohio Transportation Network to Improve Supply Chain Efficiency: Freight ATIS
TS 1, project 3	Congestion Relief by Travel Time Minimization in Near Real Time
TS 13, project 1	Improving Paratransit Services in the Toledo Metropolitan Area
TS 14, project 1	Modeling Metropolitan Detroit Transit
TS 15, project 1	New Approach to Enhance and Evaluate the Performance of VII and ITS Communication Systems
TS 18, project 1	A Novel Image Database Analysis System for Maintenance of Transportation Facility
TS 19, project 1	The Woodward Transit Catalyst Project
Educational Projects	
AF 1, project 3	Multipurpose Educational Modules to Teach Hydraulic Hybrid Vehicle Technologies
K-12 Outreach Proj.	
K 12 -1, project 3	K-12 Outreach Ford PAS Alternate Fuels Module
K 12 -2, project 2	DAPCEP Saturday Class
K 12 -3, project 2	Transportation Summer Camp
K 12 -14, project 1	STEPS Camp

2007-2008 Year 2 Ongoing Projects

Research Projects	**Title**
AF4, project 1, project 2	Improved Oxidative Stability of Biodiesel Fuels: Antioxidant Research and Development
SC 2, project 1, project 2	Enabling Congestion Avoidance and Reduction in the Michigan-Ohio Transportation Network to Improve Supply Chain Efficiency: Freight ATIS
TS 1, project 1, project 2	Congestion Relief by Travel Time Minimization in Near Real Time
TS 4, project 1, project 2	Evaluation of SCATS Control System
Educational Projects	
AF 1, project 1, project 2	Multipurpose Educational Modules to Teach Hydraulic Hybrid Vehicle Technologies
K-12 Outreach Proj.	
K 12 -1, project 1, project 2	K-12 Outreach Ford PAS Alternate Fuels Module



Completed Projects

Projects	Titles	Completion Date
AF3, project 1, project 2	Production of Fuel Ethanol from Cellulosic Peat for Future Transportation Systems	Aug. 31, 2008
SC 1, project 1, project 2	Supply Chain/Transportation Efficiency Systems Graduate Degree Program	Aug. 31, 2008
TS 2, project 1	Investigation of Hovercraft Operation in Detroit Weather Conditions	Aug. 31, 2008
K 12 -2, project 1	DAPCEP Saturday Class	April 31, 2007
K 12 -2, project 2	DAPCEP Saturday Class	April 31, 2008
K 12 -3, project 1	Transportation Summer Camp	Aug. 31, 2007
K 12 -3, project 2	Transportation Summer Camp	Aug. 31, 2008
K 12 -14, project 1	STEPS Camp	Aug. 31, 2008

Project Name**: Improved Oxidative Stability of Biodiesel Fuels: Antioxidant Research and Development**

Focal area: **Alternative Fuels** Project Identifier: **AF 4 Research**

AF 4, Project 1: **Nov. 22, 2006 to May. 31, 2008**
AF 4, Project 2: **May 1, 2007 to Aug. 31, 2008** continuing
AF 4, Project 3: **Sept. 1, 2007 to Aug. 31, 2008** continuing

Principal Investigator: **Dr. Steven O. Salley, WSU**
Co- Investigators: **Dr. K.Y. Simon Ng, WSU**

Student Involvement: **1 graduate student** at Wayne State University.

Budget:

	AF 4, Project 1 2006-07	**AF 4, Project 2 2007**	**AF 4, Project 3 2007-2008**
US DOT funds	$17,000	$23,000	$21,333
Match funds	$13,363	$52,181	$45,871
Total funds	$30,363	$75,180	$67,204

Project Name: **Improving the Energy Density of Hydraulic Hybrid Vehicles (HHVs) and Evaluating Plug-In HHVs**

Focal area: **Alternative Fuels** Project Identifier: **AF 12 Research**

AF 12, Project 1: **Sept. 1, 2007 to Aug 31, 2008** continuing

Principal Investigator: **Dr. Mohammad Elahinia, UT**
Co-Principal Investigators: **Dr. Mark Schumack, UDM**

Student Involvement: **1 graduate student** at The University of Toledo and **1 graduate student** at University of Detroit Mercy.

Budget:

	AF 12, Project 1, 2007-08
US DOT funds	$39,270
Match funds	$67,333
Total funds	$106,603

Project Name: **Enabling Congestion Avoidance and Reduction in the Michigan-Ohio Transportation Network to Improve Supply Chain Efficiency: Freight ATIS**

Focal area: **Supply Chain** Project Identifier: **SC 2 Research**

SC 2, Project 1: **Nov. 22, 2006 to May 31, 2008**
SC 2, Project 2: **May 1, 2007 to Aug. 31, 2008** continuing
SC 2, Project 3: **Sept. 1, 2007 to Aug. 31, 2008** continuing

Principal Investigator: **Dr. Ratna Babu Chinnam, WSU**
Co-Principal Investigators: **Dr. Alper E. Murat, WSU**
and **Dr. Gregory Ulferts, UDM**

Student Involvement: **5 graduate students** at Wayne State University and **1 graduate student** at University of Detroit Mercy.

Budget:

	SC 2, Project 1, 2006-07	**SC 2, Project 2, 2007**	**SC 2, Proj. 3, 2007-08**
US DOT funds	$17,870	$27,130	$30,000
Match funds	$46,070	$81,378	$103,850
Total funds	$63,940	$108,508	$133,850

Project Name: **Congestion Relief by Travel Time Minimization in Near Real Time**

Focal Area: **Transportation System Efficiency and Utilization**
Project Identifier: **TS 1 Research Projects**

TS 1, Project 1: **Nov. 22, 2006 to May 31, 2008**
TS 1, Project 2: **May 1, 2007 to Aug 31, 2008**
TS 1, Project 3: **Sept. 1, 2007 to Aug. 31, 2008**+ no cost extension

Principal Investigator: **Dr. Charles R. Standridge, GVSU**
Co-Investigators**: Dr. Shabbir Choudhuri, GVSU**
and **Dr. Snehamay Khasnabis, WSU**

Student Involvement: 4 **graduate** and **2 undergraduate students** at Grand Valley State University and **1 graduate student** at Wayne State University.

Budget:

	TS 1, Project 1 2006-07	**TS 1, Project 2 2007**	**TS 1, Proj. 3, 07-08**
US DOT funds	$9,355	$40,645	$33,334
Match funds	$37,188	$64,494	$75,214
Total funds	$46,544	$105,139	$108,548

:

Project Name: **Improving Paratransit Services in the Toledo Metropolitan Area**

Focal area: **Transportation System Efficiency and Utilization**
Project Identifier: **TS 13 Research**

TS 13, Project 1: **April 2, 2008 to Aug. 31, 2009**

Principal Investigator: **Dr. Hokey Min, BGSU**

Student Involvement: **7 undergraduate students** at Bowling Green State University.

Budget:

	TS 13, Proj. 1, 2007-08
US DOT funds	$30,000
Match funds	$39,356
Total funds	$69,356

Project Name: **Modeling Metropolitan Detroit Transit**

Focal area: **Transportation System Efficiency and Utilization**
Project Identifier: **TS 14 Research**

TS 14, Project 1: **Sept. 1, 2007 to August 31, 2008**+ no cost extension

Principal Investigator: **Dr. Snehamay Khasnabis, WSU**
Co-Principal Investigators: **Dr. Utpal Dutta, UDM**

Student Involvement: **2 graduate students** at Wayne State University and **1 graduate student** at University of Detroit Mercy.

Budget:

	TS 14, Proj. 1, 2007-08
US DOT funds	$39,270
Match funds	$70,310
Total funds	$109,580

Project Name: **New Approach to Enhance and Evaluate the Performance of VII and ITS Communication Systems**

Focal area: **Transportation System Efficiency and Utilization**
Project Identifier: **TS 15 Research**

TS 15, Project 1: **Sept. 1, 2007 to August 31, 2008** + no cost extension

Principal Investigator: **Dr. Nizar Al-Holou, UDM**

Student Involvement: **4 graduate students**

Budget:

	TS 15, Proj. 1, 2007-08
US DOT funds	$36,667
Match funds	$75,810
Total funds	$112,477

Project Name: **A Novel Image Database Analysis System for Maintenance of Transportation Facility**

Focal area: **Transportation System Efficiency and Utilization**
Project Identifier: **TS 18 Research**

TS 18, Project 1: **Feb. 5, 2008 to August 31, 2008** +no cost extension

Principal Investigator: **Dr. Kami Makki, UT**

Student Involvement: **4 graduate students** at The University of Toledo.

Budget:

	TS 18, Proj. 1, 2008
US DOT funds	$12,000
Match funds	$16,124
Total funds	$28,124

Project Name: **The Woodward Transit Catalyst Project**

Focal area: **Transportation System Efficiency and Utilization**
Project Identifier: **TS 19 Research**

TS 19, Project 1: **Sept. 1, 2007 to August 31, 2008** continuing

Principal Investigator: **Dr. Leo Hanifin, UDM**

Budget:

	TS 19, Proj. 1, 2007-08
US DOT funds	$0
Match funds	$225,000
Total funds	$225,000

Project Name**: Multipurpose Educational Modules to Teach Hydraulic Hybrid Vehicle Technologies**

Focal area: **Alternative Fuels** Project Identifier: **AF 1 Educational Projects**

AF 1**: Nov. 22, 2006 to Dec. 31, 2007**
AF 1, Project 1: **Nov. 22, 2006 to May 31, 2008**
AF 1, Project 2: **May 1, 2007 to continuing**
AF 1, Project 3: **Sept. 1, 2007 to continuing**

Principal Investigator: **Dr. Mohammad Elahinia, UT**
Co-Principal Investigator: **Dr. Mark Schumack, UDM**
Co- Investigators: **Dr. Walter Olson, UT** and **Dr. Mark Vonderembse, UT**

Student Involvement: **1 graduate student** at The University of Toledo and **2 graduate students** at the University of Detroit Mercy.

Budget:

	AF 1 2006-07	**AF 1, Project 1 2006-07**	**AF 1, Project 2 2007**	**AF 1, Project 3 2007-08**
US DOT funds	$30,000	$250	$4,750	$23,333
Match funds	$34,696	$10,000	$5,000	$49,053
Total funds	$64,696	$10,250	$9,750	$72,386

Project Name: **K-12 Outreach Ford PAS Alternate Fuels Module**

MIOH UTC Project Identifier: **K 12 -1 Educational Outreach**
Focal area: **Alternative Fuels**

K 12 -1, Project 1: **Nov. 22, 2006 to May 31, 2008**
K 12 -1, Project 2: **May 1, 2007 to continuing**
K 12-1, Project 3**: Sept. 1, 2007 to continuing**

Principal Investigator: **Dr. Mark Schumack, UDM**

Co- Investigators: **Dr. Stakes Baker, UDM, Dr. James Graves, UDM, Dr. Mark Benvenuto, UDM, Dr. Arthur Haman, UDM** and **Daniel Maggio, UDM**

Student Involvement: **2 undergraduate students** at University of Detroit Mercy.

Budget:

K 12 -1	**K 12 -1 Project 1 -2007**	**K 12 -1 Project 2 -2007**	**K 12 -1 Project 3 2007-08**
US DOT funds	$16,957	$0	$2,800
Match funds	$9,235	$36,753	$15,000
Total funds	$26,192	$36,753	$17,800

Project Name: **DAPCEP Saturday Class: "Fueling the Car of Tomorrow"**
Detroit **A**rea **P**re-**C**ollege **E**ngineering **P**rogram **class March 2007**

MIOH UTC Project Identifier: **K 12 -2**
Focal area: **Educational Outreach, Alternative Fuels**

K 12 -2: **Nov. 22, 2006 to Aug. 31, 2007**
K 12- 2**: May 1 , 2007 to continuing**

Principal Investigator: **Dan Maggio, UDM**

Student Involvement: **2 undergraduate students** at University of Detroit Mercy.

Budget:

	K 12 -2 Project 1 2006-07	**K 12 -2 Project 2 2007-08**
US DOT funds	$6,401	$4,256
Match funds	$3,600	$778
Total funds	$10,101	$5,034

Project Name: **Transportation Summer Camp**

MIOH UTC Project Identifier: **K12 -3 Educational Outreach**
Focal area: **Transportation Systems**

K 12 -3: **Nov. 22, 2006 to Aug. 31, 2007**
K 12- 3: **May 1, 2007 to continuing**

Principal Investigator:
Daniel Maggio, UDM

Student Involvement: **1 undergraduate student** at the University of Detroit Mercy.

Budget:

	K 12 -3 Project 1 2006-07	**K 12 -3 Project 2 2007-08**
US DOT funds	$17,154	$9,376
Match funds	$4,264	$3,104
Total funds	$21,418	$12,480

Project Name: **STEPS Camp**

MIOH UTC Project Identifier: **K12 -14 Educational Outreach**
Focal area: **Transportation Systems**

K 12 -14, project 1: **Sept. 1, 2007- Aug. 31, 2008**

Principal Investigator:
Daniel Maggio, UDM

Student Involvement: **7 undergraduate students** University of Detroit Mercy.

Budget:

	K 12 -14 Project 1 2007-08
US DOT funds	$6,900
Match funds	$8,245
Total funds	$15,145