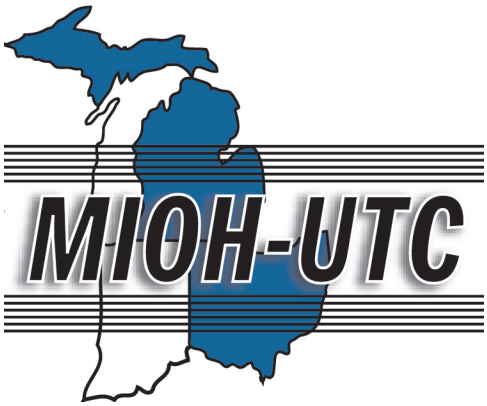

Michigan Ohio

University Transportation Center

Annual Report 2006-2007, Year One

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 that do just that, serve the needs of both the region and the nation. It identifies and selects such projects through processes that directly involve leaders from the 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 over thirty (30) 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 all of these activities, MIOH has honed its focal areas and selected ten research, education and outreach projects that are nearing completion or will be continued into year two, plus four new projects that were recently initiated. This, together with the processes and criteria described herein, will continue to assure that all MIOH projects are not only of the highest quality, but also well focused to meet a variety of objectives, including:

- 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 will yield 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 year, MIOH research has already been reported in ten papers.)*;
- 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 year, over 50 university students participated in MIOH transportation research/education/outreach projects. In addition, 43 high school students 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, in its first and second years, MIOH has been able to achieve 174% and 191% match of the US DOT funds, leveraging the DOT funds to multiply the impact of the UTC.

For over one year, the MIOH partners from academia, government and industry have collaborated effectively in the development of this enterprise . . . and it is beginning to achieve 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 that their predecessors…and 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 and across the nation by increasing the effective capacity of existing transportation infrastructure, reducing transportation energy dependence thorough 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

Bowling Green State University

Bowling Green, Ohio

Supply Chain Management

The Supply Chain Management specialization in the BGSU's AACSB-accredited College of Business Administration is nationally recognized as a top undergraduate program (*U.S. News and World Report, 2004)*. Seven full-time faculty members teach and perform research in supply chain management. In the Fall of 2006, Dr. Hokey Min joined the faculty as the James R. Good Chair in Global Supply Chain Strategy. Dr. Min has developed an international reputation for his research in transportation and logistics. He was previously at the University of Louisville where he was the Executive Director of the Logistics and Distribution Institute at University of Louisville.

In 2000, the College of Business Administration established the Supply Chain Management Institute (SCMI). Dr. Amelia Carr is the Director of the Supply Chain Management Institute. The mission of the SCMI is to support excellence in supply chain education and practice by forging collaborative partnerships with supply chain professionals. There are 15 member companies in the SCMI: BP, Bechtel Power Corporation, Bendix, Deere & Company, Eli Lilly, Emerson Climate Control, HP, GlaxoSmithKline, Honda of America Manufacturing, Lowes, Marathon, Nordson Corporation, Owens Corning, Parker Hannifin and SAIC.

The Electric Vehicle Institute

In 1993, the College of Technology established the Electric Vehicle Institute in order to develop and promote advanced electric propulsion technology and transfer these technologies to corporations and public agencies for production and implementation. The hybrid-drive currently under development at the EVI operates on a combination of diesel fuel and electricity. Future models could operate on biofuel, fuel cells or micro turbines.

This project has yielded two functioning vehicles, each of which features the Hybrid Booster Drive® (HBD) system. One vehicle is a step van, commonly used by parcel delivery services. The second is a medium size bus commonly used in shuttle service. These two vehicles will provide manufacturers and operators with an opportunity to examine first hand the HBD system. Although the medium duty truck and bus applications were the focus of this project, the HBD system is scalable to larger and smaller vehicles.

Grand Valley State University

Grand Rapids, Michigan

Supply Chain Management in Business

In the Seidman College of Business at Grand Valley, both the Management and Marketing Departments focus on some dimensions of supply chain management. The Marketing Department recently introduced an *Emphasis* (concentration within the Marketing Major) *in Distribution and Logistics*. This Emphasis focuses on logistics activities related to distribution system design, transportation, warehousing and inventory planning. Attention is directed towards the strategic management of distribution assets,

customer service, finished goods inventory control, transportation, warehousing and international distribution planning.

The Management Department has an *Emphasis in Operations Management* that focuses on operations research, manufacturing management and purchasing and is designed to prepare the student in the technical and strategic aspects of producing goods and services. Operations Management involves the application of managerial, quantitative and computer skills to areas of quality assurance, inventory management, forecasting and scheduling with the goal of giving students the tools to effectively manage service and manufacturing operations.

The two departments work together on various aspects of the two Emphasis Programs. Students from these programs are employed in internships or full time positions at firms such as Alticor, Delphi, Johnson Controls, Brunswick, Ryder, Dedicated Logistics, Gordon Food Service, Meijer, Target, Office Depot, Lean Logistics and Concentrek Logistics.

Supply Chain Management in Engineering
The GVSU School of Engineering has bachelor and masters degree programs in computer engineering, electrical engineering, mechanical engineering as well as product design and manufacturing engineering. Transportation related efforts in the School of Engineering have concentrated on the modeling and analysis of supply chain logistics. Much work has been done in partnership with Shell Global Solutions in the analysis of in plant logistics, inventory management and multi-plant supply chains. Simulation models, sometimes used jointly with optimization models, have been the primary means of evaluation. Work has focused on issues involving loading strategies, inventory capacities, fleet sizing and rail yard sizing. Supply chain logistics is taught in *EGR 642 Material Handling and Facility Layout*. Both masters' students and advanced undergraduate students take this course.

University of Detroit Mercy
Detroit, Michigan
(Lead Institution)

The University of Detroit Mercy (UDM) is the largest private comprehensive university in Michigan. UDM offers engineering degrees in Civil, Electrical (including Computer Engineering concentration), and Manufacturing and Mechanical Engineering at bachelors, masters and doctoral levels. One year of cooperative education assignments are required of undergraduates. The AACSB-accredited College of Business Administration offers undergraduate business and MBA degrees.

In recent years, UDM has been a leader in educational innovation and interdisciplinary, interuniversity and corporate collaboration. The following are a few examples:

- Master in Product Development (a joint degree in business and engineering) developed through an NSF grant with MIT, RIT and major companies, including Ford, Xerox and IBM;

- Lead university for the launch of the Greenfield Coalition, an NSF Engineering Education Coalition (with Wayne State, Lehigh, Lawrence Tech and Michigan); Leo E. Hanifin as the Coalition Director;
- Mexican American Partnership in collaboration with Monterrey Tech and seven corporations to attract Hispanic American students to engineering careers and develop them as international leaders;
- Ford Partnership for Advanced Studies: a consortium of about ten universities across the nation that is assisting over 80 high schools in introducing courses on technology, business and the environment (Note: this is one of UDM's twelve pre-college programs that involve approximately 3,000 to 4,000 K-12 students each year. These programs serve approximately 61% minority students and 50% female students.); and
- Kern Entrepreneurship Education Network: UDM faculty, from business and engineering, have been named Kern Fellows as part of a program to develop entrepreneurship curriculum for both business and engineering students. (Understanding of entrepreneurship by both faculty and students will aid the transfer of MIOH's research results into products and systems.)

Alternative Fuels:
Dr. Shula Schlick, of the Chemistry Department, is performing research on fuel cells that has been funded by General Motors Corporation and Ford Motor Company. She is studying membrane degradation in fuel cells using electron spin resonance.

UDM's Civil & Environmental Engineering department offers Fuel Cells-related courses as part of the Master of Engineering and Master in Product Development Programs.

Also, Dr. Robert Ross, a faculty member in Physics, has performed extensive research and development in the area of solar energy, primarily while working at United Solar Ovonics Corporation, a leader in alternative energy. He and professors Mark Schumack and Arthur Haman (Mechanical Engineering) received a grant from the State of Michigan Energy Office (funded by the U.S. Department of Energy) under which they installed an array of solar panels on the roof of the Engineering Building as a demonstration and teaching system.

Transportation Systems:
Dr. Utpal Dutta, Professor of Civil and Environmental Engineering, teaches transportation related courses. He has performed extensive research related to the Detroit People Mover system. In recent years, he has studied performance indicators of various transportation systems, namely smart signals and road warranty. Chair of Civil & Environmental Engineering, Dr. Alan Hoback, conducted research on walking distance to transit stops and public health facilities using Geographical Information Systems (GIS).

Supply Chain:
Dr. Shahram Taj of the College of Business Administration teaches Supply Chain Management-related courses as a part of UDM's business curriculum. He also consults with a number of organizations on Supply Chain Management. Both Professor Taj and Professor Mary Higby (Business) have research interests focused in curriculum development related to supply chains.

University of Toledo

Toledo, Ohio

In the fall of 2006, The University of Toledo received approval of its Strategic Plan to begin a new University Transportation Center. The UT-UTC benefits from being in the same university environment as the Intermodal Transportation Institute (ITI) established in 2002. The benefits to the MIOH UTC include access to a broad cadre of researchers and students with depth of interest to participate in funded projects.

Transportation Systems and Supply Chain Management:
The University of Toledo offers the following undergraduate programs: Transportation Planning through the Civil Engineering Dept., GIS and Transportation through the Geography and Planning Dept. and Supply Chain Management through the College of Business Administration. The Civil Engineering Department offers Masters and Ph.D. degrees in Transportation Planning. The Geography and Planning Department offers a Masters degree in GIS and Transportation. The College of Business has a Masters degree and a Doctoral degree in Manufacturing Management. These programs, both graduate and undergraduate, provide talent for research and education projects. There is active and on-going research in transportation planning, infrastructure utilization and supply chain management.

Alternative Fuels: UT also has an active research program in alternate energy:

- Its Bio-Diesel Fuel Study project evaluates the impact of using a mixture of bio-fuel and diesel fuel on operating costs, emissions, engine performance, and engine life over a three-year period. This is the only long-term study that uses ultra-low sulfur diesel as the basis for comparison.
- UT's research in alternate fuel involves the production of hydrogen from sunlight. The hydrogen is then captured and stored for use in a fuel cell that powers a vehicle on UT's campus.
- In the realm of hybrid vehicles, UT researchers have been funded by the MIOH UTC for education curriculum development in the area of Hydraulic Hybrid Vehicle Technologies.

Wayne State University

Detroit, Michigan

Transportation Systems:
The College of Engineering offers programs leading to Bachelors, Masters and Doctoral degrees in various branches of engineering. The transportation program, which is a part of the Civil and Environmental Engineering Department, conducts research projects that encompass such diverse areas as traffic engineering and control, transit asset management, highway safety, transit planning and operations, transportation economics, transit privatization, use of advanced technology (ITS), social/economical and environmental impact of transit, pavements, bridges and construction. Additionally, the

nationally renowned Bio-Engineering Program in the College of Engineering focuses on automotive safety.

Transportation research in the WSU Department of Civil Engineering has been supported by various agencies including USDOT, MDOT, National Research Council, Michigan Office of Highway Safety Planning and others.

Alternative Fuels:
The College of Engineering has a graduate (Masters and Certificate) program in the area of Alternative Energy Technology (AET). The program is not 'housed' in any particular department; rather, it is offered under the larger umbrella of the College and faculty members from all departments participate in various aspects of the program. The development of this graduate program was supported by the Michigan Economic Development Corporation. Classes include Fundamentals of Fuel Cell Systems, Alternative Energy Technologies for Various Transportation Modes and Hydrogen Infrastructure and Alternative Fuel Transportation.

A major research program on bio-diesel is operated through the College in collaboration with NextEnergy. In addition to these educational program, the College of Engineering's Center for Automotive Research (CAR) focuses on automotive engines and alternative fuels.

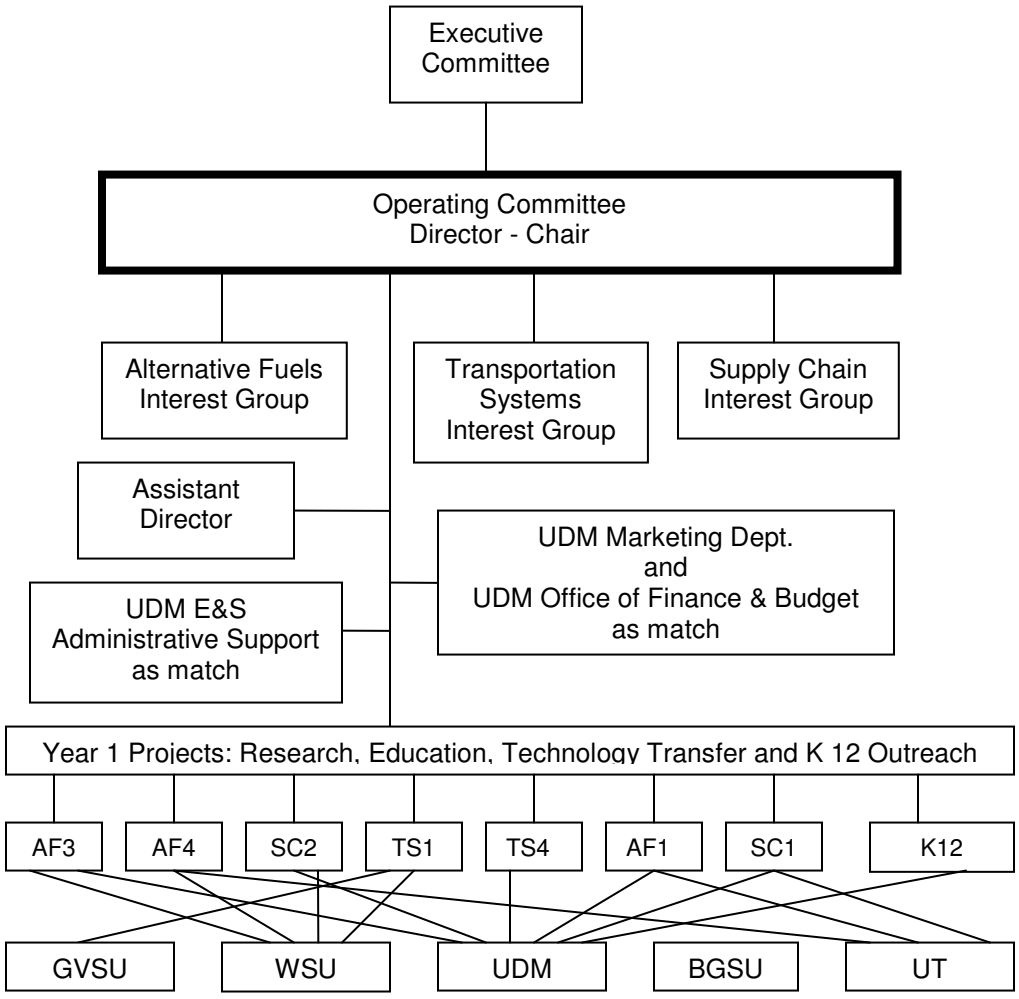
Supply Chain Management:
The College of Engineering, through its Industrial & Manufacturing Engineering (IME) Department, established Supply Chain Management curriculum to strengthen its graduate program. The *IE7325: Supply Chain Management* course introduces contemporary supply chain and logistics tools and practices to graduate students. The advanced course, limited to doctoral students, *IE8325: Advanced Supply Chain Management* challenges tools and algorithms available in the literature and calls for further algorithmic advances.

The Supply Chain (SC) research group pursues real-world research that aims to "coordinate" supply chains under conditions of information asymmetry and decentralized decision making. The research group employs novel "collective intelligence" techniques, multi-agent system (MAS) technologies, information theory, game theory, advanced statistical methods (mostly using extremely novel and promising Bayesian and Dynamic Bayesian Network methods and more broadly Graphical Methods), optimization techniques and contracts to purse supply chain coordination. Its research is supported by the National Science Foundation and industry.

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 government agencies and corporations. 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 sit on interest groups and/or the MIOH Operating Committee that stimulate, identify and review project proposals and develop and approve the MIOH annual program plan and budget.

A. Organization 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 2007 as Assistant Director. Her background includes administrative experience as Asst. Dean of Architecture at UDM, as well as, corporate event planning for a Michigan destination management company. Ms. Martinico 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 1** as of August 31, 2007

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

Operating Committee, **Year 1** as of August 31, 2007

Leo Hanifin	UTC Director
Hokey Min	Faculty Representative BGSU
Utpal Dutta	Faculty Representative UDM
Charles Standridge or John Taylor	Faculty Representative GVSU
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	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 1 as of August 31, 2007 (7-12 members each)
Operating Committee Members may also participate in interest group(s).

Alternative Energy

Jim Saber	Director of Technology Collaborations, NextEnergy
Mark Schumack	Faculty, Mechanical Engineering, UDM
Martin Abraham	Dean, Science, Technology, Engineering and Mathematics, Youngstown State University
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
TBD	Other corporate partners

Transportation Systems

Carmine Palombo	Director of Transportation, SEMCOG
Ralph Robinson	Ford and President – VIIC
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
Mark K. Krage	Delphi – Electronics & Safety
Richard Beaubien	President, ITS Michigan

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	Quality Coach/Assessor, Ford
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 first year the MIOH UTC initiated education projects in five areas. Of these two were at the university level (one undergraduate and one graduate) and three were at the pre-college level:

1. Multipurpose Educational Modules to Teach Hydraulic Hybrid Vehicle Technologies to Undergraduate Engineering Students (AF1)

The project team of four faculty and several students from The University of Toledo (lead university) 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. Also, the simulation will enable students to compare the performance of various hybrid configurations with conventional IC engines. The educational modules and computer simulation software developed throughout this project period will become available on the internet for other universities. Additionally, the investigators will present and publish their educational finding at national and international conferences and in educational journals.

2. Supply Chain/Transportation Efficiency Systems Masters Degree Program (SC1)

A team of business and engineering faculty members and graduate students from the University of Detroit Mercy (lead university) and The University of Toledo are developing a unique Master's Degree Program that integrates the design and management of supply chains and transportation systems. The team has established a strong Board of Advisors from manufacturers, suppliers, logistics companies and delivery firms to provide insights regarding the competencies and knowledge needed by engineers and managers in this area. During this year the overall program and four courses are being developed. Other graduate programs in logistics and supply chain were investigated to assure that this new program would offer differentiation of learning objectives and content.

3. Ford PAS Alternate Fuels Module for High School Students

This project has been undertaken by five UDM faculty members from mechanical engineering (2), biology (2) and chemistry (1) 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 will involve a wide variety of experiences for students including 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 be will piloted in the winter term at two Detroit area high schools. They 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.

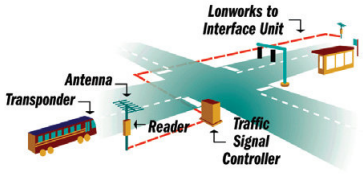
4. Alternative Fuels Saturday Class for High School Students

Faculty members from UDM's Biology, Chemistry and Mechanical Engineering Departments have developed and piloted a five week Saturday class offered though Detroit Area Pre-College Program (DAPCEP). The course, *Fueling the Car of Tomorrow,* includes classes focused on Internal Combustion Engines, Making Biodiesel, Testing Biodiesel and Measuring Energy Content, Building a Fuel Cell Car, and Comparing Fuel Alternatives. This course also allowed these faculty members to pilot educational content and experiences for possible incorporation in the Ford PAS modules (above). Twenty students participated in this course.

Dr. Mark Schumack discusses vehicles

Students learn the chemistry of biodiesel production

5. Transportation Summer Camp for High School Students



A one week summer camp named "TRANS-IT" was designed and piloted by Civil 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 for 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, VII, traffic signals/controls and regional transit systems. Twenty-three students participated in the camp.

TRANS-IT Students on their Visit to the RCOC-TOC

"Paving Systems 101"

Modeling Transportation Systems

B. MIOH Research Program

During its first year, the MIOH UTC defined and launched research projects in five areas: two each in the alternative fuels and transportation systems and one in the supply chains. These all focused on important national priorities including independence from foreign oil (cellulosic ethanol and biodiesel), efficient freight delivery and congestion mitigation.

1. Production of Fuel Ethanol from Cellulosic Peat (AF3)

A team of three faculty and several students from the University of Detroit Mercy (lead) and Wayne State University investigated the production of ethanol from cellulosic plants indigenous to the Michigan-Ohio region including such novel feedstock sources as peat. The team investigated both the chemical processes involved and viability of the sources with regard to their volume, concentration and accessibility. After a series of experiments, some with positive results and some with negative, and a more thorough assessment of the regeneration cycle and accessibility of the peat sources, it was determined that peat would not be a viable feedstock for ethanol production. Further research was recommended to investigate production of weedy biomass that does not require fertilization but has favorable chemical disposition to efficient and scalable fermentation processes.

2. Improved Oxidative Stability of Biodiesel Fuels (AF4)

A team of two faculty members and their graduate students from Wayne State University, in cooperation with the National Biofuel Energy Laboratory at NextEnergy in Detroit, are investigating the factors associated with biodiesel oxidative stability, a significant problem associated with the commercial acceptance of biodiesel. This study investigates the effectiveness of eight different natural and synthetic antioxidants on various types of biodiesel (soybean oil, cottonseed oil, poultry fat and yellow grease) at varying concentrations and varying storage conditions (indoors and outdoors). The results will be reported through both MIOH reports and scholarly publications.

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

A team of three faculty members and four students from Wayne State University (lead) and the University of Detroit Mercy is developing effective static and dynamic routing algorithms for congestion avoidance and reduction of commercial cargo carriers given real-time information regarding recurring and non-recurring congestions by Advanced Traveler Information Systems (ATIS). 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. The efforts of this team are currently focused on three areas:

- Data collection for the MI-OH road network structure and historical incident data from MDOT, ODOT and other agencies using ArcGIS software.
- Developing road network models representative of major freight transportation routes.
- Developing static and dynamic rerouting optimization models and algorithms, and their implementation for a limited set of scenarios.

4. Congestion Relief by Travel Time Minimization in Near Real Time (TS1)

A team of three faculty members and five students (four graduate and one undergraduate) from Grand Valley State University (lead) and Wayne State University are collaborating 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. Their work involves the following:

- Acquiring, managing and analyzing/fusing corridor data from the Michigan Intelligent Transportation System (MITS) Center;
- Designing and implementing a traffic corridor routing algorithm for rerouting traffic around incidents in this corridor;
- Studying alternative corridor simulation models and software and selecting one of those alternatives;
- Reviewing previous project ranking and selection models for traffic corridor repair and improvement projects.

All of these activities are directed toward the ultimate goal of creating a validated model of a specific corridor of interest with an integrated dynamic route selection model and determining how route selection information can be transmitted to travelers via an ITS.

5. Feasibility Evaluation of Hovercraft for Transit on the Detroit River (TS2)

A University of Detroit Mercy professor and his student are investigating the ability of hovercraft to operate in Detroit's weather conditions as a new transit mode. If such a system can operate reliably and safely in Detroit's weather it may provide an exciting, fast and relatively inexpensive alternative mode of travel. It is hoped that Southeast Michigan will embrace this project because of its "water culture."

6. Evaluation of SCATS Control System (TS4)

A team of faculty members and students from the University of Detroit Mercy is performing an evaluation of the effectiveness of a SCATS (Sidney Coordinated Adaptive Traffic System) that is installed in a 7 traffic signal corridor in Oakland County, Michigan. This study includes:

- A state-of-the-art literature review of traffic signal related publications;
- Design of a pre-timed traffic signal timing for the M-59 corridor; and a
- Collection of travel time, delay and traffic queue data along the M-59 corridor for different signal timing plans.

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 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: Soon after the end of the first year projects (in early 2008), the MIOH UTC will create a "transportation technology tour" whereby the results of those projects will be presented to UTC partners and other interested parties at each of the partner UTC universities.

3. Partnered Technology Transfer Events: Later in 2008, the MIOH UTC will partner with NextEnergy and Michigan ITS to co-sponsor technology transfer events focused on alternative fuels and transportation systems. 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 achieving the 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, ultimately, through their career efforts, the reduction of our nation's dependence on foreign oil, improvement of the environment and enhanced competitiveness of U.S. automakers.

B. Extensive K12 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 competencies of students 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. One project was successful in developing a small scale chemical process for the conversion of peat into ethanol. However, the efforts to employ common yeasts as fermentors of ethanol from peat were not successful. Like much advanced research, both the positive and negative results are valuable findings.

D. A team of researchers at Wayne State University have investigated the oxidative stability of different types of biodiesels and blends and the results of long-term indoor and outdoor storage. Their findings indicated:

    1. Some synthetic antioxidants can enhance the oxidative stability of different types of biodiesel while others have no noticeable effect.

However, the effect of each antioxidant on biodiesel was different depending on the feedstock employed in its production.

2. The different effects of antioxidants on undistilled and distilled biodiesel may be attributed to the natural antioxidant content and total glycerin content.
3. After 9 months indoor and outdoor storage, the oxidative stability of untreated SBO-based biodiesel depends on time. The addition of antioxidant can improve the oxidation stability of the biodiesel to increase storage time. Specific antioxidants were determined to be good for long term storage.

E. The team of MIOH researchers, most 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% of traffic congestion. This effort is specifically focused on improvement of supply chain (freight) performance, and is directly responsive to two of DOT's six strategic RD&T priorities. These results have already resulted in three conference presentations and a conference session at the 2007 *INFORMS 2007 Annual Meeting, titled,* "Urban Transportation Planning Models: Dynamic Routing with Real-time ITS Information."

F. 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 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.

As most MIOH UTC projects have not yet completed their first year, even more significant accomplishments are expected in the 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[5]
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**

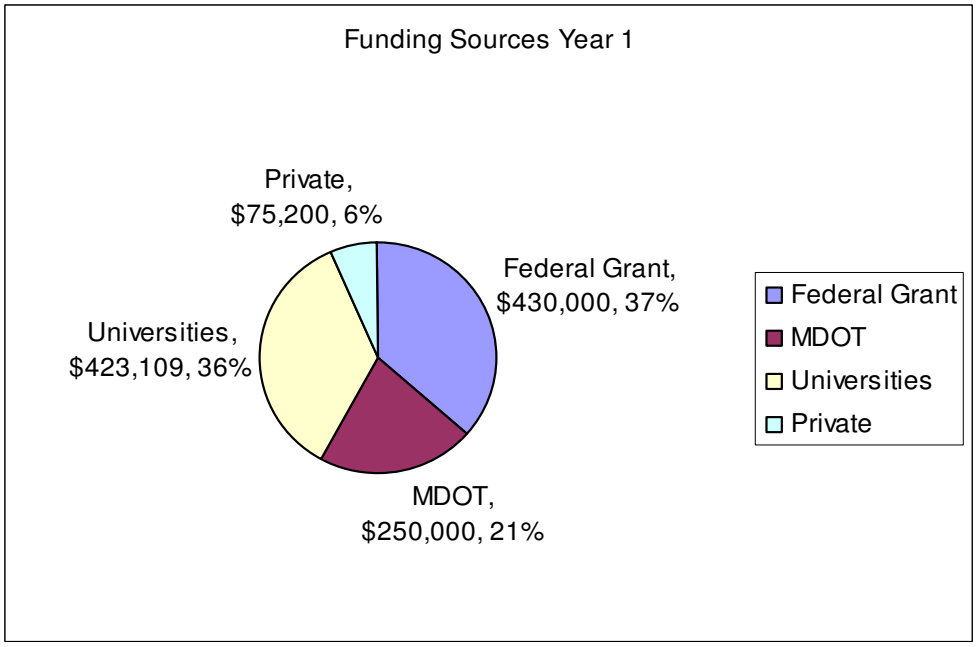
Education and Workforce Development Strategic Objective:

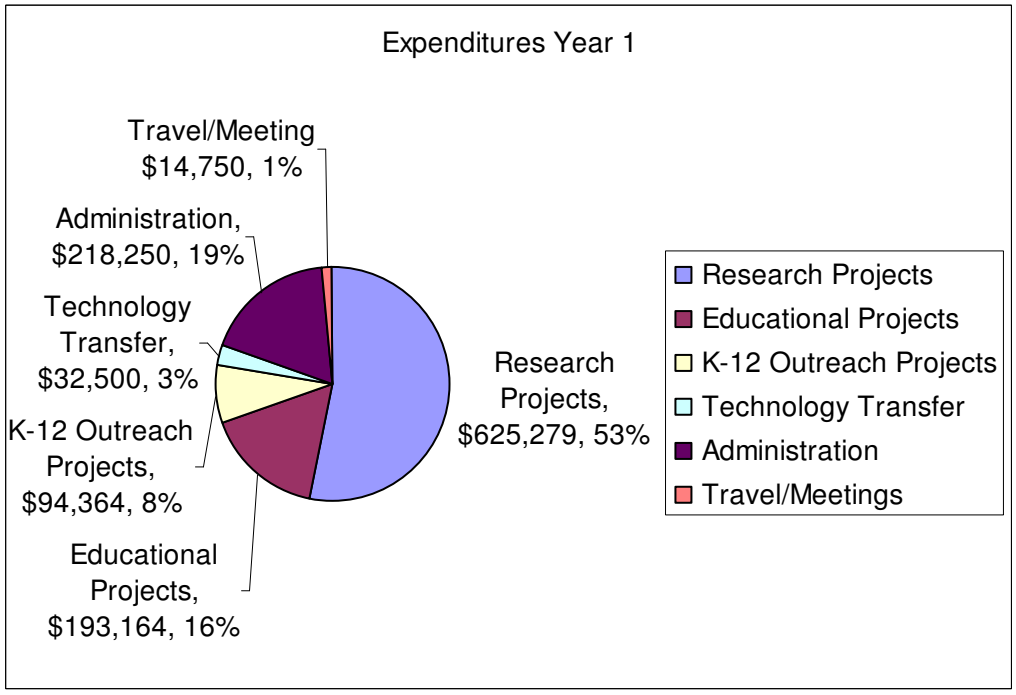
RITA will work with **partners in academia and industry to build the professional capacity of the transportation workforce.** RITA's activities will complement the efforts of DOT's operating administrations by reaching out to the broader transportation and education communities. In addition, the Administration's 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 & environ.**	**Improve energy alt. fuels**	**Mitigate adverse environ. Impacts**	
AF1					x	x	x	x
AF1, project 1					x	x	x	x
AF1, project 2					x	x	x	x
AF3, project 1					x	x	x	
AF3, project 2					x	x	x	
AF4, project 1					x	x	x	
AF4, project 2					x	x	x	
SC1, project 1	x	x	x					x
SC1, project 2	x	x	x					x
SC2, project 1	x		x	x				
SC2, project 2	x		x	x				
TS1, project 1	x		x	x				
TS1, project 2	x		x	x				
TS2, project 1	x							
TS4, project 1	x		x	x				
TS4, project 2	x		x	x				
K 12 -1, proj. 1					x			x
K 12 -1, proj. 2					x			x
K 12 -2					x			x
K 12 -3					x			x

VII. Illustrations of Funding Sources

Planned Funding Sources and Expenditures Year 1 2006-2007





Year 1 includes administrative costs related to development and submission of the Strategic Plan starting in January 2006 to August 31, 2007. Year 1 projects were funded beginning November 22, 2006 with a "no cost extension" through December 31, 2007.

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.

2006-2007 Year 1 New Projects

Research Projects	**Title**
AF3, project 1, project 2	Production of Fuel Ethanol from Cellulosic Peat for Future Transportation Systems
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 2, project 1	Investigation of Hovercraft Operation in Detroit Weather Conditions
TS 4, project 1, project 2	Evaluation of SCATS Control System
Educational Projects	
AF 1, project 1, project 1	Multipurpose Educational Modules to Teach Hydraulic Hybrid Vehicle Technologies
SC 1, project 1, project 2	Supply Chain/Transportation Efficiency Systems Graduate Degree Program
K-12 Outreach Projects	
K 12 -1, project 1, project 2	K-12 Outreach Ford PAS Alternate Fuels Module
K 12 -2	DAPCEP Saturday Class
K 12 -3	Transportation Summer Camp

2006-2007 Year 1 Completed Projects

K-12 Outreach Projects	Title	Completion Date
K 12 -2	DAPCEP Saturday Class	April 31, 2007
K 12 -3	Transportation Summer Camp	Aug. 31, 2007

Spring 2007 DAPCEP Mechatronics Course

Project Name: **PRODUCTION OF FUEL ETHANOL FROM CELLULOSIC PEAT FOR FUTURE TRANSPORTATION SYSTEMS**

Focal area: **Alternative Fuels** Project Identifier: **AF 3 Research**

AF 3, Project 1: **Nov. 22, 2006 to Apr. 30, 2007**
AF 3, Project 2: **May 1, 2007 to Dec. 31, 2007**

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

Co-Principal Investigators: **Dr. Charles W. Winter, WSU**
and **Dr. John Shewchun, WSU**

Student Involvement: **3 graduate students** at University of Detroit Mercy

Budget:

	AF 3, Project 1 2006-07	**AF 3, Project 2 2007**
US DOT funds	18,789	17,711
Match funds	24,864	17,500
Total funds	43,653	35,211

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 Apr. 30, 2007**
AF 4, Project 2: **May 1, 2007 to Dec. 31, 2007**

Principal Investigator: **Dr. Steven O. Salley, WSU**

Co- Investigators: **Dr. K.Y. Simon Ng, WSU**
and **Dr. Martin Abraham, UT**

Student Involvement: **1 graduate student** at Wayne State University and **1 graduate student** at The University of Toledo.

Budget:

	AF 4, Project 1 2006-07	**AF 4, Project 2 2007**
US DOT funds	$17,000	$23,000
Match funds	$13,363	$52,181
Total funds	$30,363	$75,180

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 Apr. 30, 2007**
SC 2, Project 2: **May 1, 2007 to Dec. 31, 2007**

Principal Investigator: **Dr. Ratna Babu Chinnam, WSU**

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

Student Involvement: **3 graduate and 1 undergraduate student** 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**
US DOT funds	$17,870	$27,130
Match funds	$46,070	$81,378
Total funds	$63,940	$108,508

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 Apr. 30, 2007**
TS 1, Project 2: **May 1, 2007 to Dec. 31, 2007**

Principal Investigator: **Dr. Charles R. Standridge, GVSU**

Co-Investigators**: Dr. Shabbir Choudhuri, GVSU**
and **Dr. Snehamay Khasnabis, WSU**

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

Budget:

	TS 1, Project 1 2006-07	**TS 1, Project 2 2007**
US DOT funds	$9,355	$40,645
Match funds	$37,188	$64,494
Total funds	$46,544	$105,139

Project Name: **INVESTIGATION OF HOVERCRAFT OPERATION IN DETROIT WEATHER CONDITIONS**

Focal Area: **Transportation System Efficiency and Utilization**
Project Identifier: **TS 2 Research Projects**

TS2, Project 1: **January 2007 to Dec 31, 2007**

Principal Investigators: **Dr. Alan Hoback, UDM**
Co-Investigator: **Mr. Scott Anderson, UDM**

Student Involvement: **5 undergraduate students** at the University of Detroit Mercy.

Budget:

	TS 2, Project 1 2007
US DOT funds	0
Match funds	$18,500
Total funds	$18,500

Project Name: **EVALUATION OF SCATS CONTROL SYSTEM**

Focal Area: **Transportation System Efficiency and Utilization**
Project Identifier: **TS 4 Research Projects**

TS4, Project 1: **Nov. 22, 2006 to Apr. 30, 2007**
TS4, Project 2: **May 1, 2007 to Dec. 31, 2007**

Principal Investigator: **Dr. Utpal Dutta, UDM**

Student Involvement: **15 graduate students** and **5 undergraduate students** at the University of Detroit Mercy.

Budget:

	TS4 Project 1 2006-07	**TS4 Project 2 2007**
US DOT funds	$8,875	$31,125
Match funds	$3,496	$56,245
Total funds	$12,371	$87,370

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 Apr. 30, 2007**
AF 1, Project 2: **May 1, 2007 to Dec. 31, 2007**

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 **1 graduate student** at the University of Detroit Mercy.

Budget:

	AF 1 2006-07	**AF 1, Project 1 2006-07**	**AF 1, Project 2 2007**
US DOT funds	$30,000	$250	$4,750
Match funds	$34,696	$10,000	$5,000
Total funds	$64,696	$10,250	$9,750

Project Name: **SUPPLY CHAIN/TRANSPORTATION EFFICIENCY SYSTEMS GRADUATE DEGREE PROGRAM**

Focal area: **Supply Chain** Project Identifier: **SC 1 Educational Project**

SC 1, Project 1: **Nov. 22, 2006 to Apr. 30, 2007**
SC 1, Project 2: **May 1, 2007 to Dec. 31, 2007**

Principal Investigator: **Dr. Shahram Taj, UDM**
Co-Principal Investigator: **Dr. Subba Rao, UT**

Co- Investigators: **Dr. Utpal Dutta, UDM, Dr. Paul Hong, UT, Dr. Mark Vonderembse, UT, Dr. Peter Lindquist, UT, Dr. Neil Reid, UT, Dr. Jiwan Gupta, UT, Dr. Edie Chou, UT** and **Dr. Asok Kumar, UT**

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

Budget:

	SC1, Project 1 2006-07	**SC1, Project 2 2007**
US DOT funds	$9,182	$20,818
Match funds	$37,226	$25,274
Total funds	$46,408	$46,092

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 Apr. 30, 2007**
K 12 -1, Project 2: **May 1, 2007 to Dec. 31, 2007**

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 -2 Project 2 -2007**
US DOT funds	$16,957	$0
Match funds	$9,235	$36,753
Total funds	$26,192	$36,753

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**

Principal Investigator: **Dan Maggio, UDM**

Student Involvement: **4 undergraduate students** at University of Detroit Mercy.

Budget:

	K 12 -2 2006-07
US DOT funds	$6,401
Match funds	$3,600
Total funds	$10,101

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**

Principal Investigator:
Daniel Maggio, UDM

Student Involvement: **3 undergraduate students** University of Detroit Mercy.

Budget:

	K 12 -3 2006-07
US DOT funds	$17,154
Match funds	$4,264
Total funds	$21,418