A NATIONAL UNIVERSITY TRANSPORTATION CENTER
AT MISSOURI UNIVERSITY OF SCIENCE AND TECHNOLOGY

CENTER FOR TRANSPORTATION INFRASTRUCTURE AND SAFETY

ADVANCED MATERIALS, TRANSITION-STATE FUELS AND NON-DESTRUCTIVE TESTING TECHNOLOGIES

Third Year Annual Report
July 1, 2008 – June 30, 2009

PART A: CORPORATE STYLE ANNUAL REPORT

Submitted by
John J. Myers, Ph.D., P.E.
Interim Center Director

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Third Year Annual Report
Part A: Corporate Style Annual Report

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OVERVIEW: CENTER FOR TRANSPORTATION INFRASTRUCTURE AND SAFETY

Introduction

Throughout three years of operation as a National University Transportation Center (NUTC), the Center for Transportation Infrastructure and Safety (CTIS) has become a Center of Excellence on the theme areas of advanced materials, transition-state fuel vehicle infrastructure and non-destructive testing technologies.

CTIS has provided the faculty, staff and students at Missouri University of Science and Technology (Missouri S&T) with the means for establishing key relationships with transportation-oriented state and federal agencies and industry partners. With NUTC leverage, the research and development (R&D) projects carried out at Missouri S&T have created the critical mass and the track record necessary to establish a Center of Excellence.

In addition to contributing to successful and relevant R&D projects, with the development of significant educational resources and by facilitating the transfer of advanced technology developed within the Center's theme areas, CTIS has impacted the quality of available education for engineers and transportation professionals, equipping engineers with interdisciplinary skills and experiences. As a result of CTIS activities, new academic programs for educating better-prepared engineers have been created at Missouri S&T and the University has become, and continues to be, the provider of the Local Technical Assistance Program (LTAP) for the state of Missouri.

Since its inception, CTIS has performed work in accordance with its strategic plan to accomplish projected goals in the areas of education, research and technology transfer. CTIS has put forth significant efforts to become highly visible and credible with the aim to recruit and retain quality students, faculty and professionals and to make significant contributions to transportation-related fields.

Future

The future activities of CTIS will continue to draw on the capabilities and campus expertise in the areas of advanced materials, transition-state fuel vehicle infrastructure and non-destructive testing. Partnerships with industry professionals and organizations will be continuously sought out and developed.

In particular, CTIS aims to become the point of reference and preferred partner of industry organizations that have not traditionally been involved with transportation-related applications and activities. The intention is to improve the quality and lifespan of existing transportation infrastructure using the broadest-based technology possible and to stimulate the economic viability of U.S. corporations.

Mission and Theme

Mission: The mission of the Center for Transportation Infrastructure and Safety (CTIS) at Missouri S&T is to advance U.S. technology and expertise in the many disciplines comprising transportation through the mechanisms of education, research and technology transfer at university-based centers of excellence.

Theme: To address national needs in the areas of transportation infrastructure and safety, focusing on the following topical areas:

- **Advanced materials** including constructed facilities security, which will involve several tasks:
    - The development, manufacture and application of modern construction materials
    - Installation processes and engineering design
    - Standardization and code approval of products and design protocols
- **Transition-state fuel vehicle infrastructure** leading to a hydrogen economy, which will require two critical tasks:
    - Development of safety codes, standards and regulations
    - Infrastructure development and deployment
- **Non-destructive evaluation (NDE) technologies and methods** including monitoring and evaluation of new and repaired structures and system components.

Advanced materials developed for use in transportation infrastructure offer superior mechanical properties, long-term durability and design flexibility. R&D in advanced materials address the growing needs for strengthening/rehabilitation of aging structures and for the design/construction of new structures to more stringent requirements and for extended service life. These materials apply to all modes of surface transportation.

Alternative fuel vehicles face the same implementation challenges as that of hydrogen vehicles. Research, development, demonstration and deployment activities of alternative fuel (including hydrogen) vehicles and supporting infrastructure across all modes of transportation address the growing need for a successful transition to a hydrogen economy.

Recent advances in sensor technologies and NDE techniques offer new methods of non-intrusive, in-situ monitoring of the health, geometric, environmental and structural characterization of civil structures and their supporting systems. NDE sensor technologies and methods enable more accurate, sensitive, cost-effective, rapid and straightforward evaluations. Integration of NDE technology to existing and future infrastructure systems will improve network evaluation and enhance the safety of the transportation infrastructure.

The choice of the Center theme comes from an analysis of state and national needs/opportunities, as well as the strengths/potential of Missouri S&T. We are walking the bridge that connects the transportation infrastructure of the second millennium to that of the third millennium. Existing

infrastructure was conceived to support vehicular traffic powered by fossil fuel and has dramatic shortcomings in terms of durability and congestion. But the future will be an intelligent infrastructure incorporating advances in information technology and supporting a new generation of alternative fuels up to an ending point, which is conceivably hydrogen, with all the associated challenges in terms of safety, deployment and market acceptance.

Missouri S&T has determined that it is of critical importance to its own mission and future as well as the economical success of the state of Missouri to focus on advanced materials in order to: a) help with the upgrade and maintenance (including security hardening) of the existent infrastructure; and b) contribute to the development of the new infrastructure. Similarly, NDE methods and techniques are a core area of expertise at Missouri S&T and their development and deployment will help with the health monitoring of existing infrastructure and will become an integral part of new infrastructure to ensure both acceptance and safety. Finally, the Center will use a systematic approach to tackle the challenge of alternative fuels (including hydrogen) as the only viable methodology for the safe deployment of a new form of transportation.

MANAGEMENT STRUCTURE

This section presents an overview of the Center's management structure and staff, those individuals who actively contribute to the functioning of Center activities, as well as information about the composition and purpose of the Research Advisory Board.

Center Staff

In addition to the Interim Director, the following individuals actively contribute to the management/operation of the Center: one associate director, four office staff persons and three laboratory staff persons. The Research Scholar and Lab/Research Technician laboratory staff positions are currently open.

Name	Title	Address/Phone/Fax/E-mail	Responsibilities
Myers, J. J.	Interim Director	325 Butler-Carlton Hall, Rolla MO 65409 573-341-6618/6215 jmyers@mst.edu	Center management
Sheffield, J.	Associate Director	331 Toomey Hall, Rolla MO 65409 573-341-6073/4607 sheffld@mst.edu	Research activities
Spitzmiller, G.	Admin. Assistant	221 ERL, Rolla MO 65409 573-341-7170/6215 spitz@mst.edu	Administration and accounting
Sherman, A.	Senior Secretary	222 ERL, Rolla MO 65409 573-341-7884/6215 abigayle@mst.edu	Clerical support/ student appointments
Geisler, C.	Secretary	223 ERL, Rolla MO 65409 573-341-4497/6215 geislerc@mst.edu	Clerical support
Dafni, J.	Technical Editor	220 ERL, Rolla MO 65409 573-341-7848/6215 dafnij@mst.edu	Publications/website
Open Position	Research Scholar	218 ERL, Rolla MO 65409 573-341-6223/6215	Research activities/mentoring
Cox, J.	Sr. Research Specialist	G-8 ERL, Rolla MO 65409 573-341-6742/6215 coxjn@mst.edu	Laboratory and field testing/coordination
Open Position	Lab/Research Technician	G-8 ERL, Rolla MO 65409 573-341-7895/6215	Laboratory testing/ equip. maintenance

Research Advisory Board

A Research Advisory Board (RAB) has been assembled to advise the Center Director on management procedures and, with adherence to specific merit criteria, to review the research project funding selection process. The RAB considers a proposed research project's intellectual merit: to what extent it advances knowledge and understanding within the Center's theme areas; and a proposed research project's potential impacts: how the results will be disseminated and what groups will receive the information.

Members of the RAB were selected based on personal accomplishments, background and affiliations on a regional and national level. The RAB is representative of all disciplines and departments covered by the Center's theme and can effectively guide the Center's course. The following people comprise the Center's RAB:

- Mara Campbell, MoDOT, R&D Division
- William P. Chernicoff, USDOT-RITA, National Level Hydrogen Rep., ex-officio
- Mary Davis, Missouri Enterprise, President and Chief Executive Officer
- Ken Foster, FHWA Division Bridge Engineer
- Dennis Heckman, MoDOT State Bridge Engineer
- David Hohmann, TxDOT State Bridge Engineer
- Barney T. Martin, Ph.D., Modjeski & Masters Engineers, Designer, NY Office
- Jim Myers, Coreslab Structures Inc., Fabricator-Producer
- John J. Myers, Ph.D., Center Director, Missouri S&T, ex-officio
- Angie Rolufs, Missouri Transportation Institute (MTI), ex-officio
- John Sheffield, Ph.D., Center Associate Director, Missouri S&T, ex-officio
- Raj Valluvan, P.E., Ph.D., Caltrans

In addition to these members, CTIS staff intends to select a representative of the hydrogen fuel industry. This is a rotating position.

The RAB last met on December 2, 2008 at the Havener Center at Missouri S&T. CTIS staff provided an overview of current activities, finances, new and ongoing projects and the Center's strategy for the future. The following topics were also discussed: the role of the RAB and frequency of meetings; budget and funding with regard to research projects; ideas and suggestions for the future strategy; measures of success; and a permanent director.

The next meeting of the RAB will be held in late Fall 2009.

OVERVIEW OF EDUCATION, RESEARCH, AND TECHNOLOGY TRANSFER PROGRAMS

This section presents a summary and overview of all projects awarded in Year III (2008-2009).

Research Projects

R255—Soy-Based UV Resistant Polyurethane Pultruded Composites
[Chandrashekhara, K., PI – Missouri S&T, new in this reporting period]

The objective of this project is to develop and evaluate the performance of soy-based polyurethane pultruded composites. Neat resin coupons and pultruded composite parts will be manufactured using the developed aromatic and aliphatic PU resin systems. Also, parts will be manufactured by incorporating nano-engineered fillers in the aliphatic soy-based PU resin system to compensate the loss of mechanical performance over aromatic PU resins. The cure kinetics of polyurethanes will be studied by differential scanning calorimetry (DSC) and the reaction rates of the aliphatic and aromatic polyurethanes will be compared. Mechanical performance will be evaluated by conducting tensile, flexure and impact tests. The economics of aromatic system and aliphatic systems will be assessed.

Polyurethane (PU) resin systems exhibit superior strength and damage tolerance relative to unsaturated polyester and vinylester pultrusion resins. Also, high pultrusion line speeds can be achieved using PU resins. In our previous study, we have successfully evaluated pultrudable PU with aromatic isocyanate and soy-based polyol (with 20% soy content). The performance of the soy-based resin is comparable to the base PU resin. However, aromatic PU based composites have poor environmental stability under UV light exposure and require specialized painting to provide protection. Aliphatic PU resins provide improved UV resistance but exhibit lower mechanical performance in comparison to aromatic polyurethanes. This project will investigate pultrudable PU resin systems with aromatic and aliphatic isocyanates, and soy-polyol.

R254—Missouri S&T Hydrogen Transportation Test Bed Equipment & Construction
[Sheffield, J., PI – Missouri S&T, new in this reporting period]

The objective of this project is focused on one of the Missouri S&T NUTC's theme areas: Transition-state fuel vehicle infrastructure leading to a hydrogen economy. Two identified tasks associated with this theme are the following: 1) development of safety codes, standards and regulations, and 2) infrastructure development and deployment. The overarching goals of this research are to collect and evaluate the real-world performance and utility of hydrogen-powered vehicles and to benchmark issues related to the safety, operation and maintenance of hydrogen-powered vehicles with other alternative fuel-powered vehicles.

NUTC funds, along with specific project matches, have allowed Missouri S&T to accomplish Phase I of the "E^3 Commons." Tackling Phase II requires complementary capabilities for these three areas of the Commons: EcoCAR Garage, Hydrogen Fueling Station and Renewable Energy Transit Depot. Upgrading the Missouri S&T E^3 Commons provides a unique transportation test bed for both current and future university transportation research projects focused on the

transition-state fuel vehicle infrastructure leading to the vehicular use of hydrogen as a fuel in both internal combustion engines and fuel cell plug-in hybrid electric vehicles at Missouri S&T.

R253—The Guayule Plant: A Renewable, Domestic Source of Binder Materials for Flexible Pavement Mixtures
[Richardson, D., PI – Missouri S&T, new in this reporting period]

The objective of this project is to determine the feasibility of using materials extracted from the guayule plant in the design and production of flexible pavement mixtures.

A flexible pavement mixture produced with little to no virgin petroleum-based material will be designed and tested. Due to the rising price of crude oil, the costs of flexible pavement have significantly increased. Therefore, the potential impact on highway construction could be lower costs. A thorough experimental program is necessary to assess the limits of the use of guayule rubber and resin in the context of this concept.

R250—Innovative Concrete Bridging Systems for Pedestrian Bridges: Implementation and Monitoring
[Myers, J., PI – Missouri S&T, new in this reporting period]

The objective of this project is to fabricate, instrument and monitor two new pedestrian bridges utilizing innovative advanced concrete in Rolla, MO. As part of the study, one pedestrian bridge will be constructed with high-strength concrete (HSC) as a baseline structure, while the second bridge will be constructed with high-strength, self-consolidating concrete (HS-SCC).

The use of HSC has become ordinary in the transportation industry because of its beneficial economical and material properties. HSC is advantageous because it reduces material requirements, permits longer girder spans and allows for increased girder spacing; thereby reducing material and total bridge cost. Over the past few years, the use and acceptance of SCC has increased in the U.S. due to the reduced potential for segregation, voids and surface defects. Because of the availability of new admixtures for SCC, fabrication time and labor costs can be reduced. Due to these advantages, SCC is becoming the material of choice for the precast industry. The combination of the performance characteristics of SCC with the engineering properties of HSC will produce a cost effective material for the construction industry.

R247-R242—MTI/MoDOT Transportation Geotechnical Research Program
The objective of the Geotechnical Research Program is to achieve significant and recurring cost savings for Missouri Department of Transportation (MoDOT) by developing improved, technically sound design specifications. The new specifications will be based on LRFD concepts which produce consistent and appropriate performance/risk factors for the local conditions and consequences involved.

This will lead to substantial cost savings by avoiding excessive conservatism in cases where it is not warranted and by avoiding excessive maintenance and rehabilitation costs in cases where performance is unacceptable. The execution and completion of this program will address many of MoDOT's most pressing research needs while making notable improvements to the state of the art and practice of geotechnical engineering at a national and international level.

The following six research projects represent components of this comprehensive research program.

R247—Tasks 2 & 4
[Loehr, J., PI – UMC, new in this reporting period]

The objective of these tasks is to establish load and resistance factors for design of earth slopes and foundations and to develop recommended LRFD design specifications for implementation.

Specifically, Task 2 involves full-scale load testing of foundation elements to evaluate and quantify variability and bias in relevant design methods for deep foundations. Task 4 will integrate the results of lab and field investigations performed as part of this research program.

R246—Tasks 2 & 4
[Luna, R., PI – Missouri S&T, new in this reporting period]

The objective of Task 2 is to evaluate and quantify variability and bias in relevant design methods for deep foundations through a program of full-scale load testing of foundation elements. Task 4 will focus on performing analyses to integrate the results of lab and field investigations performed as part of this research program.

The load test program will develop methods and procedures to design the lowest cost bridge foundations in different geologic conditions, to improve foundation selection so that the most appropriate foundation type is selected, and to decide when design and/or construction phase field load tests will produce lower cost structures. The primary means for achieving this objective will be to quantify the bias and variability introduced into the foundation design process by relevant design methods. The combined effects due to input parameters and due to design procedures will be integrated in the LRFD specifications developed as part of Task 4.

R245—Task 3
[Bowders, J., PI - UMC, new in this reporting period]

The objective of this task is to quantify the relationship(s) between costs and risks and identify optimum risk-cost balances and minimally accepted risks for bridge foundations and earth slopes. Specifically, this task will establish generally accepted target risk levels for different limit states and structure types based on the costs and consequences involved.

This specific portion of the work focuses on completing an extensive lab and field testing program to quantify variability and bias in relevant design parameters (e.g. shear strength and consolidation parameters) as a function of specific boring, sampling and testing techniques.

R244—Tasks 1 & 3
[Maerz, N., PI - Missouri S&T, new in this reporting period]

The objective of Task 1 is to develop methods and procedures for characterizing design parameters relevant to bridge foundations and earth slopes in a probabilistic manner to allow appropriate consideration of risk in the design process. The focus of these efforts will be to develop the knowledge, procedures, and techniques to perform site characterizations that will

produce the lowest cost transportation products possible on a system-wide basis. Specific objectives include:

- Quantify "hidden" conservatism or "bias" in measurements of design parameters relevant to foundations and earth slopes based on current practices and potential improvements to those practices
- Develop methods to establish site specific variability in design parameters for use in LRFD design specifications based on laboratory and field measurements

The objective of Task 3 is to quantify the relationship(s) between costs and risks and identify optimum risk-cost balances and minimally accepted risks for bridge foundations and earth slopes. This specific portion of the work focuses on completing an extensive lab and field testing program to quantify variability and bias in relevant design parameters (e.g. shear strength and consolidation parameters) as a function of specific boring, sampling and testing techniques.

R243—Task 1
[Ge, Y., PI - Missouri S&T, new in this reporting period]

The objective of Task 1 is to develop methods and procedures for characterizing design parameters relevant to bridge foundations and earth slopes in a probabilistic manner to allow appropriate consideration of risk in the design process. The focus of these efforts will be to develop the knowledge, procedures, and techniques to perform site characterizations that will produce the lowest cost transportation products possible on a system-wide basis. Specific objectives include:

- Quantify "hidden" conservatism or "bias" in measurements of design parameters relevant to foundations and earth slopes based on current practices and potential improvements to those practices
- Develop methods to establish site specific variability in design parameters for use in LRFD design specifications based on laboratory and field measurements

This specific portion of the work focuses on completing an extensive lab and field testing program to quantify variability and bias in relevant design parameters (e.g. shear strength and consolidation parameters) as a function of specific boring, sampling and testing techniques.

R242—Task 1
[Likos, W., PI - UMC, new in this reporting period]

The objective of Task 1 is to develop methods and procedures for characterizing design parameters relevant to bridge foundations and earth slopes in a probabilistic manner to allow appropriate consideration of risk in the design process. The focus of these efforts will be to develop the knowledge, procedures and techniques to perform site characterizations that will produce the lowest cost transportation products possible on a system-wide basis. Specific objectives include:

- Quantify "hidden" conservatism or "bias" in measurements of design parameters relevant to foundations and earth slopes based on current practices and potential improvements to those practices
- Develop methods to establish site specific variability in design parameters for use in LRFD design specifications based on laboratory and field measurements

This specific portion of the work focuses on completing an extensive lab and field testing program to quantify variability and bias in relevant design parameters (e.g. shear strength and consolidation parameters) as a function of specific boring, sampling, and testing techniques.

R241-R233—MTI/MoDOT Structural Collaborative Research Program
The objective of the Structural Collaborative Research Program is to effectively address Missouri Department of Transportation's (MoDOT) and the nation's needs in developing better, faster and cheaper solutions for transportation structures with superior long-term performance, innovative construction technologies and effective maintenance and preservation strategies. For MoDOT, emphases will be placed on critical needs, reducing costs of inspection, maintenance and repair, ensuring bridge safety and providing durable solutions.

This program is a collaborative effort of MoDOT and the University of Missouri (UM) Structures faculty with administrative oversight from Missouri Transportation Institute (MTI), which will span twenty-two months. The following nine research projects represent components of this comprehensive research program.

R241—Project 2c: Alternative and Cost-Effective Bridge Approach Slabs - UMKC
[Thiagarajan, G., PI - UMKC, new in this reporting period]

The objective of this project is to investigate the causes for any bumps at the end of a bridge approach slab and to develop remedial measures or alternative designs for a replacement.

It is clear that the problem of cracking and riding discomfort due to the "bump at the end of the bridge" stems largely from geotechnical considerations. In many instances compaction of soils under uncertain conditions when the bridge is being constructed may not be properly achieved. Provided that differential settlements cannot be entirely mitigated by geotechnical solutions, this study will be focused on cost-effective structural solutions for bridge approach slabs that will be ready for field implementation.

R240—Project 2c: Alternative and Cost-Effective Bridge Approach Slabs - UMC
[Gopalaratnam, V., PI - UMC, new in this reporting period]

The primary objective of this project is to investigate the causes for any bumps at the end of a bridge approach slab and to develop remedial measures or alternative designs for a replacement. This will be addressed with the following steps:

1. Evaluate and document the current condition of existing bridge approach slabs with data available and gather additional data from a field study. From this study, the primary issues associated with the performance of approach slabs will be identified.

2. Perform a best practice study of similar work done around the country and the practices adopted as a result of the study. Particularly review existing practices and innovations in Iowa, New Jersey and Louisiana DOTs.

3. Study the effect of a) span length variation, b) slab thickness variation and c) end condition variations in order to design a slab that could potentially withstand varying geotechnical conditions.

4. Study the feasibility of alternative solutions such as precast prestressed systems from both a design and construction cost perspective.

5. Provide final design specifications and acceptance criterion for the proposed bridge approach slab system.

R239—Project 2a: Reliability-Based Evaluation of Bridge Components for Consistent Safety Margins - UMC
[Orton, S., PI - UMC, new in this reporting period]

The objective of this project is to calibrate load and resistance factors to achieve a more uniform level of safety in bridge design. The calibration of the load and resistance factors will specifically consider Missouri environment. Load factors will be calibrated to achieve two goals: 1) the bridge components should have consistent safety margins, and 2) the bridge components designed with LRFD should be compatible with components designed with LFD which have performed well for the past years. Tasks include:

- To develop service load models and to establish service limit state criteria for Missouri conditions and environment based on past maintenance records
- To calibrate the LRFD Bridge Design Guidelines (MoDOT, 2007) and to identify over-conservatively designed bridge components for overall cost reduction
- To develop necessary revisions of MoDOT Standard Plans for Highway Construction for typical types of MoDOT bridges to reflect the LRFD design philosophy

R238—Project 1a: Structural Steel Coating for Corrosion Mitigation - UMC
[Washer, G., PI - UMC, new in this reporting period]

The objective of this project is to determine the most cost-effective coating system for structural steel bridges in Missouri by evaluating the past performance of coatings and testing the performance of new coatings.

Field evaluation of the existing coating systems in Missouri will be conducted to determine the past and current performance. The steel coating systems and procedures being utilized by other state DOTs will be evaluated with respect to current practices to identify areas to be examined for enhancing current practices and potential cost impacts. A consistent and quantitative method for characterizing the condition and performance of an in-place coating will be defined based on experiences in other states, standards and needs so that a systematic study of coating performance in Missouri can be undertaken. The field performance survey will document and correlate factors such as environment, location and extent of coating failure/corrosion, surface preparation procedures, etc.

R237—Project 2d: Calibration of Load and Resistance Factors in LRFD Foundation Design Specifications – Missouri S&T
[Chen, G., PI - Missouri S&T, new in this reporting period]

The objectives of this project include:

1) Develop a new design methodology for drilled shaft foundations to allow for limited displacements under gravity loads

2) Analyze representative highway bridges to understand the effect of foundation displacements on the design loads and strength requirements of the bridge superstructure

3) Calibrate the load and resistance factors in LRFD design specifications

Foundation is a critical part of a bridge system not only affecting the stability of the overall system, but also constituting a significant portion of bridge construction costs. Therefore, better calibrations for field tests are imperative. Foundation design calibrations warrant the consideration of a bridge system and thus require a close collaboration between geotechnical and structural engineering. Typical bridges will be analyzed to understand the demand (load factor) on drilled shaft foundations and the required strength (resistance factor) given a certain allowable displacement. Both load and resistance factors will be calibrated with the Missouri environment and traffic conditions using a reliability-based approach.

R236—Project 2b: Coated Steel Rebar for Enhanced Concrete-Steel Bond Strength and Corrosion Resistance – Missouri S&T
[Chen, G., PI - Missouri S&T, new in this reporting period]

The objective of this project is to optimize technology for construction of reinforced concrete (RC) structures for bridges, with the goal of reducing construction costs while improving structure performance. The conventional approach to improve the corrosion resistance of steel rebar is to apply a coating, like epoxy, that provides a physical barrier to the corroding environment. However, these coatings do not improve the bond strengths between the steel and the surrounding concrete environment. The chemically bonded reactive enamel coatings of this study increase bond strength while providing corrosion protection.

Approximately 90% of the bridges in the MoDOT inventory are RC structures. Construction and maintenance of RC bridges constitute a major portion of the up-front costs in the MoDOT bridge budget. Therefore, the development and utilization of new technologies that reduce the amount of steel needed for safe RC structures and that prolong the useful lifetimes of steel RC members, beam-column joints and column-footing connections could have a significant impact on MoDOT operations, especially as steel prices continue to increase. More importantly, using less reinforcement in joint and connection areas will alleviate the congestion of reinforcing bars and reduce the time-consuming construction process from rebar caging to concrete casting, ultimately improving the quality and structural safety of a constructed RC bridge. In order to reduce the RC bridge construction cost by 10%, innovative yet cost-effective reinforcing bars need to be developed to significantly increase concrete-steel bond strength and offer long-term corrosion resistance compared to conventional steel rebar.

R235—Project 2a: Reliability-Based Evaluation of Bridge Components for Consistent Safety Margins – Missouri S&T
[Kwon, O., PI - Missouri S&T, new in this reporting period]

The objective of this project is to calibrate load and resistance factors to achieve a more uniform level of safety in bridge design. The calibration of the load and resistance factors, specifically considering the Missouri environment, will lead to a reduction in the up-front cost of bridges. Load factors will be calibrated to achieve two goals: 1) the bridge components should have a consistent safety margin and 2) the bridge components designed with LRFD should be compatible with components designed with LFD, which have performed well in the past.

Task 1 of the project will include identification of service load in Missouri; identification of Service Limit State of existing bridges designed with Load Factor Design (LFD); and associated costs to maintain bridge performance. Extensive data for the past 20-30 years will be collected, including daily traffic, bridge maintenance records and relevant costs. The collected data will be organized in an efficient and extensible database, which can be used in Task 2 and 3 as well as for a future study. Service Limit State will be determined based on past performance of bridges. In Task 2, reliability of bridge components designed with LRFD will be analytically evaluated. Load models and Service Limit States from Task 1 will be used in the reliability analysis. Task 3 will result in revised load factors for LRFD Guidelines will be suggested. In addition, necessary changes in the current MoDOT Standard Plans for Highway Construction will be identified and made in consultation with MoDOT bridge engineers. The revised Standard Plans will guide private consultants and MoDOT engineers for new bridge designs that are consistent with the LRFD Bridge Design Manual.

R234—Project 1b: Spalling Solution of Precast–Prestressed Bridge Deck Panels
[Belarbi, A., PI - Missouri S&T, new in this reporting period]

The objective of this project is to investigate the cause for spalling in precast-prestressed panels and cost-effective mitigation solutions for existing bridge decks, as well as to review improved design options for new construction. Alternative solutions will be proposed and evaluated. This will include fundamental laboratory studies to evaluate and validate the proposed design. It will also include the development of procedures for the design of prototype bridge deck panels that are corrosion-free to eliminate the spalling problem. Field implementation and performance monitoring of the bridge deck panel on new construction and/or replacement of existing bridge decks will constitute Phase II of the project.

It was recently observed that some bridges in the MoDOT inventory have experienced rusting of embedded steel reinforcement and concrete spalling issues in deck panels. The plausible reasons for the spalling observed in many bridges currently in service likely include corrosion of the steel in the panels due to use of deicing salts, permeability/cracking in the panels and inadequate concrete cover. Corrosion of steel reinforcement can be detrimental as it can result in shorter life spans for the deck panels.

R233—Project 1a: Structural Steel Coatings for Corrosion Mitigation – Missouri S&T
[Myers, J., PI - Missouri S&T, new in this reporting period]

The objective of this project is to utilize collected data to identify and test an improved system(s) for coating structures in the field. The tasks will consider a broad range of available coating types and result in recommendations that provide low cost, low risk of failure systems for most common scenarios.

Significant maintenance costs are extended nationwide each year for coating structural steel bridge elements in an effort to protect them from corrosion and deterioration. Coating of structural steel presents a significant, costly maintenance challenge that is critical to mitigating the detrimental effects of corrosion thereby extending the service life of bridges and reducing operational costs. The field performance of coating can be inconsistent, being affected by the quality and method of surface preparation, the environment surrounding the bridge, presence of chlorides and corrosion products, the type of coating utilized and other factors. The goal of this study is to identify the most cost effective coating for protecting structural steel from corrosion, with consideration of factors such as ease of installation, long-term performance and costs.

R232—Developing Raman Spectroscopy for the Nondestructive Testing of Composite Materials
[Washer, G., PI - UMC, new in this reporting period]

The objective of this project is to develop new nondestructive evaluation technologies for the inspection of composite materials. This project will research and develop the application of Raman Spectroscopy as a nondestructive evaluation tool for the condition assessment of carbon fiber composites.

Composite materials are increasingly being used in engineered structures and components, ranging from highway bridges to airframes and pressure vessels. These materials have a high strength to mass ratio, making them ideal for inclusion in space vehicles, hydrogen cars and aircraft. To assess the condition of these materials in-situ, such that components and systems can be managed and repaired during service life, is a current critical need.

To date, NDE technologies developed for the inspection of composite materials have focused on mechanical damage scenarios, such as impact and fatigue. There is growing concern that environmental degradation of these materials leads to reduced strength during their service lives, and presently there are no NDE technologies capable of characterizing the degradation of composite materials in-situ.

Raman spectroscopy is a laser technique that is sensitive to molecular interactions in ordered materials such as graphite and carbon fibers. For carbon materials, the technique has been shown to be sensitive to applied elastic stresses and structural order on a molecular level. Traditionally a laboratory technique, new instrumentation implementing fiber-optic probes has extended the potential for this technology beyond the laboratory. There is potential for implementation as a hand-held device for the inspection of engineering components and structures, including bridges and hydrogen vehicles.

Research Equipment Projects

RE252—Acquisition of Equipment for Composite Manufacturing Laboratory
[Chandrashekhara, K., PI – Missouri S&T, new in this reporting period]

The objective of this project is to acquire a Metering Unit for Pultrusion Process and Fixtures for Composite Testing to upgrade the Composite Manufacturing and Testing Facilities at Missouri S&T.

An interdisciplinary team of faculty has been formed to complete the upgrade to the Composite Manufacturing and Testing Facilities. The Metering Unit will be useful in manufacturing composite pultruded parts using a two-part polyurethane resin system. The current pultrusion manufacturing facility is restricted to only epoxy, polyester and vinyl ester resin systems. The Metering Unit will enable faculty and students at Missouri S&T to manufacture composite parts using a polyurethane resin system. Composite test fixtures are required to conduct specialized tests such as Compression After Impact, Open Hole Compression and Interlaminar Shear.

Education and Technology Transfer Projects

ETT251—Women in Science & Engineering and Minority Engineering Scholarships: Year 4

[Elmore, C., PI - Missouri S&T, new in this reporting period]

The objective of this project is to make scholarships available to minority and women students interested in engineering and science in order to significantly increase the number of minority and female students recruited to Missouri S&T science and engineering programs. Recipients of scholarships will also be exposed to career opportunities in transportation.

Women in Science and Engineering (WISE) scholarships are awarded to support female Missouri S&T students studying science and engineering. Missouri S&T's WISE program provides a campus focal point for increasing the number of women in science, engineering, math and technology fields through outreach, recruitment and retention efforts from middle school age through undergraduate levels. WISE provides support programs such as mentoring, advising, professional/technical workshops and social activities, with the goal of providing a rich academic and social experience for young women at Missouri S&T.

Minority Engineering and Science Program (MEP) scholarships provide critical financial support for under-represented students majoring in engineering and science programs at Missouri S&T. MEP scholarship students receive professional and academic support through the close-knit MEP network of friends, mentors and Missouri S&T staff. MEP has a rich 30-year tradition of sponsoring events, activities and organizations that ensure its students are prepared for personal and professional success.

ETT249—2009 Summer Transportation Institute

[Pickerill, H., PI - Missouri S&T, new in this reporting period]

The purpose of the Summer Transportation Institute (STI) is to provide an educational experience which explores all aspects of the transportation industry and its role in our society for rising 11th and 12th grade high school students. The overarching goals of the program are to increase the number of youths entering the transportation profession and to aid the University in its recruiting efforts by providing students a healthy dose of campus life.

Missouri LTAP at Missouri S&T has successfully hosted a U.S. Department of Transportation STI for the past several years. STI is a 2-week intensive learning experience held during the summer for high school students, primarily targeted toward, but not limited to, minorities. STI has two main goals: 1) to expose secondary school students to and allow them to participate in a series of academic and practical experiences designed to motivate them toward professions in the transportation industry, and 2) to provide secondary school students with mathematics, science and technological enrichment to enable them to pursue a career in the transportation industry.

ETT248—2009 Missouri Local Technical Assistance Program (LTAP) at Missouri S&T

[Pickerill, H., PI - Missouri S&T, new in this reporting period]

The objective of this project is to manage the Missouri LTAP program for the Missouri Department of Transportation (MoDOT). The LTAP program was established by the Federal

Highway Administration (FHWA) in 1982 and operates in each state to provide community leadership through advocacy and implementation of education and training.

The Missouri LTAP program will provide a resource center and technology transfer activities for local officials, counties, parishes, townships, cities and towns throughout the state of Missouri in the form of: workforce development services; resources to enhance safety and security; solutions to environmental concerns, congestion, capacity and other issues; technical publications; and training materials and videos.

SUCCESS STORIES

This section lists a sampling of "success stories" for Year III, including notable Center events; NUTC News articles of interest; faculty and student awards; and media articles about the Center, faculty or campus. Articles, awards and events with corresponding clips are available in the Appendix.

Featured Articles in the NUTC News

- "Hit the Ground Running." Volume 3, Issue 4.
- "Missouri's First Hydrogen Fueling Station is Now Open." Volume 4, Issue 1.
- "MTI/MoDOT Geotechnical Transportation Research Program." Volume 4, Issue 2.
- "MTI/MoDOT Structural Collaborative Research Program." Volume 4, Issue 2.
- "Fall 2008 ACI Convention in St. Louis, Missouri." Volume 4, Issue 2.
- "Green Highway Construction: Lowering Costs and Dependence on Crude Oil with Plant-Based Materials." Volume 4, Issue 3.

Awards

- Michael Murphy, a civil, architectural and environmental engineering Ph.D. student, was named Missouri S&T's 2008 UTC Outstanding Student of the Year.
- Missouri S&T's student team in the Big Beam Competition placed first in the Precast/Prestressed Concrete Institute's Region 3 competition.
- Dr. Shamsher Prakash, professor emeritus of civil, architectural and environmental engineering, received the Distinguished Alumnus Award from the Indian Institute of Technology, Roorkee.
- Dr. Fatih Dogan, professor of materials science and engineering, received a 2008 Faculty Excellence Award from Missouri S&T.
- Dr. Scott Grasman, associate professor of engineering management and systems engineering, received a 2008 Faculty Excellence Award from Missouri S&T.
- Dr. Ronaldo Luna, associate professor of civil, architectural and environmental engineering, received a 2008 Faculty Excellence Award and a 2009 Outstanding Academic Advising Award from Missouri S&T.

- Dr. John Myers, associate professor of civil, architectural and environmental engineering, received a 2008 Faculty Excellence Award and a 2008 Global Teaching Award from Missouri S&T.

- Dr. Glenn Washer, assistant professor of civil and environmental engineering at University of Missouri – Columbia, was a Research Poster Award Winner at the Union of Turkish Engineers and Architects (UCTEA) and the Chamber of Chemical Engineers in Izmir, Turkey.

- Frank Blum Jr., a civil and environmental engineering master's degree student at University of Missouri – Columbia, took top honors in a research poster contest held by the Union of Turkish Engineers and Architects (UCTEA) and the Chamber of Chemical Engineers in Izmir, Turkey.

Missouri S&T in the News

External Media Sources

- "Hydrogen-powered shuttle service coming to post." Guidon. July 31, 2008.

- "S&T grads get top pay, survey shows." Rolla Daily News. August 11, 2008.

- "S&T grad to blog from space." Rolla Daily News. November 12, 2008.

- "EcoCar: The Next Challenge is a MUST for Missouri S&T." EcoFriendly Magazine. November 14, 2008.

- "Fox Files: Earth Become Liquid During Earthquakes." Fox News. November 26, 2008.

- "Bond Secures Funds to Help Create Clean Transit Vehicles & Jobs: Funds Will Support Partnership between Missouri S&T, Kokam America & Kansas City." Kit Bond U.S. Senate website. December 10, 2008.

- "Structure Damage Sensors Are Now a Reality: The new class of devices was recently patented." SoftpediaSciFy. January 6, 2009.

- "Pair will hit TV with a bang." Rolla Daily News. January 21, 2009.

- "Missouri: The Show-Me Energy State." St. Louis Business Journal. April 10, 2009.

- "Glass-reinforced steel." The Engineer Online. May 21, 2009.

Internal Media Sources

- "Fixing America's bridges." Missouri S&T Visions. July 28, 2008.

- “Researchers look for realistic ways to bring hydrogen technology home.” Missouri S&T Public Relations. August 21, 2008.

- “Researchers help build ‘Internet for energy’ through NSF center.” Missouri S&T Public Relations. September 4, 2008.

- “Students to re-engineer GM car with fuel cell powertrain.” Missouri S&T Public Relations. January 26, 2009.

- “Engineers Without Borders to leave S&T on May 17.” Missouri S&T Public Relations. May 13, 2009.

- “Researchers partner to curtail explosives’ effects.” Missouri S&T Public Relations. May 16, 2009.

- “Coating developed at S&T could strengthen nation’s infrastructure and create jobs in Rolla.” Missouri S&T Public Relations. May 20, 2009.

- “Missouri S&T selected to help support nation’s new energy goals.” Missouri S&T Public Relations. May 21, 2009.

- “S&T’s Scholars’ Mine garners more than 200,000 downloads.” Missouri S&T Public Relations. May 22, 2009.

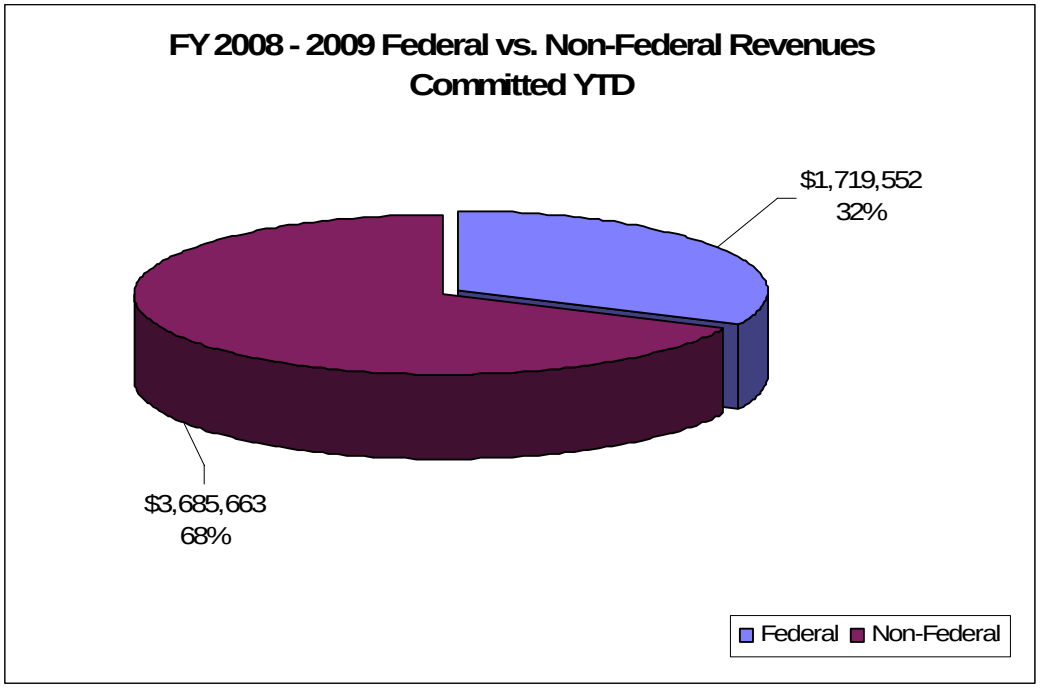
- “Lee to be keynote speaker at Korean conference.” Missouri S&T Public Relations. June 9, 2009.

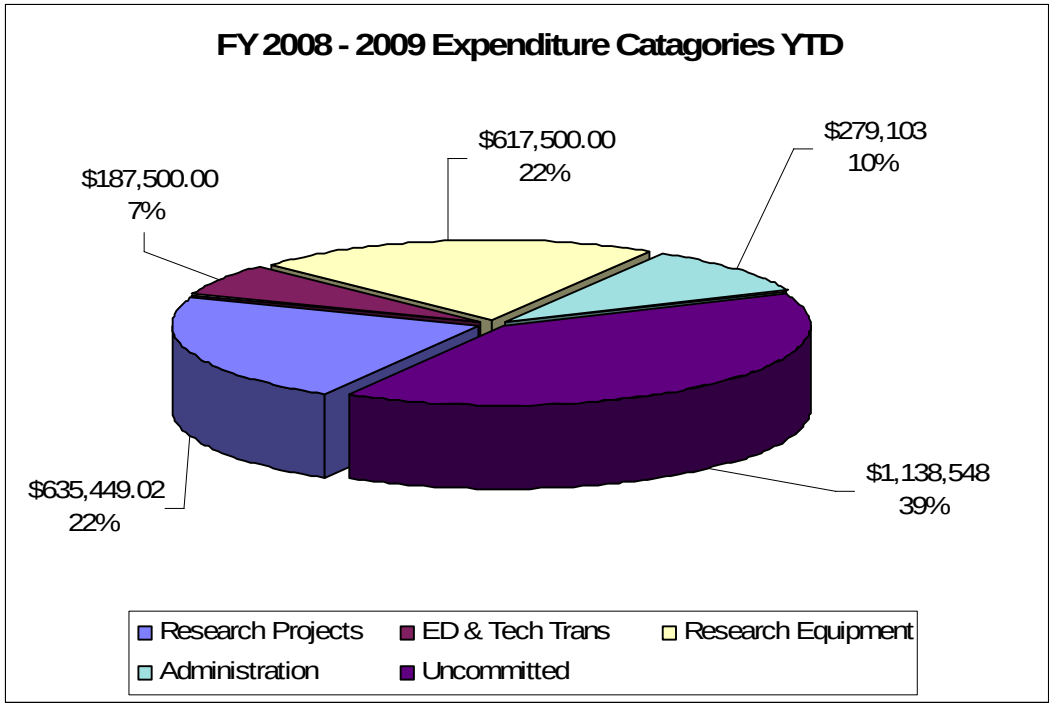
FUNDING SOURCES AND EXPENDITURES

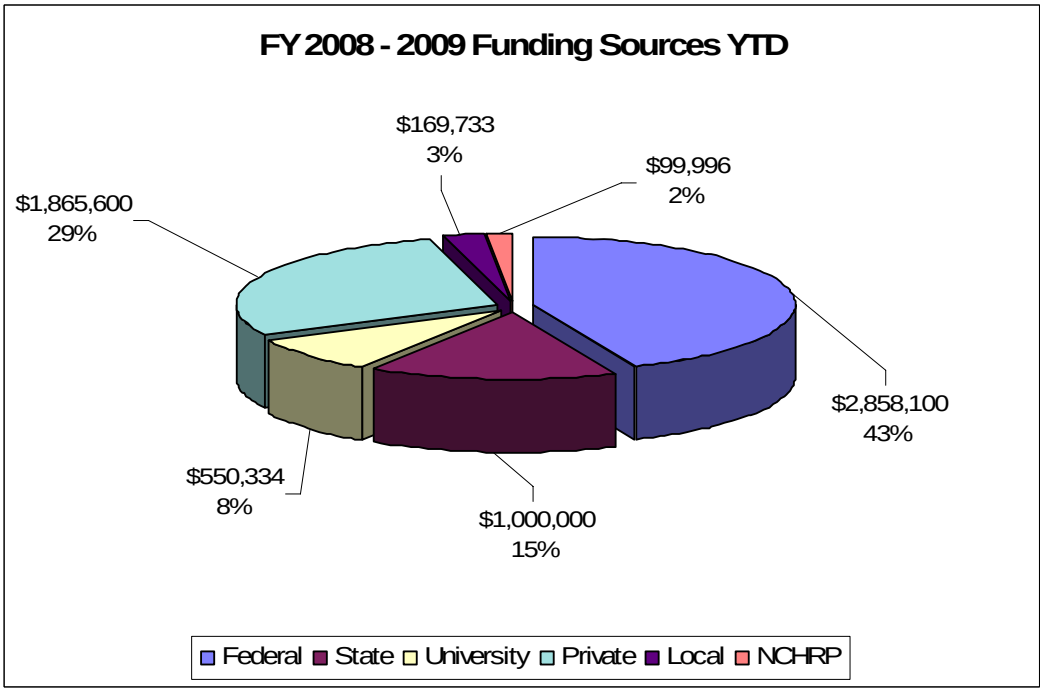
This section provides information on Funding Sources and Expenditures for Year II and Year III. Because funding for Year II and Year III was received within a single fiscal year, some Year II funds were not awarded until the third fiscal year. Therefore, information for Year III is shown here, followed by updated information for Year II.

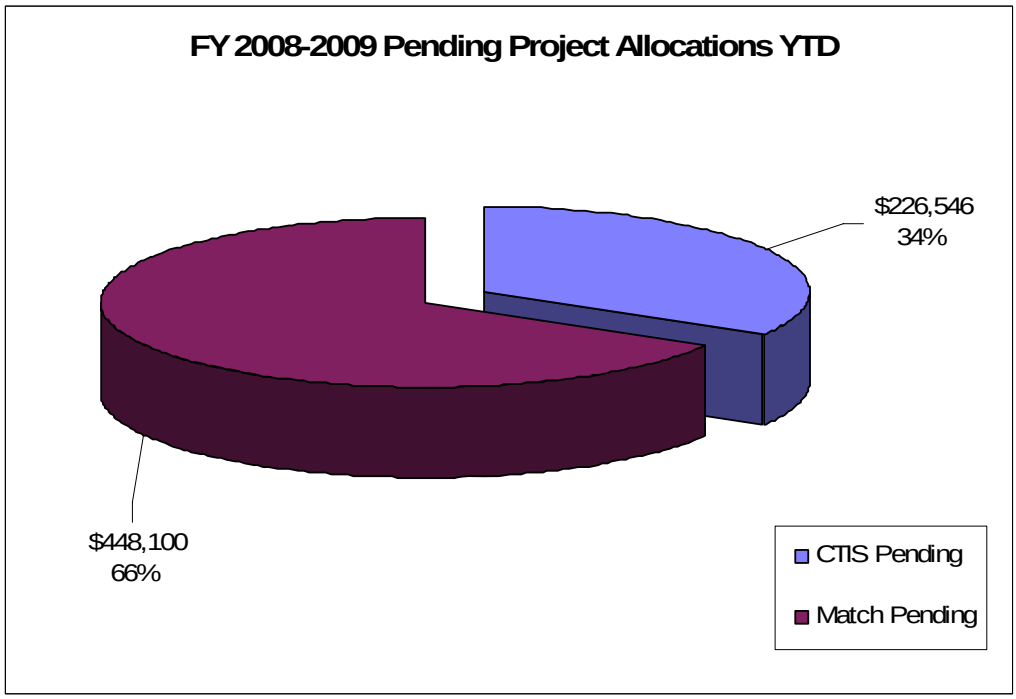
Year III: July 1, 2008 – June 30, 2009

The following funding charts and tables show committed revenues; expenditure categories; match funding sources; pending project allocations; and funding sources and expenditures for projects awarded with Year III funds during the third fiscal year.




FY 2008 - 2009 Expenditure Catagories YTD
$617,500.00
22%
$279,103
10%
$187,500.00
7%
$635,449.02
22%
$1,138,548
39%
Research Projects
ED & Tech Trans
Research Equipment
Administration
Uncommitted


FY 2008 - 2009 Funding Sources YTD
$169,733
3%
$99,996
2%
$1,865,600
29%
$2,858,100
43%
$550,334
8%
$1,000,000
15%
Federal
State
University
Private
Local
NCHRP



Funding Sources and Expenditures

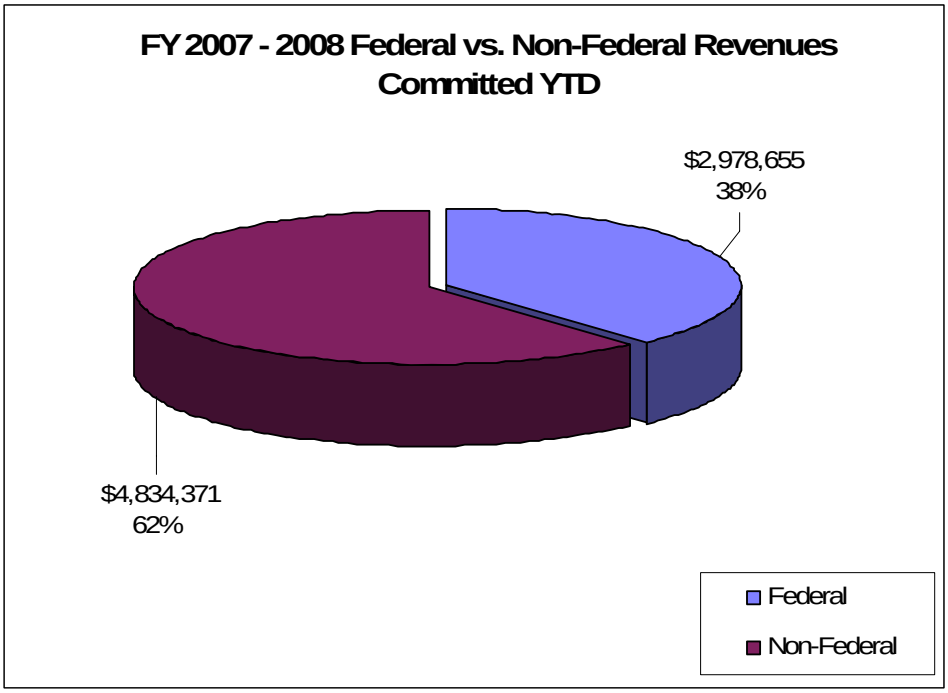
Amounts and Sources of Funding: July 1, 2008–June 30, 2009

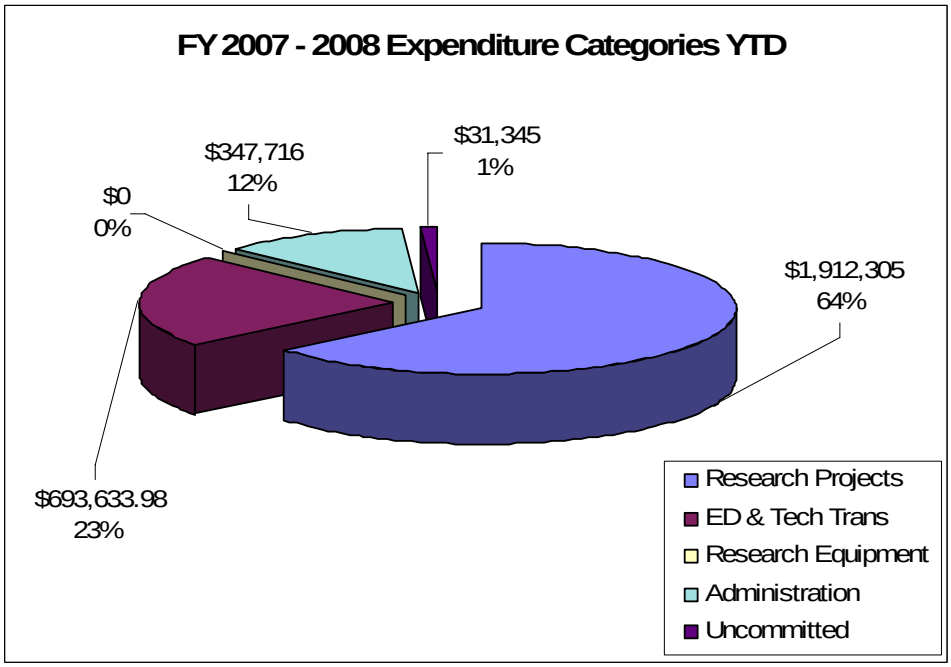
Seq. No.	Non-Federal * Source	Amount	NUTC	Total
R242	MoDOT / UMC CE	151,296	35,965	$ 187,261
R243	MoDOT / Missouri S&T CE	141,116	97,406	$ 238,522
R244	MoDOT / Missouri S&T CE	64,472	55,928	$ 120,400
R245	MoDOT / UMC CE	99,047	50,863	$ 149,910
R246	MoDOT / Missouri S&T CE	132,890	91,620	$ 224,510
R247	MoDOT / UMC CE	915,596	43,218	$ 958,814
R250	City of Rolla	169,733	165,000	$ 334,733
ETT251	Industry	375,000	187,500	$ 562,500
RE252	Spirit Aerosystems	25,000	12,500	$ 37,500
R253	NCHRP/MAPA/MS&T CE	190,910	95,449	$ 286,359
R254	Industry	1,420,600	605,000	$ 2,025,600
Facilities & Admin. Indirect Costs			279,103	$ 279,103
TOTAL		**3,685,660**	**1,719,552**	**5,405,212**

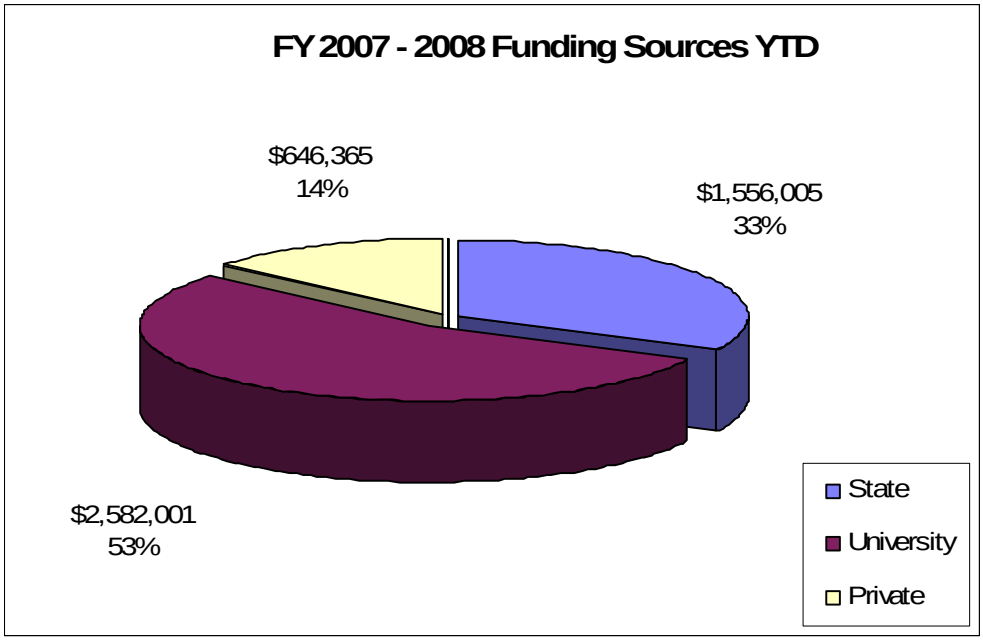
Legend:
MODOT= Missouri Department of Transportation
UMC-CE= University of Missouri-Columbia-Civil Engineering
MS&T-CE= Missouri University of Science and Technology-Civil Engineering

Year II: July 1, 2007 – June 30, 2008

The following funding charts and tables show committed revenues; expenditure categories; match funding sources; and funding sources and expenditures for projects awarded with Year II funds. Previously non-committed funds reported at the end of Year II were awarded during the third fiscal year, necessitating updated funding information for the second fiscal year.






FY 2007 - 2008 Funding Sources YTD
$646,365
14%
$1,556,005
33%
$2,582,001
53%
State
University
Private

Funding Sources and Expenditures

Amounts and Sources of Funding: July 1, 2007–June 30, 2008

Seq. No.	Non-Federal * Source	Amount	UTC	Total
ETT216	Industry	$ 414,750	$ 187,500	$ 602,250
R219	MoDOT	$ 59,997	$ 34,161	$ 94,158
ETT220	MoDOT	$ 211,885	$ 211,885	$ 423,770
R221	SCI Engineering	$ 23,431	$ 11,715	$ 35,146
R222	HNTB Corp.	$ 10,387	$ 5,116	$ 15,503
R223	Lake Sherwood Estates	$ 4,500	$ 2,250	$ 6,750
ETT224	MS&T-VPR	$ 26,102	$ 26,102	$ 52,204
R225	MS&T Departments	$ 1,800,000	$ 900,000	$ 2,700,000
ETT226	Industry	$ 77,125	$ 20,769	$ 97,894
R227	Egyptian Concrete	$ 26,172	$ 14,087	$ 40,259
R228	Ameren	$ 25,000	$ 12,500	$ 37,500
ETT229	MoDOT	$ 35,358	$ 17,679	$ 53,037
R230	NYSERDA	$ 50,000	$ 50,000	$ 100,000
R231	MS&T Departments	$ 500,000	$ 250,000	$ 750,000
R232	ASNT	$ 15,000	$ 7,475	$ 22,475
R233	MoDOT	$ 121,555	$ 75,972	$ 197,527
R234	MoDOT Missouri S&T	$ 194,612	$ 121,633	$ 316,245
R235	MoDOT	$ 78,192	$ 48,870	$ 127,062
R236	MoDOT	$ 363,590	$ 152,981	$ 516,571
R237	MoDOT	$ 76,923	$ 48,077	$ 125,000
R238	MoDOT	$ 80,033	$ 37,750	$ 117,783
R239	MoDOT	$ 105,385	$ 50,178	$ 155,563
R240	MoDOT	$ 111,382	$ 53,928	$ 165,310
R241	MoDOT	$ 124,225	$ 35,612	$ 159,837
ETT248	MoDOT	$ 218,261	$ 218,261	$ 436,522
ETT249	MoDOT	$ 30,505	$ 11,438	$ 41,943
R255	USB	$ 50,000	$ 25,000	$ 75,000
				$ -
	Facilities & Admin. Indirect Costs		$ 347,716	$ 347,716
	TOTAL	**4,834,371**	**2,978,655**	**7,813,026**

Legend:
MODOT= Missouri Department of Transportation
MS&T-VPR= Missouri University of Science and Technology-Vice Provost of Research
NYSERDA= New York State Energy Research and Development Authority
USB=United Soybead Board

APPENDIX: SUCCESS STORIES CLIPS

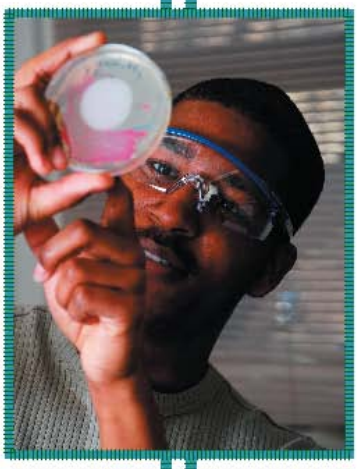
Featured Articles in the NUTC News

HIT THE GROUND RUNNING

With support from CTIS, Student Diversity and Academic Support Programs (SDP) at the Missouri University of Science & Technology (Missouri S&T) has been able to offer Minority Engineering & Science Scholarships (MEP) to academically talented students from ethnic populations that are historically under-represented in Higher Education, particularly in the areas of math, engineering, science or technology degree programs.

"HGR WILL IMPROVE YOUR GRADES!"

For selected Freshman scholarship recipients, Missouri S&T college life started with the Hit the Ground Running Program (HGR) July 6-26, 2008. HGR is a three-week summer learning program offering new students an exciting perspective on learning and an opportunity to sharpen and enhance academic skills. During the HGR Program, students lived in a residence hall and took the following courses for academic credit: Introduction to University Writing, Introduction to University Chemistry, and Introduction to University Mathematics.



In addition to the course-work, students participated in a number of social gatherings, tours, field trips and academic and leadership development activities, including student team development, the utilization of academic resources, mentor groups and student involvement in campus life and the Rolla community.

"HGR PROVIDED INSIGHT ON REAL EXPECTATIONS."

By participating in the HGR program, students were given a head-start in developing a social network and constructive strategies for succeeding academically at Missouri S&T, all while acquiring an excellent base of knowledge and course-work experience from which to build on throughout their academic careers. By interacting with faculty and graduate assistants, students became familiar with academic expectations and resources available to them so that when the Fall semester opens in a couple of weeks, these students will indeed be able to hit the ground running.

"THE PROGRAM PROVIDED A GREAT INTRODUCTION TO TIME MANAGEMENT."

For more information about Hit the Ground Running at Missouri S&T and/or other Student Diversity and Academic Support Programs, visit http://sdp.mst.edu.

Photos by B.A. Rupert

Missouri's First Hydrogen Fueling Station is Now Open

A ribbon-cutting ceremony for the highly anticipated E³ (E-cubed) Commons at Missouri University of Science & Technology (Missouri S&T) was held on Tuesday, August 19, 2008. E³ Commons is the home to Missouri's first Hydrogen fueling

station and was the 26th of 33 stops in 19 states (Maine to California) for the Hydrogen Road Tour.

The Hydrogen Road Tour, sponsored by the U.S. Department of Transportation (U.S. DOT), the California Fuel Cell Partnership and the National Hydrogen Association, stopped at the Missouri S&T campus to refuel and to allow ceremony guests a chance to either ride in or test drive one of the hydrogen vehicles on tour.

Paul Brubaker, Administrator of the U.S. DOT's Research and Innovative Technology Administration (RITA) was in Rolla for the ceremony. "Please go home and email 10 people about what you saw here today," he said, "We are taking the research out of the labs, and bringing it to the streets for the American people."

Missouri S&T's leadership in raising public awareness of Hydrogen as a viable transition-state fuel and in the development of needed infrastructure has been recognized on national, state and local levels.

In a proclamation issued by Missouri Governor Matt Blunt declaring October 2008 as Energy Month, Missouri S&T was named "a leader in the research and development of alternative fuel for vehicles, helping to increase the energy independence of the United States." Governor Blunt further encouraged his support with a stop at E³ Commons on October 1, 2008.

E³ Commons is the name given for the site of several planned renewable energy, environmental and educational initiatives sponsored by Missouri S&T in collaboration with many governmental and industry partners. The university uses the equation "E³ = C" as shorthand for the slogan "energy, environment and education equals civilization."

In addition to being a Hydrogen Fueling station, E³ Commons is also the future home of the Renewable Energy Transit Depot, a new "green-building" fabricated from four recycled shipping

Photos, top down: RITA Administrator Paul Brubaker; H2 vehicles; Gov. Blunt with Missouri S&T students

containers, the EcoCAR student design team, architectural wind turbines and a solar photovoltaic canopy.

Visit http://ecocarchallenge.mst.edu to learn more about E³ Commons activities.

MTI/MoDOT Geotechnical Transportation Research Program

The objective of the Geotechnical Transportation Research program is to achieve significant and recurring cost savings for MoDOT (Missouri Department of Transportation) by developing improved, technically sound design specifications. The new specifications will be based on LRFD concepts which produce consistent and appropriate performance/risk for the local conditions and consequences involved.

This will lead to substantial cost savings by avoiding excessive conservatism in cases where it is not warranted and avoiding excessive maintenance and rehabilitation costs in cases where performance is unacceptable. The execution and completion of this program will address many of MoDOT's most pressing research needs while making notable improvments to the state of the art and practice of geotechnical engineering at a national and international level.

Principal Tasks

To adequately address the primary sources of risk for foundations and earth slopes, MoDOT leadership and University of Missouri System (UM) Geotechnical faculty have identified the following tasks:

1. Site Characterization for Lowest Cost Transportation Products
2. Bridge Foundation Design Assessment
3. Establishing Acceptable Risk
4. Producing New LRFD Design Specifications

Program Management

The Geotechnical Research Team will be coordinated by MU and geographically distributed with team members from Missouri S&T and UMKC.

Team members include: Dr. John Bowders, MU; Dr. Louis Ge, Missouri S&T; Dr. Bill Likos, MU; Dr. Erik Loehr, MU; Dr. Ronaldo Luna, Missouri S&T; Dr. Norbert Maerz, Missouri S&T; Dr. Brent Rosenblad, MU; Dr. Rick Stephenson, Missouri S&T.

Anticipated Program Deliverables

The principal deliverables for the 2008-2010 geotechnical research program will include:

- An improved LRFD specification for design of bridge foundations
- New LRFD specifications for design of earth slopes and embankments
- Three "commentary" documents providing important supporting documentation for each LRFD specification

To learn more about the scope of work and objectives for individual projects and the researchers involved, visit http://utc.mst.edu/research/2008.html.

MTI/MoDOT Structural Collaborative Research Program

Missouri Department of Transportation (MoDOT), with administrative oversight from Missouri Transportation Institute (MTI), has collaborated with University of Missouri (UM) Structures faculty to cooperatively conduct research on transportation structures over twenty-two months with a program of six projects.

The two theme areas effectively address MoDOT's and the nation's needs in developing better, faster, and cheaper solutions for transportation structures with superior long-term performance, innovative construction technologies, and effective maintenance and preservation strategies. For MoDOT, emphases will be placed on critical needs, reducing costs of inspection, maintenance and repair, ensuring bridge safety and providing durable solutions.

Theme Areas

With consideration to the collective expertise of the participating faculty, structures faculty from Missouri University of Science and Technology (Missouri S&T), University of Missouri – Columbia (MU), University of Missouri – Kansas City (UMKC) and MoDOT engineers identified the following two theme areas:

1. Extending service life of MoDOT's existing bridges
2. Optimizing MoDOT's bridge design and construction for effective cost reduction

Program Management

The Structures Research Team will be coordinated by Missouri S&T and geographically distributed with team members from MU and UMKC.

Team members include: Dr. Abdeldjelil "DJ" Belarbi, Missouri S&T; Dr. Richard Brow, Missouri S&T; Dr. Genda Chen, Missouri S&T; Dr. Vellore S. Gopalaratnam, MU; Dr. Oh-Sung Kwon, Missouri S&T; Dr. John Myers, Missouri S&T; Dr. Sarah Orton, MU; Dr. Hani Salim, MU; Dr. Lesley Sneed, Missouri S&T; Dr. Ganesh Thiagarajan, UMKC; Dr. Jeffrey Volz, Missouri S&T; Dr. Glenn Washer, MU.

Anticipated Program Deliverables

The primary deliverables for the 2008-2010 structures research program will include the following:

- Cost-effective solutions to structural steel corrosion and precast-pretensioned deck spalling with documented performance data based on laboratory and/or field tests
- Cost-effective modular bridge approach slabs for rapid construction
- Recommended material specifications and test procedures for new materials that can ultimately lead to a significant reduction in up front cost of new bridge constructions
- Recommended design specifications for adoption by MoDOT with supporting documentation and justification as well as suggestions for periodic evaluation and update

To learn more about the scope of work and objectives for individual projects and the researchers involved, visit http://utc.mst.edu/research/2007.html.

Fall 2008 ACI Convention in St. Louis, Missouri

Missouri S&T UTC students and faculty past and present came together November 2-6, 2008 in St. Louis, Missouri at the Renaissance Grand & Suites Hotel for the Fall 2008 American Concrete Institute Convention, themed "The Spirit of Concrete."

CTIS-NUTC students Kurt Bloch and Youske Tanizawa at the CTIS exhibitor booth.

The Fall 2008 ACI Convention not only provided an opportunity for current and former students and faculty of Missouri S&T to reconnect, but a forum for engineers, architects, contractors, educators, manufacturers and material representatives from all over the world a chance to network, exchange expertise, learn about new advances in the field and to give input on concrete industry codes, specifications and guides. The ACI Convention attendees are some of the most well-informed individuals in the concrete industry.

Since the first convention held in 1905, each ACI convention has been dedicated to improving the design, construction, maintenance and repair of concrete structures by offering over 300 committee meetings, 35+ technical and educational sessions, a number of social events and a large group of exhibitors, including the Center for Transportation Infrastructure and Safety.

Some of the technical tours and special events offered at the Fall 2008 ACI Convention included an Architectural Walking Tour, a Concrete Structures of St. Louis Bus Tour and a Concrete Mixer social event. Some of the technical and educational sessions offered included: The Spirit of Structural Concrete in Performance-Based Seismic Design of Bridges; Advances in Fiber-Reinforced Concrete; Emerging Technologies in Civil Infrastructures Applications; Concrete Bridge Design for Extreme Events and Concrete Bridges along the Mississippi River.

CTIS-NUTC students, faculty and alumni dinner.

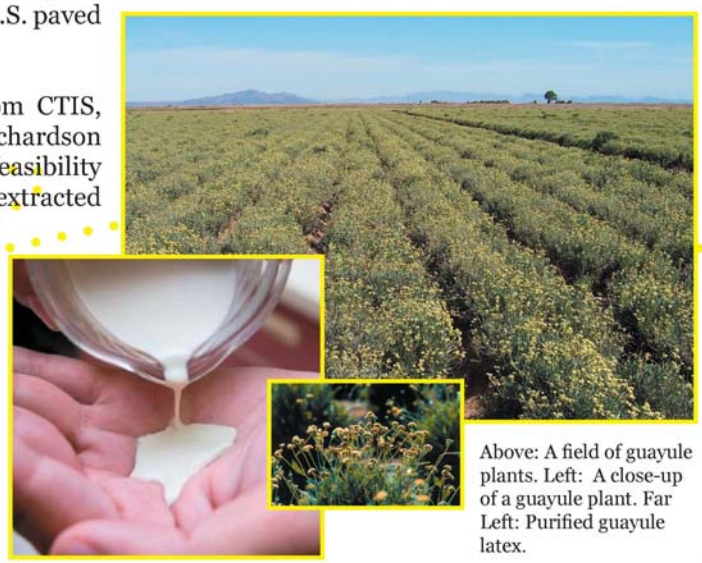
Upcoming ACI conventions include the Spring 2009 Convention in San Antonio, Texas and the Fall 2009 Convention in New Orleans, Louisiana. For more information, visit http://www.concrete.org.

Green Highway Construction

Lowering Costs and Dependence on Crude Oil with Plant-Based Materials

Due to the rising price of crude oil, flexible pavement costs have significantly increased. Flexible pavement is implemented by layering several types of materials, including petroleum-based materials, so that the total pavement structure can flex under loading. Each layer receives and distributes loads from above before passing the load to the layer below. Flexible pavements comprise about 93 percent of U.S. paved roads.

With support from CTIS, Dr. David Richardson will determine the feasibility of using materials extracted from the guayule plant in the design and production of flexible pavement mixtures. A flexible pavement mixture produced with little to no virgin petroleum-based materials will be created and a thorough experimental program to assess the limits of the use of guayule rubber and resin will be undertaken.



Above: A field of guayule plants. Left: A close-up of a guayule plant. Far Left: Purified guayule latex.

The guayule (pronounced 'why-YOU-lee') plant grows in the arid and semi-arid regions of the southwestern U.S. and Mexico and is a source of natural rubber. Currently, guayule is processed primarily for the manufacture of hypo-allergenic latex products like medical gloves and personal hygiene products. Depending on the process used, many materials can be extracted from guayule. However, there are three basic products commonly extracted: rubber, resin and bagasse.

The guayule rubber and resin, which are natural biopolymers, could prove to be a source of renewable and environmentally friendly binder materials for flexible pavement mixtures. Limited preliminary testing showed that the resin could potentially be used as a recycling agent, or viscosity modifier, when designing flexible pavement mixtures with a high percentage of reclaimed asphalt pavement (RAP), a small percentage of processed roofing shingles and some virgin aggregate.

Using guayule rubber and resin in flexible pavement mixtures could potentially result in eventual lower costs for highway construction, though until demand and technology increase, guayule-based materials may not initially be an economically attractive alternative. However, implementing guayule materials in highway construction would be a boost to the guayule processing industry, which could benefit from the opening of another market for its products, and would decrease dependence on foreign oil, thereby enhancing national security.

The possibility that guayule-based materials could perform better than petroleum-based materials in flexible pavement mixtures is an exciting prospect. Based on a search of current literature, the use of guayule products in this context seems to be a new concept. The prospect of developing a new and better product makes this research both exciting and important.

Awards

Michael S. Murphy
2008 Outstanding Missouri S&T UTC Student of the Year

Michael S. Murphy has been named Outstanding Missouri S&T UTC Student of the Year. The award was made based on his excellent academic performance, the technical merit of his research topic and his service to both Missouri S&T and the surrounding community.

Murphy earned a B.S. degree in Civil Engineering with Summa Cum Laude honors from the Missouri University of Science and Technology (formerly University of Missouri-Rolla) in December 2006. During his undergraduate career, Murphy was a member of the Missouri S&T chapters of American Society of Civil Engineers (ASCE), Chi Epsilon National Civil Engineering Honor Society and the Missouri S&T Concrete Canoe Team. He served as both Secretary and Treasurer for Associated General Contractors of America (AGC) and Secretary of the American Concrete Institute (ACI).

As a graduate student, Murphy was involved with the Missouri S&T PCI Big Beam Competition Team, helping the team secure a 2nd place regional finish. The contest involved designing, fabricating and testing a prestressed beam that needed to carry a load between 16 and 19 tons.

Civil Engineering appealed to Murphy's interests in both design and problem solving; he chose Missouri S&T because of "a great reputation for producing quality engineers." Of the chance to work on Fiber Reinforced Polymer (FRP) strengthening of concrete bridges, he says: "I saw it as an exciting opportunity to study a relatively new material...[and] to get involved in full-scale testing of concrete beams."

Murphy has been advised by Dr. Abdeldjelil Belarbi during his graduate career and received financial support from Graduate Assistance in Areas of National Needs (GAANN). He has studied and made technical contributions to the understanding of FRP applications for shear strengthening of concrete bridge girders, including: experimental testing of full scale reinforced concrete and prestressed concrete bridge girders strengthened in shear with FRP. In his research work, which is sponsored by TRB and the CTIS-NUTC, he has been responsible for writing several progress and quarterly reports.

Murphy anticipates graduating from Missouri S&T with his M.S. and Ph.D. degrees in Civil Engineering in December 2010 and plans to work in industry as a structural engineer.

S&T's Big Beam Team takes first place in region

December 5, 2008 2:09 PM | Permalink | Comments (0) | SHARE

A team of Missouri University of Science and Technology students recently placed first in Region 3 of the Precast/Prestressed Concrete Institute's Big Beam Competition.

Four S&T civil engineering graduate students designed a large-scale, pre-stressed and pre-cast concrete beam with the help of Coreslab Structures Inc., based in Marshall, Mo. The team's faculty advisor is Dr. John Myers, associate professor of civil, architectural and environmental engineering at Missouri S&T.

Entries to the competition were judged on design accuracy, lowest cost and weight, largest deflection before failure, practicality, and innovation.

The students were required to prepare a technical paper and were judged on the most accurate predictions of cracking load and deflection at maximum load, among other things.

The S&T Big Beam Team members include Jared Brewe of Rolla, Mo., a graduate student in civil engineering; David Holdener of Columbia, Ill., who received his master of science degree in civil engineering in summer 2008; Wendy Moore of Kansas City, Mo., who received her master of science degree in civil engineering in summer 2008; and Yosuke Tanizawa of Takamatsu, Japan, a graduate student in civil engineering.

The Big Beam Contest is sponsored by Sika Corporation.

In addition to finishing first in their region, the S&T students placed fifth among more than 60 competing teams in the national competition.

Prakash receives award from Indian Institute of Technology

January 21, 2009 10:25 AM | Permalink | Comments (0) | SHARE

Dr. Shamsher Prakash, professor emeritus of civil engineering at Missouri University of Science and Technology, received the Distinguished Alumnus Award from the Indian Institute of Technology, Roorkee, in December 2008.

Prakash has been cited for his internationally recognized work in the area of soil dynamics, including pioneering work on liquefaction of fine-grained soils, seismic design of piles, and seismic analysis of rigid retaining walls. He has co-authored four books, including the first comprehensive text on soil dynamics, and has published approximately 300 academic papers.

The Technical University of Civil Engineering in Bucharest, Romania, awarded Prakash an honorary doctorate in 2003, and the University of Illinois department of civil engineering recognized him as distinguished alumnus in 2004.

Prakash has served in multiple professional organizations, including the American Society of Civil Engineers, to which he was awarded life membership. He is an honorary member of the Indian Society of Earthquake Technology and the Indian Geotechnical Society. He was named honorary editor of the International Journal of Case Histories in Geotechnical Engineering in 2004.

Faculty members receive excellence awards

December 17, 2008 2:50 PM | Permalink | Comments (1) | SHARE

Twenty Missouri University of Science and Technology faculty members received Faculty Excellence Awards from Missouri S&T Chancellor John F. Carney III during an awards ceremony Dec. 16 on campus.

The awards are given annually to recognize teaching, research and service excellence. Each award winner receives a $2,500 stipend funded by industry and alumni contributions.

Receiving the 2008 awards were:

-- Dr. Mohamed Abdel Salam, associate professor of geological sciences and engineering
-- Dr. Daryl Beetner, associate professor of electrical and computer engineering
-- Dr. Joel Burken, professor of civil, architectural and environmental engineering
-- Dr. Fatih Dogan, professor of materials science and engineering
-- Dr. Curt Elmore, associate professor of geological sciences and engineering
-- Dr. Nuran Ercal, professor of chemistry
-- Dr. William Fahrenholtz, professor of materials science and engineering
-- Dr. Scott Grasman, associate professor of engineering management and systems engineering
-- Dr. Greg Hilmas, professor of materials science and engineering
-- Dr. Yue-Wern Huang, associate professor of biological sciences
-- Dr. Patrick Huber, associate professor of history and political science
-- Dr. Ronaldo Luna, associate professor of civil, architectural and environmental engineering
-- Dr. Bruce McMillin, professor of computer science
-- Dr. Julia Medvedeva, assistant professor of physics
-- Dr. Melanie Mormile, associate professor of biological sciences
-- Dr. Susan Murray, associate professor of engineering management and systems engineering
-- Dr. John Myers, associate professor of civil, architectural and environmental engineering
-- Dr. Francisca Oboh-Ikuenobe, professor of geological sciences and engineering
-- Dr. Ganesh Venayagamoorthy, associate professor of electrical and computer engineering
-- Dr. Yahong Zheng, assistant professor of electrical and computer engineering.

Outstanding advisors to be recognized

April 10, 2009 10:33 AM | Permalink | Comments (0) | SHARE

The undergraduate advising office at Missouri University of Science and Technology has announced the winners of 2009 Outstanding Academic Advising Awards.

A committee evaluated nominations and selected the winners. The following will be officially recognized during the Missouri S&T Faculty Recognition Awards Ceremony April 29 on campus.

Outstanding Academic Advisors -- Dr. Stuart Baur, assistant professor of civil, architectural and environmental engineering; Dr. Morris Kalliny, assistant professor of business and information technology; Dr. Ronaldo Luna, associate professor of civil, architectural and environmental engineering; and Dr. Julie Patock, assistant professor of psychology.

Outstanding Student Advisor, Staff -- Vicki Gibbons, manager of graduate student services.

Mizzou Engineering student earns international recognition

By Vicki Hodder, senior information specialist for the MU College of Engineering
Dec 31st, 2008

A Mizzou Engineering graduate student's work on a new technique to test the strength of carbon fiber materials vital to advanced transportation technologies has received international recognition.

Frank Blum Jr., a civil and environmental engineering master's degree student, earned international academic recognition for his work with carbon fiber composite materials for use in hydrogen transportation and aerospace systems.

Frank Blum Jr., a civil and environmental engineering master's degree student, took top honors Nov. 30 in a research poster contest held by the Union of Chambers of Turkish Engineers and Architects (UCTEA) and the Chamber of Chemical Engineers in Izmir, Turkey. Blum believes the international academic recognition underscores the central role of carbon fiber composite materials in hydrogen transportation and aerospace systems.

"The award helps me realize how important this research actually is and that further research in this area is very important, as carbon fiber will be used more and more in the future," Blum said.

Because carbon fiber composites are stronger and stiffer than steel but weigh considerably less, they often are used to reinforce gas storage tanks for space vehicles as well as the hydrogen fuel containers many believe will serve to fuel cars in the future. But no current technology exists to measure wear and tear in these materials without taking them apart, so stress-related problems may be sudden and catastrophic.

Blum's research seeks to help solve that problem. Sponsored by the American Society for Nondestructive Testing, Blum is studying whether stress on carbon fiber composite materials can accurately be measured through a type of light analysis called Raman spectroscopy.

To lay the foundation of this technique, Blum is illuminating the carbon

fiber composite material with lasers and measuring the intensity of light that the fibers reflect back at wavelengths different from that of the laser—a phenomenon known as inelastic or Raman scattering. This wavelength variation corresponds to changes within the material's molecular bonds.

Eventually Blum aims to correlate each of those reflected wavelengths with fiber strength, creating a map that would help determine any environmental damage to the material.

Blum's project is part of a larger research program led by his faculty adviser, MU civil and engineering Assistant Professor Glenn Washer. Washer's research group is seeking to develop innovative ways to assess the condition of engineering materials, focusing on nondestructive technologies designed to help ensure the safety and reliability of the nation's infrastructure.

Blum and Washer are slated to publish their research results in the Journal of Materials Science Letters within the next several months.

Missouri S&T in the News

External Media Sources

Hydrogen-powered shuttle service coming to post

User Rating: / 1

Poor Best Rate

Thursday, 31 July 2008

By Dana Finney
Special to GUIDON
If you live or work at Fort Leonard Wood, you have a way to commute within the local community that avoids the high cost of gas and also benefits the environment.

Two shuttle buses equipped with hydrogen-fueled internal combustion engines will begin making regular trips between the Fort, St. Robert, and Rolla, beginning in August. Best of all, the commuting cost is minimal thanks to a pretax benefit to Defense employees

The bus service functions as a rural test bed that helps the U.S. Department of Transportation wrestle with the technical, safety and public-perception issues of putting a new fuel infrastructure in place — new stations, new rules for emergency responders, new public concerns, and other challenges. DOT turned to a partner, the Defense Logistics Agency, which, as the Army's fuel provider, is interested in the same issues involving a hydrogen-based infrastructure.

With a Congressionally funded project to demonstrate hydrogen-powered vehicles within the Department of Defense, DLA asked the U.S. Army Engineer Research and Development Center to work with the Missouri University of Science and Technology and Fort Leonard Wood to provide commuter buses and a stationary hydrogen refueling station.

"Hydrogen-fueled ICEs have many advantages over gasoline engines, including high efficiency, all-weather operation, and near zero emissions of regulated pollutants and greenhouse gases," said Frank Holcomb, project leader at ERDC's Construction Engineering Research Laboratory. "They can also be easily hybridized for further gains in fuel efficiency."

The commuter buses that will serve Fort Leonard Wood are two Ford E-450 models with supercharged 6.8-liter V-10 engines. They are being leased with a $500,000 in-kind donation from Ford Motor Company. The service has been phased in over the past year, with a standard diesel bus making runs from the fort to two area towns since May 2007. Around the same time frame, Missouri S&T began operating the two hydrogen buses at its Rolla campus to gain a sense of their performance, maintenance needs, fueling requirements, and other characteristics. The hydrogen fuel initially is being provided by an Air Products Mobile Hydrogen Fueler at Rolla. The plan is to install a semi-permanent refueling station once a site and permits are secured.

"The Gas Technology Institute had a mobile steam methane reformer that we obtained with a lease and partial purchase agreement. It's trailer-mounted with a compressor and we'll add storage vessels on a skid external to the trailer, along with a dispenser," said Dr. John Sheffield, Professor of Mechanical and Aerospace Engineering at Missouri S&T. "We also plan to use a photovoltaic panel to power the electrolysis system, which means the fueling station will operate partially on renewable energy."

Hydrogen-powered ICE vehicles represent another step forward in U.S. industry efforts to use H2 as an alternative to fossil fuels. Hydrogen is made either through a process known as "electrolysis," water — the most abundant natural resource on Earth — can be split into hydrogen and oxygen by electricity or through a process of "reforming" natural gas with steam.

With either process, the hydrogen released is captured and stored for use as fuel. While the challenges of converting an oil-based infrastructure to one for hydrogen are well recognized, cultural obstacles exist, as well.

Commuter buses powered by hydrogen will shuttle Fort Leonard Wood personnel to St. Robert and Rolla beginning in August. (Courtesy photo)

"Everyone remembers the Hindenburg disaster," said Sheffield of the German hydrogen-filled zeppelin that caught fire in 1937 and was widely covered in the news media at the time. "In more recent years, we've seen other accidents, such as an ethanol hybrid car crash that the responders were afraid to touch. But we also went through a steep learning curve in the early 20th Century when building the infrastructure to support refineries and gas stations. We can apply those lessons learned to hydrogen as a fuel source."

As part of bringing the hydrogen-powered bus service to Fort Leonard Wood, a representative from Ford trained operators, code officials, and first responders on how to safely handle the fuels, regulate the production and sale, and respond to a potential accident. That training was completed in July 2007 for attendees from Rolla and St. Robert.

The E-450 buses will operate at the Fort through December 2009, or about 18 months of commuting. During this time,

Missouri S&T will collect operating data to assess bus reliability and long-term performance. Another goal of the project is to expose DoD personnel to hydrogen-fueled vehicles. "Educating the public about these renewable energy technologies will be critical to eventually reducing or ending our dependence on imported oil," said Holcomb.

S&T grads get top pay, survey shows

The Rolla Daily News
Mon Aug 11, 2008, 10:17 PM CDT

Rolla, Mo. -

Graduates of Missouri University of Science and Technology have the highest starting salaries in the Midwest and are among the best-paid in the nation, according to a recent report by Payscale Inc., a Seattle-based research firm.

The PayScale 2008 Education and Salary Report, released recently, puts Missouri S&T first among Midwestern universities in terms of starting median salary for graduates.

The starting median salary for Missouri S&T graduates is $57,100. Second in the Midwest was the University of Notre Dame ($56,300). Case Western Reserve University, Illinois Institute of Technology and South Dakota School of Mines and Technology rounded out the top five in the region.

The report also ranked Missouri S&T 25th in the nation for starting salaries. No. 1 nationally was California Institute of Technology, where graduates earn a starting median salary of $75,500.

“Our students are highly sought after due to their strong academics, their work experience prior to graduation through our co-op and internship programs, and their involvement with student organizations,” said Lea-Ann Morton, director of Missouri S&T’s Career Opportunities Center.

“We know this based on our annual survey of employers in which we ask them to rank Missouri S&T graduates in comparison to graduates from other universities.”

With an emphasis on engineering, science and technology, Missouri S&T prepares students who will play crucial roles in addressing many of the nation’s business and technological challenges, says Missouri S&T Chancellor John F. Carney III.

“Today’s Missouri S&T students are the future engineers, scientists, and business and community leaders who will work to solve our nation’s energy and environmental problems, address our infrastructure needs, and ensure we remain a leader in the global economy,” Carney said.

“This report underscores the importance of choosing the right university and major,” he adds. “It also shows our students and their families that their investment in a Missouri S&T education pays off.”

Last May, 74 percent of the Missouri S&T graduating class of approximately 600 bachelor degree recipients accepted a full-time position while 13 percent went on to graduate school, Morton said. The remaining 13 percent either entered the military, returned to their home countries, or did not report post-graduation plans to the Career Opportunities Center.

Last year, 673 different employers from 41 states and two international locations recruited Missouri S&T students. In addition, employers conducted 4,392 interviews on campus.

The PayScale report was conducted when Missouri S&T was still known as the University of Missouri-Rolla. The university name was changed to Missouri University of Science and Technology (Missouri S&T) on Jan. 1.

S&T grad to blog from space

The Rolla Daily News
Wed Nov 12, 2008, 11:44 PM CST

Rolla, Mo. -

NASA astronaut Sandra Magnus, a Missouri University of Science and Technology graduate, is scheduled to launch into orbit aboard Space Shuttle Endeavor Nov. 14.

The space shuttle will drop Magnus off at the International Space Station for a four-month stay, during which time she will be contributing to a Missouri S&T blog aimed at getting more kids interested in science.

Last July, kids attending Aerospace Camp at Missouri S&T wrote down questions for Magnus. She has provided answers to some of those questions in advance of her trip, and she'll also be checking in from the space station.

The questions and answers, along with other commentary from Magnus and interactive NASA links, will be available at http://spacebook.mst.edu/ .

Sample questions include:

• How long does it take to get out of the Earth's atmosphere?
• What is it like to sleep in zero gravity?
• How do you go to the bathroom in space?
• Is the space station anchored at all?

"The idea of the blog is to get more people interested in science and engineering," said Missouri S&T Chancellor John F. Carney III.

"We are grateful to Sandra for helping us reach out to kids while she's orbiting the Earth. We think it's very important to get more young people excited about math, science and engineering."

Elementary school teachers and the public are invited to follow along and submit new questions for Magnus at http://spacebook.mst.edu/ . Updates will be posted almost daily for the next four months.

Magnus is a native of Belleville, Ill. She received a bachelor's degree in physics from Missouri S&T in 1986 and a master's degree in electrical engineering from Missouri S&T in 1990. She earned a doctorate from Georgia Institute of Technology in 1996.

Magnus joined NASA in 1996. She spent 11 days in space in 2002. During that trip to the International Space Station, she operated Space Shuttle Atlantis' robotic arm.

The primary mission for Magnus and other crew members during this voyage is to install equipment needed to support a six-person crew aboard the space station. Currently, the station only has a crew of three people. Next summer, that number will double.

Space Shuttle Endeavor is scheduled to blast off from Kennedy Space Center in Cape Canaveral, Fla., at 7:55 p.m. Friday, Nov. 14.

EcoCar: The Next Challenge is a MUST for Missouri S&T

Posted by EcoFriendly

Nov 14

EcoCar: The Next Challenge is a MUST for Missouri S&T

Engineering students from Missouri University of Science and Technology (Missouri S&T) in Rolla, MO have been given a GM Saturn VUE automobile, with the challenge to turn the car into one that runs on hydrogen. Yesterday I talked about University of Michigan students being challenged by a local business to build a small unmanned airplane that runs on a fuel cell.

The Missouri S&T students will, however, be part of a larger competition sponsored by the U. S. Department of Energy called EcoCar: The Next Challenge. Teams from 17 different colleges will be competing over 3 years to build an alternative fuel vehicle solution. Only two of these teams, including Missouri S&T have received a hydrogen fuel cell for this competition.

Missouri S&T has an advantage over the other universities in that it actually has a hydrogen fueling station on its campus and this will be extremely helpful in testing the vehicle. When the Hydrogen Road Tour 2008 rolled into town on August 19, 2008 there coincided a ribbon cutting ceremony to open this hydrogen station.

With Bush and Obama right now struggling over whether or not an automotive bailout is imminent, it is exceedingly important to keep pushing forward with alternative fuel vehicles. In fact, if President-Elect Obama gets his way, the bailout package will assist GM, Ford and Chrysler in developing high mileage alternative fuel vehicles that people want to buy. Bailout or not, competitions such as EcoCar only serves to move the industry in the right direct and inspire college students, soon to be in the regular work force, to do the same.

Source: Fuel Cell News

Fox Files: Earth Become Liquid During Earthc

Last Edited: Wednesday, 26 Nov 2008, 10:10 PM CST
Created: Wednesday, 26 Nov 2008, 10:10 PM CST

By Paul Schankman

(KTVI - myFOXstl.com) --
In an engineering school lab at the Missouri University of Science and Technology in Rolla, they have been testing a controversial idea.

It is a phenomenon called liquefaction---- solid ground that during a major earthquake, momentarily turns liquid.

The idea itself is not new.

For years, engineers have known liquefaction is a risk in sandy soil. But the research done at Rolla finds there is also a substantial risk in silt, and the Rolla researchers say that could put bridges built on silty soil in danger during a prolonged earthquake at or above a 6.5 magnitude.

With MoDOT and IDOT getting ready to build a brand new bridge across the Mississippi, crews have been testing the soil where they'll dig the foundation.

And while MoDOT does evaluate the risk of liquefaction, on the MRB project, they say it will not be an issue, because the bridge will be founded in bedrock.

But what about bridges that do get some of their support from silt?

Like MoDOT, IDOT also evaluates the risk of liquefaction when building something new.

But IDOT's Chief of Bridges says even if silt has high risk for liquefaction, liquefaction does not automatically mean catastrophic bridge failures because the piers may simply settle without collapsing.

Bond Secures Funds to Help Create Clean Transit Vehicles & Jobs

Funds Will Support Partnership between Missouri S&T, Kokam America & Kansas City

December 10, 2008

WASHINGTON, D.C. – U.S. Senator Kit Bond today announced that the U.S. Department of Transportation (DOT) released $1.66 million to fund research and pilot projects for clean battery-powered transit vehicles in Kansas City.

"With the current auto industry troubles, Missouri is at risk of losing 200,000 auto-related jobs," said Bond. "This project will harness Missouri's battery technology know-how to help produce the next generation of clean transit vehicles and create jobs. We can do both."

As a senior member of the Senate Appropriations Committee, Bond secured $1.66 million in federal funds in the 2008 omnibus appropriations bill to fund research and pilot projects for alternative energy transit vehicles and plug-in hybrid electric vehicles at Missouri University of Science and Technology (Missouri S&T). The funds will support program design, infrastructure and clean technical support costs.

To build clean vehicles, Missouri S&T will partner with the Kansas City local government and Kokam America Inc., a lithium ion battery company in Lee's Summit. The project will help fulfill Kansas City's goal to reduce carbon emissions and purchase about a dozen small to mid-size plug in hybrid cars for local government employees.

Plug-in hybrids allow owners of hybrid vehicles to recharge their battery by plugging into a traditional electric socket. Plug-in hybrids also allow drivers to run the first 40 miles of their trip solely on electric power and then switch over to hybrid engines. When this technology is fully developed for consumer vehicles it will drastically lower fuel costs and emissions because many trips and commutes are less than 40 miles. This project will help lead the way to jobs and a clean and energy independent future.

"Working with the City of Kansas City and Kokam America Inc., our researchers will be able to demonstrate the viability of plug-in electric vehicle (PEV) technologies in a real-world environment," says Angela Rolufs, director of the Missouri Transportation Institute at Missouri S&T and the principal investigator for the project. "We're excited to be partnering with a company and a major city that are both at the forefront of alternative energy solutions. We're also thankful to Sen. Bond for his instrumental role in securing the necessary funding to move this project forward."

Structure Damage Sensors Are Now a Reality

The new class of devices was recently patented

By **Tudor Vieru**, Science Editor
6th of January 2009, 11:30 GMT

Assessing the structural integrity of a building is a very complex task, and a very necessary one at that, especially in the event of an earthquake or other natural catastrophe that could damage the internal make-up of a very expensive building. Until now, outside sensors were used, small devices that recorded fluctuations in the distribution of forces through the steel and concrete of a skyscraper, for instance. Now, thanks to a new device already patented, monitoring the behavior of a building becomes much easier.

Instead of collecting data from a single point, as in the case of discreet sensors, Dr. Genda Chen came up with a novel way of approaching structural integrity observations. The expert, a professor of civil, environmental and architectural engineering at the Missouri University of Science and Technology, was recently awarded a patent for a monitoring system featuring a co-axial cable, up to 100 feet (33 meters) long, that can provide a continuous flow of reads throughout its length.

The entire ensemble works like a motion detector. An emitter sends a signal wave throughout the length of the cable and, if a disturbance is encountered, a reflection wave is propagated back, to the beginning of the sensor, where a receiver picks it up and converts it into readable data, via computer software.

Their construction allows them to survive in even the harshest environments, and their built-in memory banks allow them to report back information even if they were temporarily incapacitated. This may happen in the event of an earthquake, when the sensors might be overpowered by the number of reflected impulses they receive. After the tremor ends, the data will still arrange itself nicely, offering structural architects the information they need to take into account when designing other similar structures.

These devices can be installed in a variety of buildings, ranging from office towers, parking lots, average homes and bridges to suspended highways. Constant monitoring can show exactly how wind acts on all these structures, and could provide early warning on structural failure or on what portion of the structure needs to be reinforced to prevent disaster.

Pair will hit TV with a bang

The Rolla Daily News
Wed Jan 21, 2009, 10:31 PM CST

Rolla, Mo. -

The premiere of “The Detonators,” a new Discovery Channel series featuring an explosives expert from Missouri University of Science and Technology and one of his former students will debut on Wednesday.

The 13-part series is co-hosted by Dr. Paul Worsey, professor of mining engineering at Missouri S&T, and Dr. Braden Lusk, assistant professor of mining engineering at the University of Kentucky.

Worsey is Missouri S&T’s chief explosives expert, and Lusk earned a bachelor’s degree and Ph.D. in mining engineering from Missouri S&T (then known as the University of Missouri-Rolla) in 2000 and 2006, respectively.

“The Detonators” is a co-production of RDF USA and IWC, an RDF-owned company in Scotland.

Slated to debut at 7 p.m. Wednesday, the Discovery Channel series will follow Worsey and Lusk as they meet the blasters behind such structures as urban skyscrapers, massive steel bridges and giant stadiums.

The hour-long episodes will also show Worsey and Lusk giving viewers a behind-the-scenes look at the demolitions. Persons may visit www.discovery.com/detonators for more information.

“Through the eyes of these two experts, viewers will really understand this fascinating world of demolition and more importantly how it can actually go wrong,” said Charles Tremayne of RDF USA, co-executive producer of the program.

Adds Beth Dietrich, co-executive producer for the Discovery Channel: “There’s a lot more to it than just blowing things up; there’s a surgical precision. It’s so perfect for Discovery because it’s kind of ‘gee-whiz, I had no idea,’ where it looks so easy but it’s incredibly complicated.”

The show’s producers have been working with Worsey and Lusk for several months filming at various locations around the world and at Missouri S&T’s Experimental Mine.

“It’s been a lot of work, but a lot of fun” to create the series, Worsey said. “We have a unique explosives engineering program at S&T, and this series will give viewers a glimpse of the technology behind blowing stuff up.”

Missouri S&T has a built an international reputation in recent years for its expertise in explosives engineering. The campus developed the first minor in explosives engineering in 2005.

That same year, it first offered a summer “explosives camp” for high school juniors and seniors that has become one of the university’s most popular summer camp offerings.

St. Louis Business Journal

Friday, April 10, 2009

Missouri: The Show-Me Energy State

Becoming the gateway to a secure energy future

St. Louis Business Journal - by John F. Carney III

During our nation's great westward expansion, Missouri — and specifically, St. Louis — became known as the Gateway to the West. We were the bridge between the known, settled civilization and the vast, unknown, world to the west.

Today, our state has the opportunity to again bridge the old and new. Only this time, we are poised to lead our nation in a transition into a new energy economy that harnesses the power of our state's own resources and the innovative approaches of Missouri's research universities.

Few Missourians are aware of the innovative energy research already under way in the Show-Me State. Last August, for example, our state played host to the only stop in the Midwest for the Department of Transportation's cross-country tour of hydrogen-powered vehicles. Why? Because Missouri is the only state in America's heartland that is home to a hydrogen fueling station. The facility is part of a project at the **Missouri University of Science and Technology** campus in Rolla, where college students as well as commuters to the military base at Fort Leonard Wood have access to hydrogen-powered shuttles.

The hydrogen fuel project is one of many examples of how researchers and students at our state's campuses are exploring new frontiers of energy. Their work with a broad array of energy resources — from renewable energy like wind and solar power to new approaches to help us transition from a carbon-based economy — is vital if the United States is to become less reliant on foreign oil. While coal, oil and natural gas will remain indispensable to meeting our nation's demand, it's critical that we also invest in developing new energy technologies immediately.

John F. Carney III is chancellor of Missouri University of Science and Technology in Rolla and chairman of the Missouri Energy Summit (www.missourisummits.org).

Glass-reinforced steel

Published: 21 May 2009 11:00 AM
Source: The Engineer Online

Researchers at Missouri University of Science and Technology have developed a glass-based coating for reinforcement bars that helps prevent corrosion and strengthens the bond between steel and concrete.

The material could help engineers build stronger bridges and increase the longevity of other steel-reinforced structures.

Currently, the US market for polymer-coated and galvanised rebar in the construction industry is more than $4bn per year, but research has shown that polymer coatings are not providing adequate corrosion protection for the rebar.

The Missouri coating is an engineered mixture of glass, clays and water.

A slurry is applied to the rebar and heated to more than 760C.

The coating, which adheres to steel, promotes bonding with concrete and works to prevent corrosion from water and salt.

The university has filed for a patent on the technology, which was developed by a team of researchers led by Dr Richard Brow, Curators' Professor of materials science and engineering, and Dr Genda Chen, professor of civil, architectural and environmental engineering.

The research was funded by the Leonard Wood Institute.

The university recently licensed the new technology to Pro-Perma Engineered Coatings in St. Louis.

Mike Koenigstein, managing partner of Pro-Perma. says that the company has two projects in the works that use the new coating.

The first will involve the strengthening of marine structures in Corpus Christi, Texas.

Next, Koenigstein plans to strengthen a sea wall near Pearl Harbor on Oahu Island, Hawaii.

Both projects are sponsored by the US Department of Defense.

In addition to protecting structures from water and salt, Brow and Chen say the new coating would help make bridges and buildings stronger in earthquake-prone regions.

Internal Media Sources

Fixing America's bridges

It's been a year since the nation's attention was dramatically drawn to the health of America's ailing infrastructure. The event, which killed 13 people and injured 145 others, served as a stark reminder that the nation's infrastructure is aging. It also was a dramatic example of the type of disaster researchers at Missouri S&T are working to prevent.

Long before the collapse occurred, Missouri S&T researchers were busy **developing new materials** and testing methods to preserve and protect the nation's roads, bridges and buildings.

As one of only 10 national university transportation centers in the United States, Missouri S&T's **Center for Transportation and Infrastructure Safety** is bringing together researchers from a variety of disciplines to address some of the nation's most pressing transportation issues.

As a result of their research, we may one day find ourselves driving across bridges made from soybeans and reinforced with glass, carbon or steel fibers. While we travel across these cutting-edge structures, sensors will monitor the impact of our vehicles and warn technicians at the first signs of trouble.

Nearly 30 percent of the country's bridges are structurally deficient or functionally obsolete, according to a 2006 report from the U.S. Department of Transportation. Developments at Missouri S&T in alternative building materials and methods of monitoring the structural "health" of roads and bridges could be the keys to safer and stronger transportation systems. In addition, faculty members are training today's students for a world in which these new approaches to bridge- and road-building will become commonplace.

"We want to educate the next generation of transportation engineers," says John Myers, associate professor of civil, architectural and environmental engineering and director of Missouri S&T's transportation center.

Myers and his colleagues are creating and testing alternatives to traditional building materials like steel and concrete. Polymers reinforced with carbon, glass and steel fibers already have been tested on 26 bridges in Missouri and surrounding states. A polymer made from soybeans is even being developed, and K. Chandrashekhara, Curators' Professor of mechanical and aerospace engineering and director of Missouri S&T's Composite Manufacturing Laboratory, said the material could be used to build bridge decks that are strong, corrosive-resistant and environmentally friendly.

Many of the bridges where new materials are tested are also being monitored by devices invented by Missouri S&T faculty. One such device is a sensor developed by Genda Chen, professor of civil, architectural and environmental engineering. The sensor can provide a three-dimensional model of cracks in a structure, as well as information about where and when the crack occurred.

Another device developed at Missouri S&T, called a Flood Frog, is being used to test bridges for health indicators such as strain, humidity, water level and vibration. The "frog" is an inexpensive, battery-powered device inside a waterproof case. It can easily be fixed to the outside of a structure.

"The Flood Frog can measure pretty much any quantity," says its developer Sahra Sedigh, assistant professor of electrical and computer engineering. By exposing a bridge's weaknesses in their early stages, "it opens a lot more doors to securing bridges than any other technology around."

Although it might seem like something straight out of science fiction, Missouri S&T researchers have even invented an inspection method that uses microwaves to see through sheets of reinforced polymer.

Researchers look for realistic ways to bring hydrogen technology home

08/21/2008 09:50 - Missouri S&T Public Relations

You probably won't be able to drive down the highway in your own non-polluting vehicle that runs on hydrogen power any time soon. And don't start making plans to power your whole house with expensive hydrogen-based technology in the coming years. But, some day in the not-too-distant future, you might own a cell phone equipped with a hydrogen-powered fuel cell instead of a battery.

The cell phone would come with an insert-ready hydrogen pack and a small solar array for charging.

"We need to be realistic about what we can and can't do with hydrogen right now," says Dr. Scott Grasman, associate professor of engineering management at Missouri University of Science and Technology. "In addition to some of the more Buck Rogers things that might happen in the future, we need to study some of the things we can do in the short term."

Grasman is one of the lead researchers working on a Missouri S&T study called "Hydrogen Fuel Cell Analysis: Lessons Learned from Stationary Power Generation" for the U.S. Department of Energy.

The technology necessary to produce hydrogen-powered vehicles that only emit water does exist, but those kinds of vehicles are not feasible for every-day drivers right now, according to Grasman. The main drawback is cost. Grasman says vehicles that run totally on hydrogen fuel cell technology currently cost anywhere from $50,000 to $1 million.

Things that are more economically feasible? Grasman says his group is looking at ways to use hydrogen to energize back-up power generators, forklifts, various types of military equipment and consumer electronic items, including cell phones.

Grasman has also played around with the idea of using hydrogen fuel cell technology in toys. In fact, he's got a small hydrogen car and a toy hydrogen rocket in his office. He says these kinds of items will help the public understand how hydrogen technology works.

Here's how it works at a basic level: An energy source, preferably wind or solar power, is used to send an electrical current through a substance that contains hydrogen. In water, the electrical current causes hydrogen and oxygen to separate. Compressed hydrogen is used to power a fuel cell, which is essentially a very expensive battery. The fuel cell is then able to continuously produce electricity that is stored by hydrogen in a system that discharges only pure water.

The main benefits, aside from the fact that the energy is pollution-free, are that hydrogen is an excellent source for storing electricity and that the fuel cells will last more-or-less forever, or at least a very long time. For these reasons, scientists continue to be very intrigued by the future possibilities of hydrogen, which is, after all, the most abundant element in the universe.

Next year, Grasman and his colleagues will present their findings about feasible ways to utilize what we know about hydrogen at a National Hydrogen Association Conference on strategies to bring the technology to the marketplace.

Other Missouri S&T researchers working on the DOE project include: Dr. Fathi Dogan, professor of materials science and engineering; Dr. Umit Koylu, associate professor of mechanical and aerospace engineering; Dr. K.B. Lee, professor of chemical engineering; and Dr. John Sheffield, professor of mechanical and aerospace engineering.

Researchers help build 'Internet for energy' through new NSF center

September 4, 2008 7:28 AM | Permalink | Comments (0) | SHARE

Missouri University of Science and Technology is one of seven universities in the United States and Europe involved in a new National Science Foundation research initiative that aims to transform the nation's power grid into an Internet for energy that will speed renewable electric-energy technologies into every home and business.

Missouri S&T is one of five U.S. universities in the NSF's Energy Research Center for Future Renewable Electric Energy Delivery and Management (FREEDM) Systems. The new center, announced today (Thursday, Sept. 4, 2008) by the NSF, will be led by North Carolina State University and also includes universities in Germany and Switzerland.

The center will be supported by an initial five-year, $18.5 million grant from NSF with an additional $10 million in institutional support and industry membership fees. More than 65 utility companies, electrical equipment manufacturers, alternative energy start-ups and other established and emerging firms have committed to joining this global partnership, according to the NSF.

"We're excited to be playing a lead role in helping to solve the nation's energy infrastructure problems in collaboration with our university and corporate partners through this new initiative," says Dr. Mariesa Crow, the Fred W. Finley Distinguished Professor of **Electrical and Computer Engineering** at Missouri S&T and director of the university's **Energy Research and Development Center**. "Our university has a long tradition of excellence in power engineering, and our expertise in that area, combined with our emphasis on addressing the pressing energy issues of our time, allow us to make unique contributions to this research effort."

Transforming the nation's power grid is vitally important as alternative-energy technologies prepare to flood the marketplace. Center researchers foresee widespread adoption of plug-in hybrid cars over the next several years, for example, but today's power grid would not be able to handle energy demand during peak charging times, such as when people return home from work in the evening. The smart grid developed at the center will also allow consumers to sell energy back to the power companies when demand is low, preparing the utilities for times when demand is greatest.

At Missouri S&T, Crow is joined by faculty from electrical and computer engineering and computer science to develop next-generation power transformers, distributed power grid intelligence, and ways to incorporate wind power and new energy storage technologies. Crow and Dr. Medhi Ferdowsi, assistant professor of electrical and computer engineering, are working to develop plug-in technology for hybrid vehicles. Working with Crow are Drs. Badrul Chowdhury (professor of electrical and computer engineering), Keith Corzine (associate professor of electrical and computer engineering), Mehdi Ferdowsi (assistant professor of electrical and computer engineering), Jonathan Kimball (assistant professor of electrical and computer engineering) and Bruce McMillin (professor of computer science).

Joining North Carolina State and Missouri S&T in the FREEDM project are Arizona State University, Florida A&M University, Florida State University, RWTH Aachen University in Germany and the Swiss Federal Institute of Technology in Switzerland.

More information about the research may be found on the FREEDM center website, **www.freedm.ncsu.edu** .

Students to re-engineer GM car with fuel cell powertrain

January 26, 2009 2:29 PM | **Permalink** | **Comments (0)** | SHARE

General Motors Corp. and the U.S. Department of Energy recently announced that Missouri University of Science and Technology will be the only U.S. university to receive GM's new fuel cell powertrain as part of North America's premier collegiate automotive engineering competition.

EcoCAR: The NeXT Challenge is an advanced vehicle technology competition that challenges engineering students from universities across North America to re-engineer a GM vehicle. The goals of the competition are to minimize energy consumption, emissions and greenhouse gases while maintaining the vehicle's utility, safety and performance.

Building on the strengths of the National University Transportation Center at Missouri S&T, the team is developing a hydrogen fuel cell plug-in hybrid electric vehicle. This technology represents a dramatic transformation to a more energy efficient means of transportation, says Dr. John Sheffield, professor of mechanical and aerospace engineering at Missouri S&T.

The EcoCAR competition is based on a real-world integrated vehicle design and development process. Missouri S&T will develop their vehicle following a modified GM Global Vehicle Development Process for each phase of the three-year competition.

"This competition complements ongoing Missouri S&T research and demonstration projects that are working toward making the hydrogen-powered society of the future a reality by studying the entire process of hydrogen production, storage and end use," Sheffield says.

More information concerning the Missouri S&T EcoCAR team and related activities can be found at **http://ecocarchallenge.mst.edu**.

Engineers Without Borders to leave S&T on May 17

May 13, 2009 4:47 PM | **Permalink** | **Comments (0)** | SHARE

A dozen students representing nine majors from Missouri University of Science and Technology will leave Rolla on May 17 and spend the next two weeks constructing a sustainable water supply in Erquis Sud, Bolivia, near the city of Tarija.

"During the Bolivian dry season, the residents of Erquis Sud have no nearby water sources and must sacrifice some of what little money they have to get the water they need to survive," says Emily Pasch, a senior in mechanical engineering from Lake Zurich, Ill. "During the rainy season, the nearby river is infested with bacteria from animal waste and chemicals from farmers' pesticides that causes health problems for community members."

The Missouri S&T site assessment team meets with community members in Erquis Sud, Bolivia, in November 2008.

In 2008, S&T's Engineers Without Borders site assessment team visited the town's newest rural subdivision, being built by Habitat for Humanity, to see how they could help. The unanimous request was for water, as Habitat for Humanity builds shelters, but does not construct utilities. Called Los Eucaliptos, the subdivision consists of 100 lots surrounded by farms.

"Many of the families, generally four to five people, are supported by single mothers," says Pasch, the project's leader. "The water source is especially important to them because once it's established, the population of the community will have room to expand and the surrounding municipalities will be able to justify a nearby public transportation route.

"The public transport will be invaluable to these women, who currently must walk to work to earn the money that supports their families, often with several children in tow."
S&T students have spent the last six months designing a water supply for the approximately 40 homes already constructed. Their plans for this month's visit include drilling a well and building a water-holding tank.

"In addition to these projects, we will also research the local electric company's policies so that the water could potentially be pumped automatically up to the tank," Pasch says. "We also plan to educate the community on practices that could improve their health."
Following the trip, the EWB team plans to develop a more in-depth water distribution system as well as a sewage system.

"Once residents have water, they'll need a sewage collection and treatment system too because of the dense concentration of homes on small lots. Some lots have two homes constructed on them," says Pasch. "Some lots have two homes constructed on them and there's the potential for contamination of the groundwater source for the well."

Meanwhile, **another S&T EWB team** of 10 students will be working on multiple projects in Tacachia, Bolivia, near the city of La Paz. They plan to build a water-holding tank, install an irrigation pump and distribution system, and assess the feasibility of constructing a 600-foot-long pedestrian bridge.

Students traveling to Erquis Sud, Bolivia, include:

- Laurin Bookout of St. James, Mo., a senior in civil engineering
- Nick Brackley of Cordova, Tenn., a senior in physics and aerospace engineering
- Kristine Brown of Kansas City, Mo., a senior in chemical engineering
- Dustin Fox of Rolla, Mo., a senior in computer engineering
- Jenna McGregor of Wildwood, Mo., a senior in environmental engineering
- Emily Pasch of Lake Zurich, Ill., a senior in mechanical engineering
- Erin Sage of Saint Peters, Mo., a senior in architectural engineering
- Sarah Shell of Barnhart, Mo., a senior in architectural engineering
- Amiel Weerasinghe of Colombo, Sri Lanka, a junior in civil engineering
- Tiffany Werckmann of St. Louis, a sophomore in computer science

Researchers partner to curtail explosives' effects

May 16, 2009 9:33 AM | Permalink | Comments (1) | SHARE

Researchers from Missouri S&T are partnering with ten other universities to improve the safety of buildings and other structures by reducing the impact of explosives.

The research is part of a multi-university Department of Homeland Security Center of Excellence called ALERT (Awareness and Localization of Explosives-Related Threats). Based at Northeastern University in Boston, the center conducts research, technology and educational development to understand, control and respond to explosives-related threats facing the U.S. and the world.

Dr. Jason Baird, associate professor of mining and nuclear engineering at Missouri S&T, is the principal

investigator on the project.

The researchers use structural design and advanced hybrid materials to improve resistance to blasts and reduce fragmentation. To simulate explosives effects on buildings and other large structures, barriers and wall panels made of hybrid materials are tested by explosive detonations at Missouri S&T's Experimental Mine. "Obviously, we can't blast a structure that is to scale," says Baird. "We have to restrict our work to materials testing." Baird tests the explosive load - that is, what amount of explosives causes the material to fail. "We also work to control the shockwaves after a blast."

The barriers and wall panels are made from three layers of materials. The front layer exposed to the blast wave is made from WF-FA (wood fibers and ASTM class C fly ash, a byproduct of coal-burning power plants). "We call this BMM - Blast Mitigation Material," says Dr. John Myers, associate professor of civil, architectural and environmental engineering, a co-investigator on the project. "Low density material makes up the center core and a reinforced concrete layer is put on the back face." The entire structure then receives a final polyurea coating to help reduce fragmentation, the leading cause of injury and death in explosions.

After Baird blasts the panel, he records its response to the blast. Dynamic tests are performed by dropping weights on the structure to simulate the effect of detonations from bombs or other sources. Myers uses the data to calculate the effect on large buildings and other structures.

Math models of the blasting results are done by researchers at Washington State University. "We come up with the promising materials, and WSU uses a math model to illustrate why it does or doesn't work," says Baird.

Missouri S&T's project, "ALERT: Optimal Design and Use of Advanced Structural Materials to Mitigate Explosive and Impact Threats," recently received $150,000 in funding from the federal government. Dr. Samuel Frimpong, professor and chair of mining and nuclear engineering, is also a co-investigator for the project.

Another S&T project, "ALERT: Detection and Neutralization of Electronics Used with Explosives," received $85,000 in funding. Principal investigator is Dr. Daryl Beetner, associate professor of electrical and computer engineering. Co-investigators include Frimpong and Dr. Steven Grant, associate professor; Dr. James Drewniak, Curator's Professor; and Dr. David Pommerenke, associate professor, all in electrical and computer engineering.

Baird says the research is supporting several graduate and undergraduate students. "Many experts with explosives experience are retiring now. We are training the next generation of explosives experts and working with the military to understand the field."

Coating developed at S&T could strengthen nation's infrastructure and create jobs in Rolla

May 20, 2009 8:57 AM | **Permalink** | **Comments (0)** | 

Researchers at Missouri University of Science and Technology have developed a glass-based coating for reinforcement bars that helps prevent corrosion and strengthens the bond between steel and concrete. This material could help engineers build stronger bridges and increase the longevity of other steel-reinforced structures.

Currently, the U.S. market for polymer-coated and galvanized rebar in the construction industry is more than $4 billion per year. But research has shown that polymer coatings are not providing adequate corrosion protection for the rebar that helps to reinforce the nation's aging infrastructure.

The Missouri S&T coating is an engineered mixture of glass, clays and water. A slurry is applied to the rebar and heated to more than 1,400 degrees Fahrenheit. The coating, which adheres to steel, promotes bonding with concrete and works to prevent corrosion from water and salt.

Missouri S&T has filed for a patent on the technology, which was developed by a team of researchers led by Dr. Richard Brow, Curators' Professor of materials science and engineering, and Dr. Genda Chen, professor of civil, architectural and environmental engineering and interim director of the Center for Infrastructure Engineering Studies at S&T. The research was funded by the Leonard Wood Institute.

The Department of Defense has used related technology to develop blast-resistant walls. Brow and Chen realized that some ideas originally conceived by the U.S. Army Corps of Engineers could be built upon in order to engineer the glass-ceramic coating for rebar.

Missouri S&T recently licensed the new technology to Pro-Perma Engineered Coatings in St. Louis. "The goal is to take innovations like this out of the laboratory, team up with partners, solve problems, and make an economic impact," says Keith Strassner, director of technology transfer and economic development at Missouri S&T.

Mike Koenigstein, who earned a bachelor's degree in ceramic engineering at Missouri S&T in 1993, is managing partner of Pro-Perma. So far, he says, the company has two projects in the works that utilize the new coating. The first will involve the strengthening of marine structures in Corpus Christi, Texas. Next, Koenigstein plans to strengthen a sea wall near Pearl Harbor in Oahu. Both projects are sponsored by the Department of Defense.

In addition to protecting structures from water and salt, Brow and Chen say the new coating would help make bridges and buildings stronger in earthquake-prone regions.

According to Chen, there are approximately 800 short-span bridges in Missouri that need to be retrofitted or replaced. In addition, more than 200 longer-span bridges are in urgent need of rehabilitation.

Strassner and Koenigstein think the new rebar coating will prove to be in high demand. They envision opening a pilot plant dedicated to producing the glass-based coating in Rolla, which is already home to high-tech glass manufacturer Mo-Sci Corp. as well as Missouri S&T.

Pro-Perma and Mo-Sci are working as partners to commercialize the technology developed at Missouri S&T.

"We have all of the resources here to support technology-driven businesses," Strassner says. "We want to be an economic engine for the state of Missouri."

Missouri S&T selected to help support nation's new energy goals

May 21, 2009 9:35 AM | **Permalink** | **Comments (0)** | 

Missouri University of Science and Technology is one of 31 U.S. universities selected by the Department of Energy to advance nuclear technologies in support of the nation's energy goals.

Combined, the universities will receive approximately $44 million over three years to develop technologies that address the global climate crisis and move the nation toward greater use of nuclear energy. U.S. Energy Secretary Steven Chu announced the research awards on May 6.

Missouri S&T is developing iron phosphate-based glasses for high-level nuclear waste disposal. These glasses can be processed to contain large concentrations of nuclear waste components in a way that

keeps those components from dissolving in groundwater.

Dr. Delbert Day, Curators' Professor emeritus of ceramic engineering, first developed the glasses at S&T. The work is being continued by researchers like Dr. Mark Schlesinger, professor of materials science and engineering, and Dr. Richard Brow, Curators' Professor of materials science and engineering.

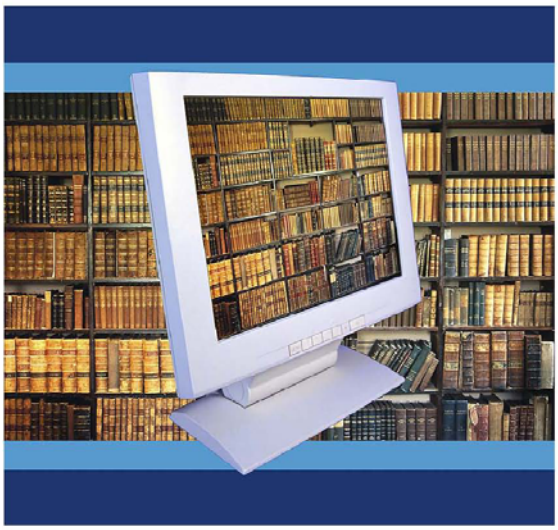
The S&T researchers will use the DOE funding to enhance the properties of the glasses and develop models that predict corrosion rates. The $376,000 project is expected to last two years.

The DOE also announced that it is accepting applications for nuclear science and engineering scholarships. As part of the DOE's efforts to recruit and train the next generation of nuclear scientists and engineers, approximately $2.9 million in university scholarships and fellowships will be awarded to students. More information is available at **www.caesenergy.org**.

S&T's Scholars' Mine garners more than 200,000 downloads

May 22, 2009 2:12 PM | **Permalink** | **Comments (0)** | SHARE

It's only been around for a couple of years, but Missouri S&T's Scholars' Mine, a free digital collection of the university's scholarly work, is getting global attention. Materials from the repository have been downloaded more than 200,000 times throughout the world.



The Scholars' Mine was developed in 2007 to manage, preserve and distribute information about current and past Missouri S&T research. Located at **scholarsmine.mst.edu**, the online repository is maintained through a partnership between S&T's information technology department and the Curtis Laws Wilson Library.

The repository currently holds more than 5,500 records for various types of scholarly publications from Missouri S&T, including theses and dissertations, faculty journal articles, conference papers and books. The oldest materials in the mine are four theses from 1876, including Lee Grabill's "Treatment of gold and silver ores as found in the Comstock Lode." Grabill received his mining engineering degree from the university in 1878.

"The collection is essentially complete for 2004 to the present," says Andy Stewart, director of the Curtis Laws Wilson Library. "We're keeping up with current faculty publications as well as working on publications from 1998 to 2003."

Items are added to the Scholars' Mine only after copyright permission is obtained. "We are absolutely strict about permissions. This might be the journal publisher, the conference sponsor or the individual author," says Stewart. "If we don't get their permission, we don't add it to the mine."

All theses from the university that have copyright permissions will be added to the Scholars' Mine. Any graduate who wants his or her thesis or dissertation added is encouraged to contact the library.

The greatest advantage of institutional repositories such as Missouri S&T's Scholar's Mine is the widespread dissemination of research. To promote this free exchange of information, many institutions, including Massachusetts Institute of Technology (MIT), are encouraging electronic submission of theses and dissertations. Due to the success of MIT's repository, DSpace, its faculty recently adopted a policy mandating submission of all scholarly articles to the repository.

Ongoing additions to the Scholars' Mine include white papers, technical reports, patent information and other materials that showcase the research work of Missouri S&T faculty and students. "The overall goal of the mine is to eventually add all campus output," says Stewart.

Stewart credits Missouri S&T Chancellor John F. Carney III and Provost Warren K. Wray with recognizing the Scholars' Mine's potential. "The library faculty and staff are deeply grateful to Chancellor Carney and Provost Wray for their support of this visionary project."

For more information about Missouri S&T's Scholars' Mine, email **scholarsmine@mst.edu** or call 341-7910.

Lee to be keynote speaker at Korean conference

By Linda Fulps on June 9, 2009 8:17 AM | Permalink

Sunggyu "K.B." Lee, professor of chemical and biological engineering, has been selected as a keynote speaker for the 2009 Annual Meeting of Korea Science and Technology (KSTAM), to be held in July. After an introduction by the Prime Minister of Korea, Lee will discuss "Energy Enabling Technologies for a Sustainable Future."

The conference is the most prestigious of its kind in Korea and is designed as an open forum for scientists, engineers and government officials. KSTAM is used to set the nation's strategic goals and agendas in science, technology and education.