Center for Local Government Technology (CLGT)

Local Technical Assistance Program
Since its inception in 1982, the mission of Oklahoma LTAP has been to provide training, technology transfer and technical assistance to local government agencies responsible for transportation systems. The major tasks of the LTAP Center are: 1) to develop and conduct training, 2) to provide technical assistance, 3) to serve as Oklahoma APWA Chapter Headquarters, 4) to publish a quarterly newsletter, and 5) to provide technology transfer material. The Center offers a County Roads Scholar Certification program, and is one of four original LTAP centers in the nation.
Sponsor: Oklahoma Department of Transportation
PI/PDs: Douglas A. Wright, Michael Hinkston

Project Monitoring/Assessment Program for Oklahoma's Rural Transit Projects
ODOT's Transit Programs Division is charged with administrating all Federal Transit Administration funds for areas with a population of fewer than 200,000 throughout the state. As a consequence of this large area of service and TPD's limited staff numbers, these projects receive an inadequate frequency of onsite project monitoring and assessments. The Center for Local Government Technology, (CLGT), assists ODOT by performing the monitoring functions through a comprehensive assessment program that: 1) assures project compliance with applicable federal and state laws and administrative rules, and 2) provides current information on the TPD website.
Sponsor: Oklahoma Department of Transportation for Federal Transit Administration
PI/PD: Kary Kiner

Oklahoma's Public Rural Transit Systems
In cooperation with ODOT's Transit Program Division, CLGT will provide 2- 5 educational programs for Oklahoma's rural public transit personnel. Programming activity shall include educational sessions provided through presentations at statewide meetings as well as other locations. Specific educational programs include: Oklahoma Rural Public Transportation Training Retreat, Oklahoma Transit Association Bus Roadeo Training, Dispatcher Certification Course, Transit 101 for Rural Transit Directors, PASS Driver Certification Training Classes, National Safety Council Defensive Driving, and Drug and Alcohol Program Training to ODOT staff
Sponsor: Oklahoma Department of Transportation for Federal Transit Administration
PI/PD: Kary Kiner

Southern Plains Tribal Technical Assistance Program (TTAP) Center
Funded by the FTA and in cooperation with the Bureau of Indian Affairs, this program provides a resource center to furnish information, training, and technical assistance related to road and bridge construction, repair, and maintenance to over 49 tribal governments in a four-state area. The TTAP mission is to meet the educational needs of tribal governments related to roads, bridges, public transit, transportation systems, inter-governmental coordination, and economic development. An important part of the mission is to provide training sessions, classes, and workshops geared to specific tribal needs. OSU's TTAP center is one of seven TTAP centers across the U.S.
Sponsor: United States Department of Transportation - Federal Highway Administration
PI/PD: Jim T. Self

County Computer Assistance Program
With oversight provided by the Oklahoma Tax Commission (OTC), the Association of County Assessors, and the Association of County Treasurers, the Center for Local Government Technology provides software programs, support of software and hardware including installation, maintenance of software and hardware, data management, conducting training programs and technical assistance for County Assessors and County Treasurers. CLGT also provides coordination with the Oklahoma Tax Commission Ad Valorem Division (OTC) in fulfilling mutual responsibilities to support State CAMA and Assessment Administration (AA) software systems.
Sponsor: Oklahoma Tax Commission

PI/PDs: Gary Snyder, Scott Warren

Assessor Training and Assistance Program
CLGT, in cooperation with the Tax Commission, the County Assessors' Association and the County Treasurers' Association will execute the PROGRAMS by providing computer software programs, support of software and hardware including installation, maintenance, data management and training, to counties currently using the services previously provided by the State Auditor and Inspector as mandated by legislation. CLGT will provide: hardware maintenance, software, software maintenance, and software support to County Assessors utilizing the PROGRAM software systems; technical support and training to County Assessors; and assistance with data extraction for OTC statutory and other agency requirements.
Sponsor: Oklahoma Tax Commission
PI/PDs: Gary Snyder, Scott Warren

Local Government Agency Summer Internship
This project facilitates experiential learning by placing undergraduate students of civil engineering, construction management, and other transportation related degree programs with local government agencies responsible for the maintenance and construction of roads and bridges.
Sponsor: Oklahoma Transportation Center for the U.S. Dept. of Transportation, RITA
PI/PDs: Michael Hinkston, Doug Wright

Southern Plains Transportation Center 2014 Summer Intern Program
SPTC is providing partial funding to CLGT for three internships the summer of 2014. CLGT's LTAP/TTAP programs will provide the remaining support for the three internships. These internships will be awarded for a period of approximately twelve weeks to students from a transportation related degree program located at the universities in Oklahoma affiliated with the SPTC - Langston University, the University of Oklahoma and Oklahoma State University. The internships will be modeled on those conducted by CLGT over the past four years.
Sponsor: University of Oklahoma for the Southern Plains Transportation Center for US Department of Transportation
PI/PDs: Doug Wright, Michael Hinkston

Chemical Engineering

CAREER: Multifunctional Polymer Coatings of Virus Particles for Safer and More Efficient Gene Delivery
The study will investigate the effects of both PEG and PLL on overall gene delivery efficiency of a targeted polymer/adenovirus hybrid vector by exploring a library of grafted copolymers with varying polymer molecular weights and grafting ratios. The study also aims to better understand why some of the PEG-PLL copolymers perform better than others by elucidating the limiting step(s) in the gene delivery process. The investigator will study and compare the mechanisms by which the hybrid vectors and native adenovirus transform cells and compare the efficiency and rate at which the viral and hybrid vectors overcome barriers to gene delivery.
Sponsor: National Science Foundation
PI/PD: Josh Ramsey

Novel Biocatalytic Approach for Upgrading of Pyrolysis Oil to Fuels and Chemicals
A novel biocatalytic approach will increase the carbon, hydrogen, and separation efficiencies of bio-oil in production of renewable fuels and chemicals. Through this project, novel enzymes and microorganisms will be developed with the ability to increase reaction rates of fuel production from pyrolysis while simultaneously producing hydrogen in-situ and converting organic acids in the bio-oil to alcohols. Advanced microbial and enzymatic approaches will be implemented for upgrading and improving the separation of renewable fuels and products derived from pyrolysis oil. Enzymes

and microorganisms will be developed for in-situ hydrogen production and conversion of acetic acids to alcohols for bio-oil upgrading.
Sponsor: National Science Foundation
PI/PD: Clint Aichele
Division of Agricultural Sciences & Natural Resources: Hasan Atiyeh, Ajay Kumar

FRI De-entrainment Characterization
Spray nozzles play key roles in chemical processing plants, yet, such nozzles have not been well studied. Their performances at large diameters and in hydrocarbons are seemingly difficult to predict. FRI and OSU jointly purchased a PDI from Artium Technologies. OSU investigators built an apparatus for the study of acid gas removal using aqueous amines in spray columns. That apparatus and PDI will be employed to study: small spray nozzles and the scale-up of data from small nozzles; deentrainment capabilities of various separator devices; and the utilization of deentrainment devices between distillation trays to improve tray performances at high rates.
Sponsor: Fractionation Research, Inc.
PI/PDs: Rob Whiteley, Clint Aichele

Preparation of Alumina Substrates
Substrates will be produced for use in a Frontier Electronic Systems Corporation product. The project involves production of flat ceramic substrates and octagon shaped ceramic cups per the FESC design. Aqueous alumina inks will be produced using pre-existing formulation and processing equipment. The 3D printing machine in the Smay lab will be used to print 10 discs of 20mm diameter and 2mm thickness through a 250μm tip. The 3D printing machine in the Smay lab will be used to print 10 octagon shaped cups per the FESC design. Disc and octagon samples will be sintered at 1650oC for 4 hours.
Sponsor: Frontier Electronic Systems Corp
PI/PD: James Smay

Nanocarrier-mediated Targeting of Bioscavengers to the Red Blood Cell for Prolonged Circulation and Projection
Parenteral administration of butyrylcholinesterase (BChE) is effective against organophosphorus anticholinesterase (OP) toxicity but its efficacy is hampered by rapid clearance from circulation. Red blood cells (RBCs) have been used as a carrier for drugs, peptides and enzymes following external manipulations and subsequent reinfusion. The hypothesis is that cationic poly(l-lysine)-graft-poly(ethylene glycol) copolymer nanoparticles (NPs) containing both an antibody to the RBC membrane protein glycophorin A and a cell-penetrating peptide can deliver electrostatically encapsulated BChE molecules to the circulating RBCs in situ. Once bound to, or internalized into RBCs, the NPs will circulate for prolonged times providing long-term protection against OP challenge.
Sponsor: Defense Threat Reduction Agency
PI/PDs: Josh Ramsey
Center for Veterinary Health Sciences: Casey Pope
Division of Agricultural Sciences & Natural Resources: Steve Hartson

Oklahoma Center for Respiratory and Infectious Diseases
OSU is the lead institution of this multi-institutional research center. The center's central theme is infectious diseases of the respiratory system with a focus on respiratory syncytial virus (RSV), influenza virus, and bacterial infections. Interdisciplinary projects cover disease pathogenesis, therapeutics, molecular mechanisms, and bioengineering. One aim of the center is to mentor junior investigators in becoming independent NIH-funded investigators and thus create a critical mass of multi-disciplinary investigators in respiratory infectious diseases. A second aim is to build up research infrastructure, and a third aim is to foster inter-institutional collaborations in Oklahoma by promoting scientific interactions through the center.
Sponsor: National Institutes of Health
PI/PDs: Heather Fahlenkamp
Arts & Sciences: Wendy Picking

Center for Veterinary Health Sciences: Lin Liu

Shear Extrusion to Treat Fecal Waste
During Phase I, it was confirmed that viscous heating and shear stress created by extrusion is effective for sanitizing fecal wastes. The PIs designed, built and operated a mechanical extruder that achieved 190°C repeatedly for a fecal simulant and destroyed 99% of parasite worm eggs in baboon feces near ambient temperatures. This continuing effort will evaluate this technology for the destruction of samples containing Ascaris. After modifying the equipment design, based on previous experimentation, the PIs will test pig fecal samples containing *Ascaris suum* at Oklahoma State University's National Center for Veterinary Parisitology.
Sponsor: Bill & Melinda Gates Foundation
PI/PDs: Gary Foutch, A.J. Johannes, Jim Smay

Surface and Airborne Monitoring Technology for Detecting Geologic Leakage in a CO2-Enhanced Oil Recovery Pilot, Anadarko Basin, Texas
OSU, with the cooperation of the Southwest Regional Carbon Sequestration Partnership (SWP), will develop and implement new near-surface and airborne monitoring technologies. The research will focus on the design and deployment of a dense grid of shallow subsurface and surface sensors in combination with low-altitude airborne detection of CO2 and CH4. These technologies will be deployed in the Farnsworth Oil Unit in the Anadarko Basin of the northeastern Texas panhandle, where the SWP and Chaparral Energy, LLC, are conducting CO2-enhanced oil recovery experiments.
Sponsor: Department of Energy
PI/PDs: Peter Clark
Civil & Environmental Engineering: Tyler Ley
Mechanical & Aerospace Engineering: Jamey Jacob, Girish Chowdhary
College of Arts & Sciences: Jack Pashin, Nicholas Materer

Petrophysics and Tight Rock Characterization for the Application of Improved Simulation and Production Technology in Shale
This research program is designed to improve understanding of how stimulation fluids and additives interact with shale matrix. Achieving this goal requires a fundamental understanding of petrology, petrophysics, and fluid-rock interactions. The proposed research is important for identifying ways to minimize formation damage caused by fracturing fluids, improving the effectiveness of hydraulic fracturing, and decreasing the need for refracturing. Identifying best practices and proposing standards for petrophysical analyses will help ensure the reproducibility of laboratory results and will increase the reliability and efficiency of hydrofracturing operations.
Sponsor: Research Partnership to Secure Energy for America (RPSEA) for Dept. of Energy
PI/PDs: Peter Clark, Khaled Gasem, Sayeed Mohammad
Arts & Sciences: Jim Puckette, Jeff White

Upgrade of the OSUMBIE Simulation Program
The objective of the project is to update the OSU Mixed-Bed Ion Exchange (OSUMBIE) simulation program to operate on a desktop PC. OSUMBIE is a computer simulation program used to predict the performance of ion exchange beds. The mathematical model is programmed for multicomponent cationic and anionic exchange for ultrapure water applications, such as nuclear and coal-fired power plants and microelectronic rinsewater. The model was developed between 1984 and 2004. Compatibility problems within the past several years have prevented the program from presenting results effectively. The OSUMBIE program will be modernized to work on Windows 7.
Sponsor: Bechtel Marine Propulsion Corporation – KAPL for Department of Energy
PI/PD: Gary Foutch

Multi-Scale Fouling Characterization of Fermented/Hydrolyzed Sweet Sorghum
Biofuel process streams are fouling intensive fluids that carry biological agents, dissolved solids, biomass, and other proteinaceous substances. Very little information is available about the fouling

mechanisms of these fluids on either a laboratory or industrial production scale. This project will focus on the fouling characteristics of fermented sweet sorghum. The goal of the project is to develop a fundamental and applied understanding of the fouling characteristics of fermented/hydrolyzed sweet sorghum in bioethanol recovery equipment.
Sponsor: South Central Sun Grant Program for U.S. Dept. of Transportation
PI/PD: Rob Whiteley

Spray Characterization Equipment
This project consists of characterizing sprays using a Phase Doppler Interferometer. Fractionation Research Incorporated (FRI) will contribute toward the purchase of the instrument. The instrument will support several fundamental and applied research projects at Oklahoma State University and FRI. Through the use of solid state lasers, the instrument has the ability to resolve a wide range in droplet diameter (0.5 μm – 2 mm). In addition, the instrument measures droplet velocity. Through the characterization of both droplet size and velocity, the measurements will provide insight to both fundamental and applied applications of spray phenomena.
Sponsor: Fractionation Research, Inc.
PI/PDs: Clint Aichele, Rob Whiteley

CAREER: An Advanced 3D Tissue Model for the Detection and Study of an Allergic Inflammatory Response
This NSF CAREER development plan seeks to use an advanced 3D tissue model to investigate the key aspects of an allergic inflammatory response, more specifically the cellular components at the site of inflammation and mediators, such as growth factors, chemokines, cytokines, and extracellular matrix components that regulate inflammation. The proposed transdisciplinary research will be complimented by the PI's education plan, which will integrate science and engineering research into curriculum at high school, undergraduate, and graduate levels.
Sponsor: National Science Foundation
PI/PD: Heather Fahlenkamp

Optimum Injectable Hydrogels for Cartilage Regeneration
The objective is to test developing an injectable hydrogel formulation mimicking cartilage architecture and use skin fibroblasts or MSCs to regenerate cartilage. The underlying hypothesis is that developing biologically inspired scaffolds mimicking the *in vivo* environment will serve as permissive substrate for cell growth, differentiation, and biological function of a cell. To test the hypothesis, the investigator will use injectable hydrogels formed using a chitosan-gelatin-hyaluronic acid (HA) mixture and test the effect on cells derived from two different lineages: fibroblasts, and MSCs.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PD: Sundar V. Madihally

Impact of Filming Amines on Polishing Ion Exchange Resins
This project will identify the effects of filming amines on the physical and chemical properties of ion exchange resins, based on the measured impacts of a selected proprietary filming amine product(s). Measured impacts will include the loss of effective and total capacity and reduction in ionic mass transfer coefficient. These properties for both short term (single regeneration cycle) and long-term impact will be evaluated. The need for performance recovery methods will be determined through identification of the ease and efficiency of regenerability.
Sponsor: Electric Power Research Institute
PI/PD: Gary Foutch
Arts & Sciences: Allen Apblet

Ethics for Researchers: Helping Moral People Act Ethically
Standard Research Ethics classes neglect the topic of *moral psychology*. Specifically, these classes do not teach students *why* people act unethically, and they do not provide students with strategies that they can use in order to increase the likelihood that they will act in accord with their own ethical commitments and/or the ethical codes of their professions. The goal of this proposal is

to develop a class, Ethics for Researchers: Helping Moral People Act Ethically, which will meet this need.
Sponsor: National Science Foundation
PI/PDs: Martin S. High
Arts & Sciences: Scott Gelfand, Shelia Kennison
Education: R. Steven Harrist

Center for Interfacial Reaction Engineering
Knowledge of the phase behavior and the thermophysical properties of organic mixtures encountered in biomass and petroleum conversion processes is essential to the proper design, operation and optimization of such processes. The project will build upon the research team's previous work in order to further develop theory-framed, structure-based phase behavior models for biphasic catalytic systems and identify improved organic solvents to optimize product separation in these systems. Completion of this research will provide the required modeling capability to develop effective bi-phasic catalytic processes for upgrading and refining of complex feed stocks including bio-oils.
Sponsor: University of Oklahoma for Department of Energy
PI/PDs: Brian Neely, Clint Aichele
Arts and Sciences: J. White

GSE/RES: Red Light, Green Light Signals - Defining Family and School Influences on Rural, American Indian Girls' Early STEM Interests
The research goal is to determine significant predictors of low-income, rural American Indian boys' and girls' early interests in science and mathematics that can provide guidance for classroom practices that encourage young girls' STEM interests. Specifically, this research will (1) determine and examine family and school influences related to changes in students' science and math interests and achievement from 3rd – 5th grade among rural, largely American Indian populations in Oklahoma and (2) generate narrative stories that illustrate positive and negative influences on girls' STEM interests within this special population.
Sponsor: National Science Foundation
PI/PDs: Karen A. High, James Smay
Arts & Sciences: Jean Van Delinder, Melanie C. Page
College of Education: J.A. Thomas

CCLI: A National Model for Engineering Mathematics Education
The inability of incoming students to successfully advance past the traditional freshman calculus sequence is a primary cause of attrition in engineering programs across the country. As a result, this project seeks to effect a transformative and nationwide change in engineering mathematics education, with the goal of increased student retention, motivation and success in engineering.
Sponsor: Wright State University for the National Science Foundation
PI/PDs: Karen A. High
Electrical and Computer Engineering: Charles F. Bunting

Civil and Environmental Engineering

Assessing Time to Deficiency for Highway Bridge Superstructures – Phase 2
The overall goal of the study is to compare the time it takes for pre-stressed concrete and steel bridge superstructures to be rated as deficient in twelve states from different regions of the United States. In order to meet this goal, the following research objectives will be pursued: 1) Evaluate time to deficiency for each bridge type, and 2) Develop time to deficiency models for each bridge type.
Sponsor: American Institute of Steel Construction LLC
PI/PD: Phil Lewis

Improving Specification to Resist Frost Damage in Modern Concrete Mixtures
Objectives include: 1) Determine the necessary properties of the air-void system to provide satisfactory frost durability in laboratory testing of laboratory and field concretes with different combinations of admixtures, cements, and mixing temperatures in salt environments; 2) Determine the accuracy of a field test method that measures air void system quality with field and laboratory concrete; 3) Determine critical combinations of absorption and the critical degree of saturation on the frost durability in accelerated laboratory testing in the presence of deicer salts; 4) Establish test methods and specifications for fresh and hardened concrete to determine frost durability and field performance.
Sponsor: Oklahoma Department of Transportation for FHWA SPR Pooled Funds, Ready Mixed Concrete Research & Education Foundation
PI/PD: Tyler Ley

Characterizing the Impact of Prefabrication on Productivity in Building Electrical Construction
The goal is to establish a series of rigorous metrics, data collecting procedures, and analysis techniques for both construction practitioners and owners in order to measure and estimate the impact of prefabrication on productivity in electrical trades. This research will use a traditional productivity study as well as activity analysis techniques. This research presents a novel way of using a Building Information Modeling-based simulation approach to estimate the potential of prefabrication in electrical productivity improvement during a project's planning and design stage. The outcome will be an understanding of the potential productivity impact of electrical prefabrication systems in building construction.
Sponsor: ELECTRI International
PI/PDs: Phil Lewis, Yongwei Shan

Determining the Long Term Performance of Petroleum Storage Tank Foundations through the Use of Case Studies
The aim is to build a database of past tank foundation performance that can be interrogated to determine the successful characterization of varying types of foundations and double bottom repairs in different environments. The team proposes to use owner inventory, construction and inspection records of tank foundations in combination with historical weather and soil information, and geotechnical reports for the existing foundations and combine this information into a single database. This database can be investigated to determine which foundations perform best in different situations. Another focus will be to determine the expected life of a double bottom tank foundation repair.
Sponsor: American Petroleum Institute, International Liquid Terminals Association
PI/PDs: Tyler Ley
Division of Agricultural Sciences and Natural Resources: Wade Brorsen

Investigating the Solubility and Reactivity of Fly Ash
Research will be conducted to determine the fly ash characteristics that have the greatest impact on its interactions with cement during early-age hydration. Several methods will be used to monitor aspects of the reactivity of various fly ashes alone and when mixed with Portland cement. This approach will establish structure-processing-property relationships that will be used to pinpoint the materials characteristics that most dramatically influence retardation and delayed setting in these systems. This will be crucial to designing improved specifications for fly ash materials and for developing test methods used to assure the early-age performance of high-volume fly ash concrete.
Sponsor: U.S. Dept. of Commerce – National Institute of Standards and Technology
PI/PD: Tyler Ley

Biosand Methods for Drinking Water
The project will develop methods for optimizing the process required for constructing and operating biosand water filters. Experiments will be conducted at OSU and tested in Honduras. The research will support efforts of a pilot facility, currently employing two people and building two

filters per week. If successful, this work will speed up the production process without compromising the efficacy of the filters, allowing the facility to construct at least ten filters a day. It will also allow for better operations of the filters. These results can easily translate to other biosand operations working with limited resources in developing countries.
Sponsor: U.S. Environmental Protection Agency
PI/PD: Greg Wilber

SusChEM: Collaborative Research: A Multi-Scale Environmental and Kinetics Study on the Pyrolysis of Sustainable Biomass Feedstock
This collaborative study between Tennessee Technological University and OSU looks at the kinetics and socio-economic broader impacts of biomass pyrolysis. The investigators will introduce a Multiple Variable Control Volume Reactor to independently control the particle-related and homogenous-related transport phenomena and associated reactions, making it possible to independently observe the two processes. In a serious of experiments, model compounds and whole biomass will be studied in an effort to understand the extent to which pyrolysis occurs within condensed phase intermediates and the homogeneous gas phase. The PIs will also introduce a new multi-scale modeling platform based on kinetic cellular automaton.
Sponsor: National Science Foundation
PI/PD: Tyler Ley

Surface Characteristics with 3D Data and Improved Airport PCI Survey Solutions
The project includes two technological developments that will provide the National Airport Pavement Test Facility with innovative tools to evaluate surface characteristics of Construction Cycles and airport pavements, and to improve airport condition survey efficiency via Pavement Condition Index. The research team will produce a white paper detailing use of new 3D imaging techniques to conduct surveys of relevant airfield pavement surface characteristics. Software modules for macro-texturing and grooving analysis will be developed as part of the updated ProGroove software. 3D pavement surface imaging data and innovative software algorithms will be used to expedite data processing for Pavement Condition Index.
Sponsor: Federal Aviation Administration
PI/PD: Kelvin Wang

Southern Plains Transportation Center
OSU is a subrecipient of the Southern Plains Transportation Center, a Regional University Transportation Center headquartered at the University of Oklahoma. OSU will conduct three research projects funded with the 2013 Regional UTC grant: embedded MEMS sensor system in pavement materials; precast concrete slabs for pavements; 3D 1mm imaging for automated assessment of pavement surfaces. In addition, OSU will conduct education and workforce development activities within the theme of the 2013 Regional UTC proposal.
Sponsor: University of Oklahoma for Southern Plains Transportation Center for the U.S. Department of Transportation
PI/PD: Kelvin Wang

Development of a Prototype Geotechnical Report Database
The ODOT geotechnical branch has scanned and stored reports in portable document format (PDF) since 2007, however, scanning and cataloging is time consuming and labor intensive. There is a need to develop a new system to allow easy data archiving and instant data access by searching the key information. The objective is to develop a proof-of-concept geotechnical report database that best fits the needs of the ODOT geotechnical branch. At a minimum, the system will feature data stemming from in-house archived files, in-house files currently being recorded in a quasi-automated recall-system, and data provided to the department via contract services.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Xiaoming Yang, Rifat Bulut

Expected Life of Silane Water Repellant Treatments on Bridge Decks – Phase II

In phase 1, laboratory and field techniques showed that silanes appear to have an effective lifespan between six and nine years. In Phase 2, the team will investigate the use of a new coating system that is a combination of silane and flood coat on existing bridges. They will also increase the number of samples taken from bridges that have been in service between 5 and 15 years to investigate silane performance, as well as further investigate concrete that has shown satisfactory silane performance in the field for extended periods of time.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Tyler Ley, Bruce Russell

Investigation of Optimized Graded Concrete for Oklahoma – Phase 2
Phase 1 focused on using optimized graded concrete for pavements and resulted in a new optimized graded specification for Oklahoma. Phase 2 will apply lessons learned to the usage of optimized graded concrete for structures. Tasks include: Develop tests to evaluate constructability of optimized graded concrete for structures; Complete testing to determine limits for the variation of aggregate gradations and changes needed in the current ODOT specification; Work with contractors to produce optimized graded concrete for structures to determine field performance; Produce specifications, design protocols and pay factors to ensure high quality optimized graded concrete is produced for Oklahoma's structures.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Tyler Ley, Bruce Russell

Shrinkage Induced Deformation in Steel Bridges Made Composite with Concrete Deck Slabs
Some of Oklahoma's re-constructed bridges have experienced decks deflecting downward more than projections anticipated. One suggestion is that the excessive deflections were caused by drying shrinkage of concrete. Other considerations could include errors in design, errors in the computation of deflections, or unexpected deformations of the forms, framing systems, or screed rails that supported the bridge decks during casting. Project objectives are to identify the causes for the excessive deflections in steel girder bridges made composite with concrete deck slabs and to develop design and construction method recommendations that will mitigate future problems associated with excessive deflections in these bridges.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Bruce Russell, Tyler Ley

Energy Dissipation in Thirty-foot Broken-Back Culverts Using Laboratory Models
This project will investigate a vertical drop of 30 feet that may result in effective energy dissipation and consequently minimum scour downstream of broken-back culverts. Findings will be directly applicable in the design of broken-back culverts to be retrofitted or reconstructed in the field. A survey of existing broken-back culverts indicates that a range of culverts exists from 6 to 30 feet. This project represents a continuation of four previous projects in which 6, 12, 18, and 24 foot drops were studied. This project will study dissipation efficiency and appurtenances design for 30 foot drops using laboratory scale modeling techniques.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PD: Avdhesh K. Tyagi

Surface and Airborne Monitoring Technology for Detecting Geologic Leakage in a CO2-Enhanced Oil Recovery Pilot, Anadarko Basin, Texas
OSU, with the cooperation of the Southwest Regional Carbon Sequestration Partnership (SWP), will develop and implement new near-surface and airborne monitoring technologies. The research will focus on the design and deployment of a dense grid of shallow subsurface and surface sensors in combination with low-altitude airborne detection of CO_2 and CH_4. These technologies will be deployed in the Farnsworth Oil Unit in the Anadarko Basin of the northeastern Texas panhandle, where the SWP and Chaparral Energy, LLC, are conducting CO_2-enhanced oil recovery experiments.
Sponsor: Department of Energy
PI/PDs: Tyler Ley

Chemical Engineering: Peter Clark
MAE: Jamey Jacob, Girish Chowdhary
College of Arts & Sciences: Jack Pashin, Nicholas Materer

Biology and Engineering for a Sustainable Tomorrow
This program is part of the Oklahoma State Regents for Higher Education's Summer Academies for Mathematics, Science, & Multidisciplinary Studies. The program will introduce the importance of biology and engineering in everyday life and will expose students to the future technologies that exist at their interface. Students will participate in design and experimentation involving critical issues that rely on both science and engineering, including water quality, renewable energy development, ecosystem balance, and environmental remediation. The academy will host 50 students per year at Oklahoma State University during two different summer sessions.
Sponsor: Oklahoma State Regents for Higher Education
PI/PDs: Gregory G. Wilber
Division of Agricultural Sciences & Natural Resources: Danielle Bellmer, G. Kakani

Collaborative Research: Coupling System Chemistry and Time-Dependent Deformation of Cementitious Materials through Evolving Thermodynamic States
The primary objective of this project is to develop a fundamental thermodynamic model framework that links evolving system chemistry and mechanics of cementitious materials, and to implement the model through a computational method that predicts the fully coupled evolution of microstructure and viscoelastic/viscoplastic properties of the materials. Any stress induced changes to the material microstructure – and resulting time-dependent deformation – will be predicted by the model. In synergy with the fundamental modeling, novel experiments utilizing time-stepping micro-computed tomography of stressed specimens will be performed to verify and quantify the interconnection between chemistry and mechanics through phase dissolution in cementitious materials.
Sponsor: National Science Foundation
PI/PD: Tyler Ley

Pavement Condition Survey Evaluation for UT Austin
The OSU team will drive the data collection vehicle to areas near Austin, Texas to collect pavement condition data in 3D at the beginning of the project. The data will be processed by the OSU team and the results, per TxDOT and UT requirements, will be submitted to the UT Austin team within the project timeframe.
Sponsor: University of Texas for the Texas Department of Transportation
PI/PD: Kelvin Wang

Investigation of Optimized Graded Concrete for Oklahoma – Phase 1
To provide ODOT guidance for acceptable variance in aggregate gradation before changes to a concrete mixture design should be made, the following will be completed: 1) Review specifications from other DOTs that deal with optimized graded concrete, 2) Complete laboratory testing to determine limits for variation of aggregate gradations and changes needed in ODOT specification, 3) Work with contractors producing optimized graded concrete for ODOT to determine typical variation in gradations and performance of mixtures, 4) Use information to produce specifications, design protocols and pay factors to ensure high quality optimized graded concrete is obtained and produced for Oklahoma's roadways.
Sponsor: Oklahoma Transportation Center for the Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Tyler Ley, Bruce Russell

Evaluation of the Enhanced Integrated Climatic Model for Modulus-Based Construction Specifications for Oklahoma Pavements
The performance specifications of pavements should be based on the short- and long-term behavior of unbound materials in terms of the principals of unsaturated soil mechanics and seasonal variation of material properties. The Enhanced Integrated Climatic Model (EICM) plays

an important role in defining the pavement materials properties used in the design guide. The proposed study will help determine the appropriateness of the EICM for the Oklahoma climatic conditions. This study will lead to the estimation of site specific variation in environmental factors that are used in predicting seasonal variation and long-term resilient modulus of unbound materials.
Sponsor: Oklahoma Transportation Center for the Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Rifat Bulut
Electrical and Computer Engineering: Qi Cheng
University of Oklahoma: K.K. Muraleetharan, M. Zaman

Drying Shrinkage Problems in High PI Subgrade Soils
Longitudinal cracking in pavements due to drying shrinkage of high PI subgrade clays has been a problem in Oklahoma. This research will evaluate the current Enhanced Integrated Climatic Model of the Mechanistic-Empirical Pavement Design Guide for analyzing the moisture regimes underneath the pavement. The formations and network of the shrinkage cracks will be investigated in the light of unsaturated soil mechanics. The study will include laboratory soil testing, field forensic investigation of problem sites, and modeling. The research will lead to practical analyses and recommendations for design of pavements on potentially shrinking clay soils.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Rifat Bulut
University of Oklahoma: M. Zaman

Distress Modeling for DARWin-ME, Phase I
The project is to investigate data needs for distress models in the new DARWin-ME (the acronym for pavement Design, Analysis and Rehabilitation for Windows), based on past ODOT research work to establish a workflow in using local level data sets on cracking, rutting, and roughness for DARWin-ME prediction models, and to assist ODOT in implementing DARWin-ME in the next decade as part of ODOT's long-term plan in studying and deploying DARWin-ME in a production environment.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Kelvin Wang, Stephen A. Cross

The Effects of Soil Suction on Shallow Slope Stability
The study will involve laboratory testing of soil suction and unsaturated soil moisture diffusivity coefficient measurements. The team will collect soil specimens with the help of ODOT personnel from sites where shallow landslides have already occurred. The research team in collaboration with ODOT engineers will decide on the number of tests for suction and diffusion parameter measurements. The Shelby tube size soil specimens will be sampled from the sites and wrapped against any moisture loss or gain, and will be delivered to laboratory for testing. The OSU team will help OU researchers conduct field investigations, soil sampling, and data analysis.
Sponsor: University of Oklahoma for the Oklahoma Transportation Center for the Oklahoma Dept. of Transportation for the Federal Highway Administration
PI/PD: Rifat Bulut

Develop Draft Chip Seal Cover Aggregate Specifications Based on Aggregate Imaging System (AIMS) Angularity, Shape and Texture Test Results
The study will develop draft chip seal specifications for Oklahoma that are not only connected to aggregate gradations and hardness but also address aggregate shape and texture in a quantitative manner. The project addresses aggregate-binder compatibility through cohesion and adhesion properties evaluated by surface free energy measurements. OSU will work with OU in selection of aggregates and binder and will evaluate aggregate-binder compatibility through evaluation of surface free energy and cohesion and adhesion properties. OSU will perform surface energy measurements on aggregate and binder materials using the sessile drop device, as well as measurements of the aggregates coated with binder.

Sponsor: University of Oklahoma for the Oklahoma Department of Transportation
PI/PD: Rifat Bulut

Data Preparation for Implementing DARWin-ME
The primary objective of the study is to establish a workflow for the Arkansas State Highway & Transportation Department (AHTD) to start implementing DARWin-ME for production and to develop relevant technologies so that positive impacts of DARWin-ME will be fully exploited in pavement design, management, materials, construction, and traffic data collection. The long-term impact of this and other follow-up studies will be the establishment of a database infrastructure to support the entire pavement engineering activities of AHTD including traffic, materials, construction, pavement management, and others.
Sponsor: University of Arkansas for the Arkansas State Highway and Transportation Department
PI/PD: Kelvin Wang

Development and Implementation of a Mechanistic and Empirical Pavement Design Guide (MEPDG) for Rigid Pavements – Phase II
There are great advantages in the design of infrastructure if the design procedures are based on mechanisms and variables that determine the performance of the element in service. The Oklahoma Department of Transportation (ODOT) is investigating implementation of the mechanistic and empirical pavement design guide MEPDG to accomplish this, but the designs would benefit from using material inputs that are typical of those used in ODOT construction projects. This project will help determine inputs for the MEPDG that are representative of Oklahoma materials, construction methods, and weather. This will improve the economy, durability and performance of rigid pavements in Oklahoma.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PD: Tyler Ley

3D Laser Imaging for ODOT Interstate Network at True 1-mm Resolution
With 3D image data representing actual pavement surface, it is possible to create a true representation of pavement surface at 1mm resolution to be used as input data for various condition evaluations and safety analysis. Objectives are 1) generating geographically true and complete virtual pavement surfaces with an Inertial Measurement Unit at 1mm resolution for the ODOT *interstate* network and SH 51 from I-35 to Sand Springs, 2) providing solutions for automated evaluation of pavement surface including cracking, rutting, faulting, and pavement macro-texture, cross-slope, and roadway geometric data, 3) providing workstation with monitors and software programs for providing the solutions.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Kelvin Wang, Tyler Ley

Energy Dissipation in Twelve-foot Broken-Back Culverts Using Laboratory Models
The object of this project is to develop a methodology to analyze broken-back culverts in Oklahoma such that the energy is mostly dissipated within the culverts or downstream of the culverts in order to minimize the degradation downstream. The project will investigate a vertical drop of 12 feet that may result in effective energy dissipation and consequently minimum scour downstream of broken-back culverts. Culvert dimensions and hydraulic parameters for scale models are provided by the Bridge Division of ODOT.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PD: Avdhesh K. Tyagi

Assessing Time to Deficiency for Highway Bridge Superstructures
Research is needed to assess the overall impact of a bridge's material type on its age at the time it is determined to be deficient as well as the financial effect of maintenance and rehabilitation costs. The goal of the study is to assess how long it takes for concrete, pre-stressed concrete, and steel bridge superstructures to be rated as deficient in the state of Oklahoma. The following research objectives will be pursued: 1) Evaluate time to deficiency for each bridge type, and 2) Develop deterioration time to deficiency models for each bridge type.

Sponsor: American Institute of Steel Construction LLC
PI/PD: Phil Lewis

Extending the Usage of High Volume Fly Ash in Concrete
A method developed by WR Grace to accelerate the strength gain of HVFA concrete involves submerging fly ash in a water and admixture solution for several hours. Remaining solids are strained from the solution and used as a powder admixture in the concrete mixture. Grace has shown the validity of this technique on a handful of materials with internal testing. More work is needed to mechanistically understand why this treatment is able to improve the performance in concrete. Using advanced particle analysis, the OSU research team will focus on understanding the mechanism for the improvement in the fly ash.
Sponsor: The Curators of the University of Missouri on behalf of Missouri University of Science and Technology
PI/PD: Tyler Ley

Sampling Analysis and Evaluation of Water Depth and Water Quality in Enid Wellfields for Two Seasons – Phase II
Recommendations from a recent investigation in a groundwater vulnerability assessment plan are to collect and analyze data on water depth, nitrate and TDS distribution in Enid wellfields. The current research proposes to collect and analyze water depth data and water quality data on nitrates and total dissolved solid for summer and winter seasons.
Sponsor: City of Enid
PI/PDs: Avdhesh K. Tyagi, Gregory G. Wilber

Mechanisms of Hydration and Setting of Ordinary Portland Cement in Simple and Complex Systems
For this proposal OSU will be responsible for completing laboratory scale micro X-ray computed tomography (mCT), focused beam X-ray Fluorescence (mXRF), and focused beam X-ray diffraction (mXRD) on Portland cement and combinations of Portland cement with mineral and chemical admixtures. In addition, several tests will be completed with these same techniques at synchrotrons facilities. The experiments will focus on investigating the change in the hydration of different clinker phases in different soak solutions that simulate the pore solution chemistry of hydrating Portland cement.
Sponsor: Trustees of Princeton University for the Federal Highway Administration
PI/PDs: Tyler Ley
Mechanical and Aerospace Engineering: Jay C. Hanan

Static Tests of Parallel Wire Cables
For this project, testing will be completed for Wilolamb construction on their patented pre-manufactured parallel wire cables. As part of this project, three sets of tests will be completed. These will consist of testing individual wires (5 to 10 tests), 7 wire bundles (5 to 7 different tests), and 100 wire bundles (3 tests). These specimens will be loaded to failure and their stress strain relationship will be found. To do these tests unique grips will be made for each of the tests. These grips will be designed so that they are fatigue resistant for possible future testing.
Sponsor: Wilolamb International Corporation
PI/PDs: Tyler Ley, Robert N. Emerson

CAREER: Increasing the Effectiveness of Mineral Additives in Concrete through Novel Particle Characterization
The aims of this project are 1) develop a strong research program focused on increasing the use of supplementary cementitious materials (SCMs) as construction binders in concrete through new levels of chemical characterization, 2) involve underrepresented undergraduates in research and mentoring, and 3) increase awareness of science and engineering by underrepresented elementary students in low income schools.
Sponsor: National Science Foundation
PI/PD: Tyler Ley

Analysis of Class F Fly Ashes
Two different class F fly ash samples will be investigated with the automated SEM, which provides the chemical composition versus the particle size. A clustering analysis can be used on the data to chemically group the particles. This technique is capable of rapidly comparing the chemistry of the small and large particles. These comparisons can also be made between different types of fly ash particles. We will also use data clustering techniques to group the data. That information can then be used to decide what the different chemical groups are and to look at their size range.
Sponsor: W.R. Grace & Co. – Conn.
PI/PD: Tyler Ley

Traffic and Data Preparation for AASHTO Darwin-ME Analysis and Design
The objective of the Prep-ME software is to assist state DOTs in the data preparation and improve the management and workflow of the DARWin-ME input data to make the DARWin-ME software more accessible, and input data sets of high quality. Additionally, it can be used as a tool for calibrating and implementing the DARWin-ME. For production use, the Prep-ME software in its current form needs to be enhanced to improve speed, usability, functionality and stability. The team will take advantage of four years' experience working with the MEPDG and Prep-ME to efficiently implement necessary enhancements for the DARWin-ME software program.
Sponsor: Louisiana Transportation Research Center for the Louisiana Dept. of Transportation
PI/PD: Kelvin Wang

Safety Culture of the US Transit Industry
The objective of the proposed work is to assist the FTA's Office of Transit Safety and Security in assessing and enhancing the existing safety culture of transit agencies. The anticipated results include presentations in technical conferences and a survey of the safety culture of transit agencies.
Sponsor: University of Oklahoma for the Federal Transit Administration
PI/PD: M.S. Ahmed

Investigating the Use of Algaecides for Removal of Geosmin and Methylisoborneol
Drinking water treatment utilities face a number of significant challenges. Among these is the emergence of public concerns regarding a variety of trace-level organic compounds. These include compounds released by algae and aquatic microbes (such as geosmin, 2-methylisoborneol, and cyanotoxins), pharmaceutical and personal care products (PPCPs, which include hormones, antibiotics, analgesics, surfactants, and other chemicals) and other organic substances. Given the concerns about these contaminants, efforts are underway to better understand how these compounds can be efficiently controlled. This collaborative research project will contribute significantly to this effort, focusing on the chemical control of these trace contaminants.
Sponsor: Water Research Foundation
PI/PDs: Gregory G. Wilber, Dee Ann Sanders, John N. Veenstra

Electrical and Computer Engineering

Development of an endoscopic position-sensitive beta-radiation-detection system toward in situ positron emission topography for bladder cancer surveillance
This research is specific to bladder cancer. The goal of this research is to develop an endoscopic imaging technology that combines white-light-cystoscopy (WLC) with intravesical detection of positron (beta+) -labeled deoxyglucose (DG), the standard contrast agent for malignant metabolism, for more effective outpatient surveillance and treatment management of bladder cancer. The initial stage of this research aims to develop an endoscopic position sensitive beta-radiation-detection method for in situ detection of positron emission. This research also aims to

evaluate if endoscopic detection resolves positron-emission at a higher spatial resolution or at a lower dose than is possible by the whole-body PET.
Sponsor: University of Oklahoma
PI/PD: Daqing Piao

STIR: High Performance Thermoelectric Cryo-coolers based on II-VI Low Dimensional Structures
This project targets development of a high-performance, thermoelectric (TE) cooler with ZT > 3; which is fabricated using low-dimensional structures or “superlattices” (SL) constructed from Group II-VI semiconductors, i.e. HgCdSe (MCS) and HgCdTe (MCT). This technology could be immediately used in high-performance, infrared (IR) imaging systems of interest to astronomy, medical imaging, search-and-rescue and the military. Monolithic integration with IIVI IR sensors is possible since the proposed cooler is made from similar materials. This integration will extend component lifetime and provide a very fast cooling response due to the small thermal mass of the cooler and excellent thermal contact.
Sponsor: United States Army Research Office, Amethyst Research Incorporated
PI/PD: D. Vashaee

Digital Micro Neural Sensing with Inductive Harvesting
The goals are: 1) Transition the existing MNI RFID functional blocks to the UMC180nm CMOS; 2) develop and integrate a digital 100,000 MicroNeural Interface (MNI) based on inductive coupled powered and Megabit optical communications. Objectives include: 1) Convert the existing IBM CMOS MNI to a simplified version (without ADC) supporting the "time-stamped" mode only for use with an optical LAN communications interface. 2) Design of a COTs based optical based communications interface; 3) Validate neural bandpass amplifier and in situ harvesting; 4) Migration of the validated l80nm IBM MNI blocks will result in two 180nm UMC fabrication runs.
Sponsor: University of Texas at Dallas
PI/PD: Chris Hutchens

Planning Grant: I/UCRC for Systems Electromagnetic Compatibility
OSU’s Robust Electromagnetic Field Testing and Simulation Lab will engage industry partners to identify and solve problems that exist due to electromagnetic interference at a system level. The problems will extend from a simply enclosed cavity analysis to fully functional integrated platforms. Examples of the problems include predicting emissions from printed circuit boards radiating inside an enclosed cavity with apertures, validating the performance of different absorber materials placed inside cavities with complex operational electronics via simulation and measurements, and electromagnetic compatibility problems while performing system integration in unmanned aerial systems. This work complements the work at the center at MS&T.
Sponsor: National Science Foundation
PI/PDs: Chuck Bunting, Vignesh Rajamani, James West

Trans-Bronchial Spectral Optical Tomography for Imaging Lung Lesions Distant from Bronchial Airway
The broad objective of this project is to develop a pre- or intra-operatively compatible optical imaging technology for the detection and image-guided intervention of pulmonary nodules located within centimeters depth from the bronchial airway. The near term objective of this project is to demonstrate the technical feasibility of *ex vivo* trans-bronchial spectral diffuse optical tomography in localizing emulated lung nodules of which the size, depth, and tissue contrast have clinical implications.
Sponsor: Intuitive Surgical Operations, Inc
PI/PDs: D. Piao
CVHS: Bartels

Measuring the Shielding Effectiveness of Surrogate Samples
Reverberation Chambers are used to measure the Shielding Effectiveness (SE) of different materials because it exposes the material to a uniform and isotropic field from multiple angles of

incidence. In this project, the SE of surrogate samples will be measured using the nested reverberation chamber measurement approach. The SE measurement is based on the comparison of the electromagnetic power without the sample on the secondary chamber wall to the electromagnetic power when the sample is present on the wall of the secondary chamber. The received power will be measured over the frequency range of 700 MHz to 8 GHz.
Sponsor: Applied Research Associates, Inc.
PI/PDs: Vignesh Rajamani, Chuck Bunting

Development of a Soft IP Core for JESD204B Standard with Validation Synthesis in 180 nm CMOS
This project entails the design/development of Verilog code for the JESD204B standard. Design/development and verification will take approximately 9 months, in which Oklahoma State University's MSVLSI Design Group will convert the existing JESD204B standard into functional Verilog code with electrically compatible 1 V operation using a low power digital CMOS library. The effort deliverable will be IP Core Verilog Code with simulation/verification testbench.
Sponsor: EXtreme ENvironment ELectronics, LLC (EXENEL)
PI/PD: Keith Teague

High Coefficient of Performance Semiconductor and Metal Superlattice-Based Thermoelectric Coolers for Infrared Focal Plane Arrays Cooling
The first objective is to optimize the design of Hg1-xCdxTe/Hg1-yCdyTe SLs to minimize the thermal conductivity and maximize electrical conductivity and thermoelectric power within constraints imposed by material properties, MBE growth and device fabrication. The calculations will focus on Hg0.8Cd0.2Te/Hg0.2Cd0.8Te SLs, which have large barrier heights. The second objective is to measure the ZT and COP characteristics of the devices and compare the measured results with those predicted by modeling.
Sponsor: EPIR Technologies, Inc.
PI/PD: D. Vashaee

Embedded Computer Systems Curriculum Development with Intel Atom based DE2i-150 FPGA Development Kit
The project integrates Intel ® Atom-based embedded systems into lab exercises in the Embedded Computer Systems course. The six lab exercises and the final project will focus on a mobile robot constructed from the iRobot Create. The lab exercises will focus on the different aspects of building this intelligent mobile robot, such as communication (serial communication and TCP/IP networking), sensor interfacing (IR, Webcam, Kinect RGB D), multi-threaded programming for reactive control, etc. The final project will be a robot competition. Each group of students will design an intelligent mobile robot with the available sensors to accomplish some real world tasks.
Sponsor: Intel Corporation
PI/PD: Weihua Sheng

Thermoelectric energy harvesting devices for structural components
The product of this project will be stabilized, thick film, nanostructured thermoelectric energy harvesting devices with high figure of merit based on bismuth telluride alloys that can be attached to any structural component to take advantage of the temperature difference between any two surfaces of the structure in service and generate power from waste heat. Attachment of thick film thermoelectric devices to structural components is a simpler and cost-effective method and an enabling technology compared to thin film thermoelectric devices.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PDs: Daryoosh Vashaee
Materials Science and Engineering: Ranji Vaidyanathan

Scalable Rapid Solar Hydrogen Production via Photo-Bio-Chemical Hydrolysis
In this project, scientists from the Helmerich Advanced Technology Research Center combine their expertise to implement a bio-mimetic photo-thermal electrolyzer that, if successful, can result in a significant leap forward in solar hydrogen technology. The approach relies on Drs. Vashaee

and Tayebi's recent discovery that certain hybrid organic/inorganic particles are capable of splitting water molecules when the particles are dispersed in water. The system consists of semiconducting particles coated with their recently synthesized bio-compatible additives. This concept has the potential to place Oklahoma in a position to contribute effectively in the potentially large market of solar hydrogen industry.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PDs: D. Vashaee, J. Krasinski
Materials Science and Engineering: Lobat Tayebi
Graduate College: Ken Ede

Evaluation of the Enhanced Integrated Climatic Model for Modulus-Based Construction Specification for Oklahoma Pavements
The performance specifications of pavements should be based on the short- and long-term behavior of unbound materials in terms of the principals of unsaturated soil mechanics and seasonal variation of material properties. The Enhanced Integrated Climatic Model (EICM) plays an important role in defining the pavement materials properties used in the design guide. The research will help determine the appropriateness of the EICM for the Oklahoma climatic conditions. This study will lead to the estimation of site specific variation in environmental factors that are used in predicting seasonal variation and long-term resilient modulus of unbound materials.
Sponsor: Oklahoma Transportation Center for the Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Qi Cheng
Civil and Environmental Engineering: Rifat Bulut
University of Oklahoma: K.K. Muraleetharan, M. Zaman

Photonic-needle assessment of hepatic steatosis
The goal is to establish a rapid, objective, and minimally-invasive deep-tissue sensing technology to quantify the intensity of hepatic steatosis and to differentiate macro-steatosis from micro-steatosis of the donor-liver, assessments vital to the outcome of many liver transplants. The objective is to develop a method based on an ultra-fine fiber needle that combines near-infrared reflectance spectroscopy with low coherence interferometry, and to test the sensitivity and specificity of this method in quantifying the volume-content as well as the size-distribution of fat vacuolae in phantom and animal models of hepatic steatosis.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PDs: Daquing Piao
Center for Veterinary Health Sciences: K.E. Bartels, J.W. Ritchey, G.R. Holyoak

SHB: Type I (EXP): Context-aware Ubiquitous Human Health Monitoring
The project objective is to develop a ubiquitous human health monitoring system that collects not only vital signs, but also daily activities and environmental context of a human subject in an everyday life setting. From these collected data, higher level knowledge such as anomalies will be extracted to assist in health evaluation, medical diagnosis/prognosis or healthcare delivery. Such a system is called a Smart Health Monitoring (SmartMon) System, which will help realize ubiquitous health monitoring and healthcare delivery. The major research tasks focus on the development and evaluation of the proposed hardware platform and theoretical framework of the SmartMon system.
Sponsor: National Science Foundation
PI/PDs: Weihua Sheng, Qi Cheng

Collaborative Research: Manipulating Terahertz Waves Using Three-Dimensional Metamaterials
THz waves have proven challenging to control due to a paucity of electromagnetic materials with an effective response at THz frequencies. This "THz gap" results in a great impediment for the development of functional THz optical components and systems. In view of these challenges, the objective is to develop a synergetic approach that incorporates Transformation Optics (TO) theory

the tunable metamaterials design under effective media approximation, the scalable 3D fabrication technologies, and the experimental validation to explore a range of novel Terahertz optical components: 1) TO-enabled aberration free THz imaging lens, and 2) an integrated THz lab-on-chip sensing platform.
Sponsor: National Science Foundation
PI/PDs: Weili Zhang, John O'Hara

Collaborative Research: CI-ADDO-NEW: An Open Memory Array Compiler Framework to Support Devices, Circuits and Systems Research
The objective is to enable memory and computer system research by creating an open-source memory compiler infrastructure called Open-RAM, to be used by architects and system designers, circuits/device researchers, and CAD researchers. No current memory compilers allow researchers to experiment from the system to device level using real, synthesized memories. The PI intends to: generate single and multi-port RAM arrays and register files; provide detailed specification for portability and extensibility to future processes; perform automated timing, power, and yield characterization; be interoperable with common academic and commercial tool flows; verify correctness of memories, methodology, and characterization in two prototype chips.
Sponsor: National Science Foundation
PI/PD: James E. Stine

A Tool for Posture Assessment and Personalized Training
This project seeks an integrated multi-sensor approach to develop a comprehensive yet economic tool for functional and dynamic posture/gait assessment, which is expected to surpass existing ones by providing accurate and reliable motion measurement as well as supporting personalized in-home training via serious health games. The proposed research is translational in the sense that it incorporates the most recent advancements in sensor technology and tends to bridge the gap between lab and clinic.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PD: Guoliang Fan

GOALI: Lateral-Mode MEMS Filter Arrays on Ultrananocrystalline Diamond for Multi-Band Communication
One of the key bottlenecks in the progress of MEMS filters is the substantially lower coupling coefficient (usually less than 1%) compared to that of existing technologies (e.g. surface acoustic wave), which sets a hard limit on the filter insertion loss (IL) and bandwidth (BW). This research is expected to overcome these limitations and establish lateral-mode MEMS filters as a viable solution for the implementation of emerging multi-band transceivers. The successful demonstration of low-loss thin-film piezoelectric-on-UNCD filters proposed in this work will be a crucial step towards the realization of multi-band RF MEMS filter platforms.
Sponsor: National Science Foundation
PI/PD: R. Abdolvand

RF Physical Layer Authentication via Watermarking
The purpose of this project is to test the viability of several physical layer authentication schemes in both simulated and real-world scenarios in order to inform further development of those methods that may be of interest to the U.S. Navy. This project will perform testing of the impact of these schemes on both watermark aware & non-watermark aware receivers. A WACR should be able to reliably process a physical layer authentication signal. Ideally the performance of a standard non-WACR receiver should not be degraded by that same signal and the presence of the authentication signal should remain unknown.
Sponsor: Exelis, Inc. for Department of Defense Naval Research Laboratory
PI/PDs: George Scheets, Keith A. Teague

Nano-Engineered Infrared Sensors
In this proposal, novel fabrication techniques are combined with application of material with enhanced thermal properties in an optimized pixel structure which potentially enables

thermoelectric IR imaging units with unprecedented performance. The proposed devices are expected to significantly close the gap between the two IR imaging techniques (thermal and photon detection) while offering significant advantages in size, cost and power consumption.
Sponsor: Amethyst Research, Inc. for Oklahoma Economic Development Generating Excellence (EDGE)
PI/PD: R. Abdolvand

Synthetic Aperture Radar Processing for Change Detection
The work addresses the processing of synthetic aperture radar imagery to detect changes of a land environment over time. The work is associated with coherent imaging radar systems developed by Sandia National Laboratories. The researcher will investigate automated methods to apply accurate phase-error autofocus functions to all pixels in radar images. The researcher will also investigate image-registration algorithms used in determining the coherent change between images.
Sponsor: Sandia National Laboratories for U.S. Department of Energy
PI/PD: James West

Exploration and Evaluation of Nanometer Low-Power Multi-Core VLSI Computer Architectures
As the complexity of computer architectures increases, engineers resort to efficient streams of computer programs or design flows to accomplish the task of producing Very Large Scale Integration (VLSI) architectures. The research emphasis in this proposal is placed on designing a complex VLSI multi-core architecture using an elaborate design flow or sequence of steps. The major concern of this design flow is whether this project can create a design which can be implemented that outperforms other similar architectures in terms of propagation delay and area consumption, yet still produces a significant savings in terms of the amount of power consumed.
Sponsor: United States Air Force
PI/PD: James E. Stine

Time-domain Spectroscopy Characterization of Novel Terahertz Devices and Structures
Characterizations (testing) of terahertz components and devices will be carried out, including transmitter and receiver modules and novel subwavelength terahertz structures using terahertz time-domain spectroscopy for Petawave Networks, Inc., Lenexa, Kansas. Within this project, only testing will be done. Equipment to be used includes: Terahertz transmission spectroscopy system; Terahertz reflection spectroscopy system; Terahertz cryo spectroscopy system; Coherent Verdi pumping laser (532 nm, 6 W); and KM Labs Ti:sapphire femtosecond laser (800 nm, 500 mW, 26 fs). Dr. Weili Zhang will oversee the terahertz testing experiments. Such testing services are not commercially available to the sponsor, Petawave Networks, Inc.
Sponsor: Petawave Networks, Inc.
PI/PD: Weili Zhang

Services Necessary in Support of LANL Project: "Harnessing Nonlinearity for Transformative Metamaterial Technology"
This research proposes to develop electromagnetic models and device designs. OSU will provide Los Alamos National Laboratory (LANL) with theoretical models and numerical simulation work designed to enhance understanding of nonlinear metamaterials. This will involve development of a modal analysis software tool whereby nonlinear metamaterial resonator behavior is determined at an "atomic" level, in contrast to current metamaterial analysis methods. OSU will work with the LANL team to: develop the electromagnetic theory; implement the theory in software; assist in validation of the theory/software in conjunction with LANL experimental efforts; and collaborate with the LANL team to develop the electromagnetic source.
Sponsor: Los Alamos National Security, LLC for the Department of Energy National Nuclear Security Administration
PI/PD: Weili Zhang

CAREER: Content-Based Image and Video Coding Using Higher-Level Models of Human Vision
Effective image and video coding methods capitalize on low-level aspects of the human visual system (HVS). A strategy is to place the errors into regions which can better hide compression artifacts, an approach which can be guided by computational models of early/low-level HVS processing. The investigator will research how compression artifacts influence the HVS's ability to process and interpret images and video. Three areas are investigated: new models of visual masking which take into account image recognition, appearance-preserving strategies of data quantization, and analysis and quantization strategies which honor rules of visual cognition derived from quality-rating experiments coupled with eye-tracking.
Sponsor: National Science Foundation
PI/PD: Damon Chandler

CAREER: A Generalized Compressive Sensing Approach to Data Acquisition and Ad-Hoc Sensor Networking
The objective of this project is to advance the field of compressive sensing and broaden its scope into a multitude of new applications, such as ad hoc networking, by significantly enhancing the efficiency through the utilization of problem-specific signals and systems properties. The proposed approach is to design a novel rateless-coding-inspired generalized compressive sensing (GCS) framework and to integrate it into different stages of sensing, information processing, and cross-layer designs in the network design processes.
Sponsor: National Science Foundation
PI/PD: N. Rahnavard

Enabling Battlefield Situational Awareness through a Cooperative and Intelligent Video Sensor Network
The project objective is to provide the Army with anytime, anywhere, rapid video surveillance capabilities by transforming the state-of-the-art in wireless video sensor networks (WVSNs). A WVSN requires more battery power and more communication bandwidth than is realistically available. By automatically identifying the most important regions of the video, and by stripping away irrelevant portions, we believe that it is possible to 1) reduce bandwidth requirements, 2) improve accuracy, and 3) facilitate autonomous system calibration. Thus, the proposed technique has the potential to simultaneously overcome the limitation of resources, meet the desire for easy system setup, and achieve high accuracy.
Sponsor: Oklahoma State Regents for Higher Education
PI/PDs: Damon Chandler, Qi Cheng, Weihua Sheng, Keith A. Teague

Challenges of Zinc-Specific Transrectal Fluorescence Tomography to Detect Prostate Cancer
The objective of this research is to develop a novel ionic-sensitivity prostate cancer imaging capability by utilizing zinc-based cancer biomarker to detect malignant prostate tissue with trans-rectal fluorescence diffuse optical tomography (FDOT). This training project will prepare the investigator for an academic career in computational analysis and instrumentation development important to prostate cancer diagnosis and therapy management, by investigating trans-rectal fluorescence diffuse optical tomography with zinc specificity.
Sponsor: United States Army Medical Research Acquisition Activity
PI/PD: Daqing Piao

New Methodologies for System-Level Electromagnetic Compatibility (EMC) Analysis of Electronic Systems
The project aims to formulate, implement and test methodologies for enabling enhanced EMI/EMC design of electronic systems. The CAD methodologies offer a generalized perspective of analyzing EMI coupling scenarios faced by engineers. The methodologies and framework are independent of computational tools or techniques. Instead, they provide ideas based on Artificial Neural Networks for integrating existing methods to handle problems of higher complexities, while reducing computational overhead. Study aims are to identify sensitive parameters in an EM

environment using statistical analysis, to decide, for a given EMI coupling scenario, whether deterministic tools are required in the overall analysis of electronic systems.
Sponsor: The University of Toledo for the National Science Foundation
PI/PD: Charles F. Bunting

(Energy Harvesting) Thermoelectric Nanocomposite Materials for Medium to High Temperature Range
In an aircraft there is a broad range of temperatures at different locations. Energy harvesting from low temperature regions suffers from the small thermodynamic limit set by Carnot efficiency. However, thermoelectric materials that can work efficiently in the medium to high temperature range will benefit from large Carnot efficiency. Despite recent developments in advanced thermoelectric materials, there is an apparent lack of materials that can work efficiently from 500 C to 900 C. The project objective is to develop efficient nanocomposite thermoelectric materials suitable for this entire range of temperature in a combined theoretical and experimental effort.
Sponsor: Air Force Office of Scientific Research
PI/PD: Daryoosh Vashaee

CIF: Small: Collaborative Research: Cooperative Sensing and Communications for Cognitive Radio Networks
The emerging cognitive radio network (CRN) technology has potential to solve what seems to be a spectrum crisis, by allowing the secondary (unlicensed) users to opportunistically and dynamically utilize the white spaces within the licensed bands, without causing harmful interference to the primary (licensed) users. Efficient design of CRNs is still in its infancy. This study addresses two components of a CRN: spectrum sensing and spectrum access and sharing. The project includes: 1) novel integrated signal processing and communication designs for data fusion in cooperative spectrum sensing, and 2) new communications and networking schemes based on a mutualistic cooperation paradigm.
Sponsor: National Science Foundation
PI/PD: N. Rahnavard

CSR: Small: Infrastructure-free Human Context Awareness with a Wearable Sensing and Computing System
Context is a very important and fundamental concept in pervasive computing, especially in wearable computing. The major objective of this project is to develop the fundamental theoretical framework and algorithms that realize human context awareness in an infrastructure-free fashion and validate them through physical experiments using a prototype body sensor network. The central problem that this project solves is the simultaneous tracking and activity recognition of a human subject in indoor environments by using wearable sensors and computers only. The underlying theoretical framework is developed based on novel dynamic Bayesian modeling and probabilistic reasoning.
Sponsor: National Science Foundation
PI/PD: Weihua Sheng

Control and Operation of Large-Scale Wind Farms in the Power System
OSU is responsible for: 1) Modeling of large-scale wind farms for power system operation: constructing mathematical models of large-scale wind farms for power system operation, 2) Assessing the efficacy and practicality of the controller developed by the OU group, aimed at seamlessly controlling both the active and reactive power outputs of large-scale wind farms in both the maximum power tracking and power regulation modes, 3) Derivation of dynamic output characteristics of large-scale wind farms: evaluating the dynamic output characteristics of large-scale wind farms, operating under the controller, 4) Facilitating collaboration between OU/OSU and power companies.
Sponsor: University of Oklahoma for the National Science Foundation
PI/PD: R.G. Ramakumar

CPS Small: A Unified Distributed Spatiotemporal Signal Processing Framework for Structural Health Monitoring
With advances in sensing technology, large numbers of *in situ* sensors can be deployed inside a structure for non-destructive health monitoring purposes. The project objective is to develop collaborative signal processing techniques by coupling spatial-temporal sensing data with physics-based and data-driven models by: investigating the feasibility of statistical modeling of dynamic structures to address the spatial and temporal correlation of sensing data; developing efficient distributed algorithms to ascertain whether a significant damage of a certain magnitude exists and its exact location; investigating how to enhance the network through the strategic placement of sensors; and addressing optimal sensor collaboration.
Sponsor: National Science Foundation
PI/PD: Qi Cheng

THz Surface Waves, Waveguide THz-TDS and the 2D-TEM Plane
This program explores fundamental optical physics and applications using far-infrared terahertz (THz) radiation. The PI has previously extended the concept and utility of parallel-plate waveguides to that of a much larger two-dimensional plane. Within this plane, two-dimensional quasi-optical elements have demonstrated THz guiding and diffraction. This project investigates optical physics with recently designed two-dimensional quasi-optical components with negative index of refraction. In addition, the program experimentally measures and theoretically studies the propagation of THz surface electromagnetic waves (plasmons) on planar subwavelength arrays of holes in thin metal films.
Sponsor: National Science Foundation
PI/PD: Daniel R. Grischkowsky

Fire Protection Publications

IFSTA – Study of Emergent Topics in Emergency Vehicle and Roadway Operations Safety for Law Enforcement and the Fire Service
This project responds to the Scope of Work for the *Study of Emergent Topics in Emergency Vehicle and Roadway Operations Safety for Law Enforcement and the Fire Service.* IFSTA will conduct all research associated with the plan of work. IFSTA will compile existing data available from government, trade industry, research, and educational sources. Actual vehicle crashes documented in the public domain, that the project is intended to prevent, will also be assessed. IFSTA will develop a summary and final report that will present the resulting information in a meaningful way and identify best practices.
Sponsor: United States Department of Homeland Security – Federal Emergency Management Agency
PI/PDs: Nancy J. Trench, M.A. Wieder

Fire Safety Solutions for Oklahomans with Disabilities 2013
The goal for Solutions 2013 is education that will improve the safety of Oklahomans with disabilities. To meet this goal, FPP will collaborate with Oklahoma ABLE Tech and provide technical support in two major projects: 1) Installation of specialized smoke alarms for individuals who are deaf or hard of hearing that reside in targeted areas of Oklahoma, and 2) Create two training courses for firefighters and Emergency Medical Technicians on how to serve Oklahomans with disabilities in fire prevention and safety.
Sponsor: Oklahoma Assistive Technology Foundation for the United States Department of Homeland Security – FEMA
PI/PD: Nancy J. Trench

Fire Service Training

Safety Cabinet Next Generation Design
Justrite Manufacturing Company, a leading producer of safety cabinets, is working with OSU to extend its product analysis and testing. The New Product Development Center (NPDC) and Fire Service Training (FST) at OSU will work with Justrite to engineer and test innovative concepts that will cement Justrite as the market leader in safety cabinet design and manufacture. NPDC and FST will provide modeling, analysis, and testing of new safety cabinet design concepts which will allow Justrite to meet and/or exceed the current legislative requirements and standards, as well as gain a competitive advantage in the marketplace.
Sponsor: Justrite Manufacturing Company
PI/PD: Ed Kirtley

National Fire Academy State Fire Training Grant
OSU's Fire Service Training will deliver a series of training programs in cooperation with the Federal Emergency Management Agency (FEMA) and the U.S. Fire Administration's National Fire Academy (NFA) to enhance the capabilities of the fire service in Oklahoma. Courses for Emergency Responders will be provided throughout the state in both conference settings as well as single course deliveries. The trainings will be provided in rural and metropolitan settings in an effort to bring the training to the responder locally.
Sponsor: Department of Homeland Security Federal Emergency Management Agency National Emergency Training Center
PI/PD: Ed Kirtley

Oklahoma Emergency Response Systems Stabilization and Improvement Revolving Grant
The project provides for regional educational opportunities for EMS personnel to ensure high quality training is available within easy driving distance for all Oklahoma rural EMS providers. The project also facilitates training courses for regional medical directors.
Sponsor: Oklahoma State Department of Health
PI/PD: Mike Duncan

State Homeland Security Program - Citizen Corp CERT Training Program
The Community Emergency Response Team (CERT) Program educates people about disaster preparedness for hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations. Using the training learned in the classroom and during exercises, CERT members can assist others in their neighborhood or workplace following an event when professional responders are not immediately available to help. CERT members also are encouraged to support emergency response agencies by taking a more active role in emergency preparedness projects in their community.
Sponsor: Oklahoma Office of Homeland Security
PI/PD: Steve George

Rescue Equipment for Training Trailer
The award was for the purchase of rescue equipment for a training trailer including items such as pulleys, rescue racks, straps, ropes, etc.
Sponsor: Oklahoma Office of Homeland Security
PI/PD: Caroline Reed

Industrial Engineering and Management

Collaborative Research: Risk-Averse Cluster Detection in Network Models of Bigdata Under Measurement Uncertainty
This project will establish theoretical and computational foundations that lead to polyhedral and probabilistic approaches for detecting low-diameter clusters in network models of social and

biological big-data that are subject to measurement errors and incomplete information. The proposed polyhedral study of the "k-club" cluster model is novel as it is the first nonhereditary graph property to be investigated in the polyhedral combinatorics literature. Conditional-value-at-risk-constrained k-club detection models in a random graph will be studied to produce risk-averse solutions. Sampling-free exact decomposition algorithms will be investigated that exploit the combinatorial structure of the sample space.
Sponsor: National Science Foundation
PI/PD: Baski Balasundaram

Real-Time Decision Support Systems for Healthcare and Public Health Sector Protection
The PIs will develop a preliminary systems requirement document for the development of the real-time decision support system (RTDSS) for the Louisville metro area and will collaborate with HPH and ESS sector personnel to refine the systems requirement document. Alternate methods for secure information exchange for medical surge capacity management will be developed. The team will develop spreadsheet-based, mixed-integer, linear programming models to determine the optimal location and quantities of stockpiles of vaccines, HPH protective gear, medical materials and other critical supplies needed during and immediately after a disease outbreak for the Louisville metro area.
Sponsor: University of Louisville Research Foundation, Inc. for the National Institute of Hometown Security, Inc. for the U.S. Department of Homeland Security
PI/PDs: Sunderesh Heragu, M. Kamath, C. DeYong

Customer Pairing Algorithm for GE
The PI will develop a near-optimal customer pairing model and a corresponding algorithm. The model will examine all shipments from a specific appliance distribution center and develop a transportation solution that combines the shipments such that the total travel distance is minimized without violating delivery date and other demand and trucking related constraints. Results from the first task will be used to perform extensive sensitivity analysis based on GE needs. A computer interface will be developed to allow GE personnel to enter parameters for the customer pairing program, and produce results that can be viewed in a user-friendly interface.
Sponsor: University of Louisville Research Foundation, Inc. for General Electric Company
PI/PD: Sunderesh Heragu

RFID Technology Center at the University of Louisville
Protocols and processes to store, track and trace individual parts as they are removed from end items that are under repair and sent to various shops for different types of repair will be developed. A protocol for utilizing tag and trace data coming from auto ID systems and DLA's supply systems data to assist in the load building of out bound freight will be developed. A protocol and process for order fulfillment at one of DLA's Strategic Distribution Platforms will be developed, tested and piloted by the end of 18 months.
Sponsor: University of Louisville Research Foundation, Inc. for the Defense Logistics Agency
PI/PDs: Sunderesh Heragu, M. Kamath, Baski Balasundaram, Tieming Liu

Wireless Sensor Networks in Oil and Gas Production Environment
The project will involve developing a wireless sensor unit. A demonstration of the installed sensors will be held at an oil field. The performance of the device will be assessed, followed by installation and testing of the sensors in the field.
Sponsor: MySource, LLC
PI/PD: Satish Bukkapatnam

Black Ice Detection and Road Closure Control System for Oklahoma
A major obstacle to widely implement the black ice detection and warning system is that current sensors specific for black ice detection are too expensive. Typically they cost more than $1,000 per unit. So, it is economically impractical to adopt existing ice sensors for black ice detection across Oklahoma. To tackle this challenge, an objective of this project is to develop a functionally competent and economically feasible sensing system for black-ice detection by using regular

temperature, humidity, and light sensors, which are much more viable in terms of cost with less than $100 per unit, to replace expensive ice sensors.
Sponsor: Oklahoma Department of Transportation for the Federal Highway Administration
PI/PDs: Tieming Liu, Satish Bukkapatnam
Arts & Sciences: Hongbo Yu
Division of Agricultural Sciences and Natural Resources: Ning Wang
University of Oklahoma: Yang Hong, Jeff Basara

A Recurrent Nested Bayesian Non-parametric Model for Real Time Monitoring of Pattern Dependent Surface Topography in Chemical Mechanical Planarization (CMP) Operations
The project will address critical quality assurance issues facing the semiconductor industry. The PIs propose a new approach to effectively capture the underlying nonlinear and nonstationary evolution of the multi-dimensional process states in Chemical Mechanical Planarization (CMP) to meet the following objectives: 1) connecting online sensor features with evolution of pattern-dependent surface topography, such as dishing/erosion; and 2) investigating the strategy in real-time wafer surface topography detection/alleviation for CMP process quality control. The PIs will collaborate closely with industry partners to implement and validate these objectives.
Sponsor: National Science Foundation
PI/PDs: Z. Kong, S.T.S. Bukkapatnam

Collaborative Research: US IGNITE: EAGER: Exploring Ultrafast Networks for Training Surgeons Using Virtual Reality Based Environments
The goal is to develop and demonstrate new virtual reality based applications for training medical residents and doctors in microsurgical techniques using the Global Environment for Network Innovations (GENI) infrastructure and capabilities. Surgical training is usually limited to face-to-face situations where the expert surgeon and trainees are in the same room performing intricate procedures. Since experts in microsurgical techniques are not available in most parts of the country, such training is not readily available to many medical students. The virtual reality based surgical training application will address this challenge by eliminating the need for experts and trainees to be co-located.
Sponsor: National Science Foundation
PI/PD: J.A. Cecil

EAGER/Collaborative Research: Web Architectures for Extensible, Adaptable and Scalable Manufacturing
While the Internet is used for communication and collaboration of engineering activities in manufacturing, the impact has been less than expected. This investigation answers: Is there an architecture that will enable manufacturing enterprises to pursue new collaborations while accepting the shortcomings of such an architecture as well as recognizing the complexities in a broader manufacturing life cycle context? If such an architecture can be formalized, what would be its core characteristics? The project will throw light on this problem with a view towards laying foundations and requirements for an architecture that can foster such a community involved response.
Sponsor: National Science Foundation
PI/PD: J.A. Cecil

Clique Relaxations in Biological and Social Network Analysis: Foundations and Algorithms
The project proposes a tentative taxonomy classifying previously defined clique relaxations under a unified framework. The project builds on elementary graph-theoretic properties of cliques to provide a hierarchically ordered classification of clique relaxation models. The taxonomy is complemented by providing tight bounds relating the clique properties guaranteed, in a relaxed form, by the so-called first-order clique relaxations. This provides solid grounds for a more comprehensive understanding of the relations among the known clique relaxation models, which could serve as a guide for practitioners in selecting a cluster model suited for a particular application.
Sponsor: Texas Engineering Experiment Station for AFOSR

PI/PD: Baski Balasundaram

Smart Garment Development for at Home Measures of Health
The goal is to develop a wearable garment integrated with microelectromechanical system (MEMS) wireless sensor technology that will continuously and noninvasively acquire hemodynamic signals to track cardiorespiratory dynamics, and quantitatively assess health status for short-and long-term prognoses. The analysis is rooted in nonlinear dynamic systems theory and will be capable of detecting dynamic changes in physiological coupling that occur during transitions from health to disease. The proposed device will aid in diagnosis and treatment of human disease. It will be particularly beneficial to rural citizens because the technology will be suitable for home diagnostics.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PDs: Satish Bukkapatnam
Center for Health Sciences: Bruce Benjamin
Human Sciences: Semra Peksoz, Mary Ruppert-Stroescu

I-Corps: HealthSmart Technical Development Plan
The I-Corps activity brings together an interdisciplinary team of investigators led by Dr. Bukkapatnam to explore pathways to commercialize HealthSmart technology resulting from the PIs' ongoing research. The OSU ICorps team has been collaborating and pursuing innovative biomedical research activities for over 7 years. Central to the proposed HealthSmart technology is a multi sensor platform that has evolved from prior NSF TiE CMMI grants for the collection, high-speed wireless transmission, and visualization of multiple heterogeneous physiological signals continuously and synchronously at sampling rates that permit advanced clinical diagnostics and prognostic procedures.
Sponsor: National Science Foundation
PI/PD: Satish Bukkapatnam

Motorcycle Crash Causation Study
The following are the objectives of this study: 1) Determine the main human, vehicular, environmental and roadway factors that contribute to motorcycle crashes and impact crash avoidance; 2) Identify the types of motorcycle crashes; 3) Assess the effectiveness of existing countermeasures including protective gear and rider training/education; 4) Identify additional feasible countermeasures/interventions that can reduce motorcycle crashes and crash injuries; and 5) Estimate the risk factors for motorcycle crash involvement.
Sponsor: United States Department of Transportation - Federal Highway Administration
PI/PD: J.W. Nazemetz

Failure via Three-Dimensional Cracking in Fuel Clad for Advanced Nuclear Fuels
The project investigates crack initiation and propagation in fuel cladding material. Both experimental and numerical analysis will be undertaken. Nuclear fuel cladding is made of materials, such as stainless steels and ferritic steels, with various alloying elements added to increase its stability under irradiation conditions and hence durability. Fuel cladding is subjected to water, chemicals, fission gas, pressure, high temperatures, and irradiation in service. Understanding fuel cladding behavior is essential for improvement in the performance and life of fuel cladding which will increase the fuel burnup.
Sponsor: University of Texas at Dallas for Batelle Energy Alliance for Dept. of Energy
PI/PDs: S.T.S. Bukkapatnam
Mechanical and Aerospace Engineering: R. Singh, S.P. Harimkar

Industrial Assessment Center Program
The mission of the IAC is to assess energy, waste, and productivity practices with the purpose of enhancing the management of the same within the clients enterprise and to share best practices with other IACs, while educating and training the next generation of energy, waste, and productivity professionals. The IAC will focus on IOFs and small and medium-sized manufacturers located within Oklahoma, Kansas, western Missouri, western Arkansas, eastern New Mexico, and

beyond, as coordinated by our field managers. The latest technology will be employed to perform assessments that focus on energy, waste, and productivity issues in the clients' facilities.
Sponsor: Department of Energy
PI/PD: William J. Kolarik

Optimization and Simulation of Large Scale Supply Chain Networks
In this project, one of our principals will be directing the research of Chinnatat Methapatara in the performance aspects of supply chain optimization and simulation algorithms on actual large-scale supply chain networks.
Sponsor: Diamond Head Associates, Inc.
PI/PD: Ricki G. Ingalls

Characterization and Real Time Defect Mitigation in Chemical/Mechanical Polishing of Microelectronic Wafers Using Decision Theory and MultiSensor Fusion
The semiconductor industry relies heavily on the CMP process to meet the surface planarity and finishing needs to sustain the trend of increasing density on small feature-size (~30nm) devices. In this context, the defects generated during CMP, such as scratch, dishing, and chatter marks, etc. have emerged as the top wafer yield inhibitors. The objective of this project is to invoke a new bottom-up multi-sensor fusion and decision theory to derive quantitative relationships connecting the force- and vibration- signal features with specific defect patterns in chemical mechanical planarization (CMP) of microelectronic wafers for real-time surface defect mitigation in this process.
Sponsor: National Science Foundation
PI/PDs: Satish Bukkapatnam, Z. Kong

Development of an Available-to-Promise Decision Support System for Webco Industries
The overall objective of this project is to develop an Available-To-Promise Decision Support System (ATP-DSS) for Webco Industries. ATP-DSS will have the following functions:
• Calculate for each order if the client specified due date could be met;
• If not, provide the earliest available delivery date subject to other commitments;
• Suggest optimal allocations of tube inventory to satisfy orders.
The system will provide multiple solutions for the manager to choose. Solutions will be provided with considerations of Webco's available inventory, production plan, and customer order specifications.
Sponsor: Webco Industries, Inc.
PI/PDs: Tieming Liu, Baski Balasundaram

Robust Optimization for Connectivity and Flows in Dynamic Complex Networks
The goal of this project is to study robust connectivity and flow patterns of complex multi-scale systems modeled as networks. Networks provide effective ways to study global, system level properties, as well as local, multi-scale interactions at a component level. Numerous applications from power systems, telecommunication, transportation, biology, social science, and other areas have benefitted from novel network-based models and their analysis. Modeling and optimization techniques that employ appropriate measures of risk will be developed for identifying robust network designs that assure reliable connectivity and efficient flow distribution patterns in networks under uncertainty.
Sponsor: United States Department of Energy
PI/PD: Baski Balasundaram

GOALI: Collaborative Research: A Mode-Based Simulation Enabling Model and Methodologies for Geometric Variation and Tolerance Control
In spite of the recent advances in tolerance model research and Geometric Dimensioning & Tolerancing (GD&T) standards, the existing tolerance techniques lack the capability of modeling GD&T tolerances and simulating manufactured features for probabilistic design. This is due to the challenges in complex GD&T design requirements; rich feature variability, and intensive numerical

computation. To address the above challenges, the objectives of this project are to establish 1) a mode-based GD&T tolerance model to enable effective GD&T design simulation, 2) Bayesian statistical GD&T model estimation, and 3) probabilistic GD&T tolerance analysis and synthesis methodology.
Sponsor*:* National Science Foundation
PI/PD: Z. Kong

Collaborative: CELDI (Center for Engineering Logistics and Distribution)
The Center for Engineering Logistics and Distribution (CELDI) is a multi-university, multi-disciplinary NSF sponsored Industry/University Cooperative Research Center (I/UCRC). The mission of the Center is to solve integrated design and analysis problems in logistics and distribution via simulation and mathematical modeling, analysis, and the development and application of powerful, intelligent, real-time algorithms. Member organizations come from the commercial and government sectors (including the military) of the economy. CELDI has received both RET and REU Supplements from the National Science Foundation.
Sponsor: National Science Foundation
PI/PDs: Manjunath Kamath, Baski Balasundaram

Continuous State Space Modeling of Assembly Line Systems
The presence of numerous sensors and data loggers has made the modern automotive assembly process a data-rich environment. The objective of the project is to investigate a data-driven modeling approach based on continuous-time nonlinear dynamic systems principles for modeling assembly operations for accurate, “conference time” prediction of aggregate performance.
Sponsor: General Motors Corporation
PI/PDs: S. Bukkapatnam, S. Heragu

Materials Science and Engineering

RDIP: Interns for absorbed natural gas composite tanks
Undergraduate interns will be trained to develop non-cylindrical type of all composite adsorbed natural gas storage vessels for passenger cars for CleanNG LLC. The technology will be based on technologies being developed by CleanNG and OSU under a currently funded NSF Phase I STTR project as well as a concurrent OARS accelerated project. The technology to be developed will also be partially based on adsorbent technologies being developed by the PI and the mentor as well as those being developed at Oak Ridge National Laboratory. The interns will work on a project that could revolutionize the natural gas vehicle industry.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PD: Ranji Vaidyanathan

Cation Substituted CCTO Super Capacitors
To demonstrate the superior performance of CCTO:Al dielectrics, CCTO films will be fabricated using a sol-gel process. The CCTO based capacitors will be used for performance comparisons. CCTO:Al films will be fabricated in a similar manner. The CCTO:Al films will be deposited on metallic electrodes. The sol-gel films will be calcined at elevated temperatures to remove solvent to form the dielectric base for capacitors. Characteristic X-ray diffraction peaks will assure that CCTO:Al samples have the proper crystalline quality. Energy dispersive X-ray analysis will determine composition and Al content of the sol-gel grown CCTO:Al dielectric wafers to determine optimum Al% substitution.
Sponsor: US Ferroics for Oklahoma Center for the Advancement of Science and Technology
PI/PD: Raj Singh

SBIR Phase 1: Development of long service life vacuum insulation composites

MaxQ LLC, in collaboration with a team from OSU's Helmerich Research Center, will characterize an innovative, fiber reinforced compartmentalized vacuum insulation composite container for life saving vaccines and blood products. Vaccines and blood products are temperature sensitive and primarily shipped using polystyrene and polyurethane based containers. More recently, state of the art Vacuum Insulation Panel (VIP) based containers are being used. MaxQ proposes to develop an innovative fiber reinforced compartmentalized vacuum insulation composite that is better insulating, structurally rigid and more efficient than state of the art VIPs.
Sponsor: MaxQ Research LLC for National Science Foundation
PI/PD: Ranji Vaidyanathan

Nanodiamond Resonators for Sensing Applications
The PIs propose to develop "proof-of concept" nanodiamond pillar (NDP) sensor technology for detecting trace quantities of chemical and biological substances. The research will result in robust, portable, and compact sensors that can be deployed in a variety of environments. Two Oklahoma firms have been identified that are interested in a commercialization partnership, and a third Oklahoma company has expressed interest in NDP sensors. The companies will partner in demonstration of the concept. Of the companies identified, one is a manufacturer of sensors and switches, the second produces high purity chemicals, and the third monitors air quality.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PDs: Nirmal Govindaraju, Raj Singh

STTR Phase 1: All-composite Storage for Absorbed Natural Gas
CleanNG LLC, with a team from OSU and Oak Ridge National Laboratory, will develop and manufacture innovative, low-pressure, all-natural, liner-less, all-composite storage tanks (MagmaCel). The gas fuel will be stored using a high-surface area carbon material for adsorption of the gaseous fuel, while the construction of the tank will allow it to carry natural gas in a non-cylindrical tank. The activated carbon material will be based on carbon-based materials including activated carbon and carbon fibers with high adsorption capability, while the fiber and matrix systems for the composite tank will be fabricated from low-cost carbon fibers and natural resin systems.
Sponsor: CleanNG, LLC for National Science Foundation
PI/PD: Ranji Vaidyanathan
Electrical and Computer Engineering: D. Vashaee

Medishine
Phase I involves development and refinement of the prototype, which is a device for treatment of Obstructive Sleep Apnea (OSA). The first task focuses on development of small-batch manufactured prototypes of the device. The second task involves assessment of sleep data and evaluation of device effectiveness. The last task in Phase I focuses on testing and product refinement. Phase II is the IRB testing and customer modeling phase. An alpha prototype of the new OSA treatment system will be completed. The Gen 2 prototype and IRB testing will be done by late 2014. Initial sales will be ready by 2015.
Sponsor: National Collegiate Inventors and Innovators Alliance
PI/PD: Ranji Vaidyanathan

All-Composite Storage Tanks for Absorbed Natural Gas
The Next Generation Materials Laboratory at OSU, in collaboration with CleanNG LLC, will develop and manufacture low-pressure, liner-less, all-composite adsorbed natural gas tanks (Magmacel AD™). The natural gas will be stored at low-pressures using a high-surface area carbon material for adsorption of the gaseous fuel, thus enhancing the safety of the fuel tanks. Several different activated carbon materials including their combinations will be evaluated. OSU will assist CleanNG to produce the prototypes, test and characterize the fuel storage capacity of the adsorbent and improve the mechanical properties of the composites through nano-additives based on natural ingredients.
Sponsor: Oklahoma Center for the Advancement for Science and Technology
PI/PDs: Ranji Vaidyanathan

CAS: P. Jaswal

Thermoelectric energy harvesting devices for structural components
The product of this project will be stabilized, thick film, nanostructured thermoelectric energy harvesting devices with high figure of merit based on bismuth telluride alloys that can be attached to any structural component to take advantage of the temperature difference between any two surfaces of the structure in service and generate power from waste heat. Attachment of thick film thermoelectric devices to structural components is a simpler and cost-effective method and an enabling technology compared to thin film thermoelectric devices.
Sponsor: Oklahoma Center for the Advancement of Science and Technology; Amethyst Research, Inc.
PI/PDs: Ranji Vaidyanathan,
Electrical and Computer Engineering: Daryoosh Vashaee

Self Repairable Seals by Crack Healing of Glass and Glass-Ceramic Composites for Solid Oxide Fuel Cells
A study of the crack-healing in glasses and glass-ceramic composites of varying composition and reinforcement/ceramic phase is proposed to show a systematic correspondence with the physical properties, such as glass transition and softening temperatures, coefficient of thermal expansion, modulus, viscosity, surface energy/tension and creep behavior, thereby elucidating the key materials parameters affecting crack-healing mechanisms.
Sponsor: National Science Foundation
PI/PD: Raj N. Singh

Novel Material for High-Pressure Vessel
The project aims to create a high-pressure fuel storage tank based on a student designed technology. The technology allows for an increased operating pressure in natural gas tanks. The design adds value to the fuel system by storing a larger amount of energy in the same container and by maintaining the same fuel amount in a smaller container. A team has been created to pursue the technology and commercialize it. Objectives are to: produce four prototypes; test prototypes at Authorized Testing Incorporated in Riverside, CA; evaluate results and determine future viability; and educate students in fields of practical study.
Sponsor: National Collegiative Inventors and Innovators Alliance
PI/PDs: Ranji Vaidyanathan

Thermal Transport in Diamond Thin Films: Roles of the Nanostructure and Interfaces
Heat dissipation in high performance microprocessors and power semiconductor devices is a challenge facing the microelectronics industry. One way to remove heat from integrated circuits (ICs) is to use materials with high thermal conductivity in contact with ICs. In this context, a high thermal conductivity material, especially diamond with the highest thermal conductivity of any material, is promising for thermal management of ICs. The research objective is to synthesize layered thin films of diamond in which one layer (nanocrystalline diamond-NCD) will provide smooth surfaces for lower interface resistance and the second layer (microcrystalline diamond-MCD) will result in high thermal conductivity.
Sponsor: National Science Foundation
PI/PD: Raj N. Singh

EAGER: Self Repairable Glass-Ceramic Composites for Solid Oxide Fuel Cells
Glasses are used for sealing and joining materials in a myriad of technological applications such as vacuum technology, microelectronics and power electronics. Seals are also needed for new and more efficient energy producing devices such as solid oxide fuel cells (SOFCs) for conservation of limited natural resources for energy production. The seals for SOFCs function at very high temperatures and are susceptible to cracking in service. The research work is expected to develop a new class of glass and glass-composites that self-repair cracks or damage thereby providing long-life and cost-effective solutions to seals for SOFCs.
Sponsor: National Science Foundation

PI/PD: Raj N. Singh

High Temperature Electronic Devices Based on Wide Bandgap Thin Films
High temperature electronics has emerged as a very important area because the dominant silicon electronics provide low reliability or fail to function altogether at elevated temperatures. The primary scientific objectives of this research project are to: 1) synthesize diamond thin films suitable for fabricating devices useful at high temperatures, and 2) fabrication and characterization of devices made from diamond thin films. In addition, education and training of post docs, graduate and undergraduate students are also an essential objective of this project.
Sponsor: National Science Foundation
PI/PD: Raj N. Singh

Mechanical and Aerospace Engineering

U1B Support
FSS is contracted with the Navmar Applied Sciences Company to provide engineering design, test, and development of components for a Department of Defense UAS platform. FSS is contracting with Oklahoma State University's School of Mechanical and Aerospace Engineering to perform propulsion testing and component UAS platform modifications. The contractor will provide: 1) support for technical meetings with FSS and sponsor; 2) engine and propeller testing; 3) exhaust cooling duct modifications for UAS; 4) support for ground and flight test.
Sponsor: Fail-Safe Solutions, LLC for Department of Defense
PI/PD: Andy Arena

Quiet Propeller Development
FSS is contracted with Oak Ridge National Laboratory to provide the Department of Defense a propeller design for a UAS platform that has minimal noise radiation. An acoustic liner is sought to dampen the noise emanating from the gas turbine engine that provides power to the propeller. FSS is contracting OSU's School of Mechanical and Aerospace Engineering to perform design trade studies on propeller configurations that will lead to lower noise signatures. OSU will provide: 1) technical meeting support; 2) perform propeller design trade studies that minimize noise radiation using simplified aerodynamic performance and acoustic radiation codes; 3) technical documentation.
Sponsor: Fail-Safe Solutions, LLC for Department of Defense
PI/PD: Jamey Jacob

Adaptive Multi-Objective Optimization Control for Active Wing Shaping on Efficient Lightweight Aircraft
The objective is to develop synthesis techniques for new output-feedback Multi-Objective Optimizing (MO-Op) adaptive controllers that simultaneously learn and stabilize the aircraft dynamics, and use the learned knowledge to improve performance and efficiency during flight. The project is in collaboration with the Advanced and Evolvable Systems group at NASA Ames led by Dr. Nhan Nguyen. The PI and students will work with Dr. Nguyen's group in developing MO-Op adaptive controllers, validating them in high fidelity simulations powered by Flexible Generic Transport Models, and prepare a preliminary design for a scaled technology demonstrator to be designed and built at OSU.
Sponsor: University of Oklahoma for NASA
PI/PD: Girish Chowdhary

Acoustic Measurements of SUAS for DHS RAPS 2
OSU will provide graduate student(s) who will travel from Stillwater to OTC-US (Elgin OK) to acquire acoustic data of SUAS participating in the DHS RAPS 2 program. Data acquisition will consist of fly over and loiter data of SUAS of each vehicle from up to four separate microphones. Data will be processed and documented in a report for each tested DHS SUAS vendor. During the

period of performance, support is expected to include data acquisition on five different vehicles.
Sponsor: University Multispectral Laboratories
PI/PD: Jamey Jacob

Carry Bay
OSU will provide essential engineering, research, development, procurement, modeling & simulation, and test & evaluation capabilities in support of USSOCOM's goal of rapid acquisition of an under-the-wing payload carrier system for use with the Aerovironment PUMA All Environment Capable Variant (AECV) unmanned aircraft system (UAS). This system will support emergent and ongoing contingency needs under the Special Application for Contingencies (SAFC) program.
Sponsor: University Multispectral Laboratories for United States Special Operations Command
PI/PD: Andy Arena

CAREER: Fundamental Studies on Mechanics of Three Dimensional Random Fiber Networks
The objective is to investigate the relationship between small scale and system-level mechanical properties of materials with discrete fibrous microstructure. The research will address gaps in the mechanics of 3D semiflexible fiber networks by investigating their mechanical properties across various length scales. Specific aims are: 1) investigate the structure of 3D fiber networks and characterize the microstructural scaling properties, 2) quantify the non-affine mechanics of 3D semiflexible networks using a new strain-based non-affinity measure, and 3) develop a microstructure-based 3D homogenization technique that incorporates the non-affine mechanics and long-range correlated randomness of the network structure.
Sponsor: National Science Foundation
PI/PD: Hamed Hatami-Marbini

JHAPL UAV Drop Project
OSU will design and build two balloon payload Delivery Systems capable of carrying up to a 20 lb UAV payload to 10,000 ft. and commanding release of the payload. The JHAPL UAV payload will be electrically independent of the delivery system and will not need to communicate with it. Tracking and cutdown will be handled via the delivery hardware. The UAV payload will have the option to be dropped, or brought down on parachute in the event of comm loss or UAV malfunction prior to drop.
Sponsor: John Hopkins University Applied Physics Laboratory for Naval Sea Systems Command (NAVSEA)
PI/PDs: Andy Arena, J. Conner

A Study on Nonlinear Adaptive Control for a Continuous Steel Strip Processing Line
The PI will develop an adaptive controller considering the nonlinear characteristics of steel strip transmission line under CAL/CGL annealing furnace environment which requires a strict and sensitive tension control standard. The performance of this controller will be evaluated through model simulations and experiments on a laboratory web platform. Strip compliance under transient and steady temperature distribution will be modeled and the effect will be investigated for the purpose of deriving an adaptive tension controller. The development of a nonlinear estimation method for strip tension and friction for the feedback control of tension of this system will also be investigated.
Sponsor: POSCO
PI/PD: P.R. Pagilla

1:8 Scale Cessna Longitude Flying Demonstrator
OSU will build a 1/8 scale flying demonstrator of the Cessna Longitude according to the requirements from Cessna.
Sponsor: Cessna Aircraft Company
PI/PD: Andy Arena

Development of a Load-Based Method of Test for Light Commercial Unitary HVAC

This project aims to develop a new method of testing for assessing the performance of advanced unitary equipment for light commercial HVAC applications. The PI will develop a new test protocol that measures a comprehensive energy performance figure of merit for advanced Roof Top Units versus its energy input at various outside conditions and at various indoor thermal loading conditions. The system energy efficiency enhancements due to economizer effectiveness, variable speed fans, fan cycling, variable speed compressor systems and condenser pre-cooling will be measured in a system level method of test as opposed to individual component level method of test.
Sponsor: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
PI/PD: Lorenzo Cremaschi

Surface and Airborne Monitoring Technology for Detecting Geologic Leakage in a CO2-Enhanced Oil Recovery Pilot, Anadarko Basin, Texas
OSU, with the cooperation of the Southwest Regional Carbon Sequestration Partnership (SWP), will develop and implement new near-surface and airborne monitoring technologies. The research will focus on the design and deployment of a dense grid of shallow subsurface and surface sensors in combination with low-altitude airborne detection of CO_2 and CH_4. These technologies will be deployed in the Farnsworth Oil Unit in the Anadarko Basin of the northeastern Texas panhandle, where the SWP and Chaparral Energy, LLC, are conducting CO_2-enhanced oil recovery experiments.
Sponsor: Department of Energy
PI/PDs: Jamey Jacob, Girish Chowdhary
Chemical Engineering: Peter Clark
Civil Engineering: Tyler Ley
College of Arts & Sciences: Jack Pashin, Nicholas Materer

UAV Integrated Power Management
OSU will support Microlink in the development and feasibility demonstration of a small UAV that can operate as a perching micro air weapon. The air vehicle platform will incorporate Microlink's energy harvesting system. The platform will utilize electric propulsion and advanced battery chemistries such as lithium polymer batteries for energy storage. OSU will provide technical and engineering services and support to facilitate testing of Microlink's energy harvesting technology as applied to the air vehicle platform. This testing may include wind tunnel and simulated flight testing, testing and analysis of power management and allocation of all vehicle subsystems and components.
Sponsor: MicroLink Devices, Inc. for United States Air Force
PI/PD: Jamey D. Jacob

Optimally Controlled Air-Conditioning Equipment for Sustainable Building Systems
The objective of this project is to develop and deploy optimal supervisory and process control algorithms in all of AAON's equipment. To achieve this goal a simulation testbed will be developed that merges a detailed physics based building model with a detailed, physics based vapor compression system model. This will allow development of both process and predictive supervisory control schemes that take into account such factors as building thermal mass and changing weather.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PDs: D.E. Fisher, L. Cremaschi, J.D. Spitler

Acoustic Measurements of SUAS for DHS RAPS
OSU will provide one qualified and skilled researcher to travel to OTC-US in Elgin, OK on a pre coordinated day of a DHS RAPS event week (typically Monday) to set up OSU-owned acoustic capture equipment, take multiple acoustic measurements of multiple UAS at various altitudes and azimuths. Upon completion of each series of tests, the researcher will remove the acoustic gathering equipment and return to OSU to perform data analysis. Within two weeks of capturing acoustic data, a professional-grade acoustic report based on the captured data will be submitted to the UML UAS Program Manager.

Sponsor: University Multispectral Laboratories
PI/PD: Jamey Jacob

Performance Analysis of HVAC Systems in the ASHRAE Headquarters Building
In 2008, the ASHRAE Headquarters Building in Atlanta underwent major renovation. Of interest are the new HVAC systems, particularly a ground source heat pump system that serves the second floor and a variable refrigerant flow system that serves the first floor. In addition, a dedicated outdoor air system provides filtered and conditioned outdoor air to maintain indoor air quality. The objectives of this work are to compare the performance of the two heating/cooling systems, explain the reasons for the differences, and do this with sufficient rigor so that the comparisons and explanations can be published in peer reviewed literature.
Sponsor: The Geothermal Exchange Organization
PI/PD: Jeffrey D. Spitler

OSU Support for REF Puma Endurance Solar Enhancement (PESE) Project
This subcontract involves assisting Design Intelligence Incorporated, LLC (DII) in the design and development of "solar wing" upgrades for the Puma unmanned aerial vehicle. DII was awarded a subcontract from MicroLink Device, Inc. (MLD), to provide power-conditioning electronics and develop a new design and process for producing "solar wings" for the Puma using MLD's proprietary flexible solar cell technology. As part of this effort, DII requires research and development assistance from OSU in the design and development of the wing molds, the new wing design, and development of the manufacturing and production processes required to produce wings.
Sponsor: Design Intelligence Incorporated, LLC
PI/PD: Jamey Jacob

Aspirin Protects Endothelial Cells from Secondhand Smoke
The goal of this study is to investigate how secondhand smoke affects endothelial functions and if the use of low-dose aspirin can sufficiently inhibit this adverse effect, especially for patients with pre-existed cardiovascular disease conditions. Results obtained from this study will not only help us better understand the relationship between secondhand smoke, pathological shear stress and cardiovascular diseases from a scientific point of view, but also lead to a new affordable way to protect nonsmokers from secondhand smoking, and in a long run, significantly save smoke-related health costs in Oklahoma and the nation.
Sponsor: Oklahoma Center for the Advancement of Science and Technology
PI/PDs: Wei Yin, David Rubenstein

Viscoelastic Creep of a Laminated Web in Wound Rolls
The purpose of the project is to determine the viscoelastic behavior of a laminate composed of polyethylene and non-woven laminate that has been wound into the form of rolls. The investigator will run elastic material property tests as well as viscoelastic creep tests on the laminate. Rolls of the laminate will be wound on OSU winding equipment and instrumented with pressure sensors at several radial locations. Tests will be run at both room and two elevated temperatures.
Sponsor: Kimberly-Clark Corporation
PI/PD: James Good

Next Generation Green and Sustainable Manufacturing in Oklahoma – NPDC Support
The OSU Applications Engineering Program will provide engineering support to the OSU New Product Development Center (NPDC) as part of the National Institute of Standards and Technology's (NIST) "Next Generation Green and Sustainable Manufacturing in Oklahoma" grant by serving as liaison between the NPDC and its manufacturing clients.
Sponsor: New Produce Development Center for the Oklahoma Alliance for Manufacturing Excellence, Inc. for the National Institute of Standards and Technology
PI/PD: Daniel E. Fisher
Division of Agricultural Sciences and Natural Resources: D. Thomas

SNM: Roll-to-Roll Atomic/Molecular Layer Deposition
The goal is to investigate and develop atomic/molecular layer deposition (ALD/MLD) processes for continuous production and to develop a roll-to-roll machine for ALD/MLD process which will enable thin-film growth on a flexible, moving substrate. The Colorado team will study the ALD/MLD processes which will be compatible for R2R manufacturing and the OSU team will design and develop a R2R machine for this process to conduct the experimentation in the project. The OSU team will build two R2R machines, one for experimentation at OSU and the other for experimentation at Colorado.
Sponsor: University of Colorado at Boulder for National Science Foundation
PI/PD: Prabhakar R. Pagilla

Horizontal Habitability Layout Studies
The project is to design, develop, build and test a portable habitat system for the X-Hab Academic Innovation Challenge. Goals of the project include the short-term goal of an interdisciplinary senior design project to design, build and evaluate a horizontally oriented habitat and a long-term goal to develop capabilities in education, research, and outreach in the field of space habitat design. This will include both technical engineering and outreach efforts. Faculty with diverse specialties from across the schools at OSU will participate in the project with the goal of developing technology and designs to facilitate human habitation in outer space.
Sponsor: National Space Grant Foundation for NASA
PI/PD: Jamey D. Jacob

Mechanisms of Hydration and Setting of Ordinary Portland Cement in Simple and Complex Systems
For this proposal OSU will be responsible for completing laboratory scale micro X-ray computed tomography (mCT), focused beam X-ray Fluorescence (mXRF), and focused beam X-ray diffraction (mXRD) on Portland cement and combinations of Portland cement with mineral and chemical admixtures. In addition, several tests will be completed with these same techniques at synchrotrons facilities. The experiments will focus on investigating the change in the hydration of different clinker phases in different soak solutions that simulate the pore solution chemistry of hydrating Portland cement.
Sponsor: Trustees of Princeton University for the Federal Highway Administration
PI/PDs: Jay C. Hanan
Civil and Environmental Engineering: Tyler Ley

Enhancing the Oklahoma Alliance for Manufacturing Excellence with Applications Engineers in Rural Areas
The Applications Engineering Program works to increase the competitiveness of existing small and medium sized rural manufacturers by providing on-site, focused engineering assistance and technology transfer services. By placing a staff of engineers across the state, the program provides manufacturers with direct access to the latest in technology including access to the resources of Oklahoma State University's engineering faculty. The program is a cooperative effort between the University and the Oklahoma Manufacturing Alliance.
Sponsor: Oklahoma Alliance for Manufacturing Excellence, Inc. for National Institute of Standards and Technology
PI/PDs: Daniel E. Fisher,
Division of Agricultural Sciences & Natural Resources: D. Thomas

Subsurface Damage in IR Optics Materials
The approach will investigate the near surface state of a range of materials employed in IR optics applications. The PI will investigate damage created at the surface and near surface of polycrystalline ZnSe and ZnS (multi-spectral) that have been processed by traditional polishing, traditional diamond turning, and diamond turning using a fast tool servo. The depth and amount of damage, residual stress state, and changes in surface stoichiometry will be quantified. The subsurface damage created in single crystal Si that has been finished by diamond turning, and single crystal CdTe processed by fine grinding with loose abrasives, will be investigated

Sponsor: II-VI Foundation
PI/PD: Don A. Lucca

Measurements of Pipe Insulation Thermal Conductivity
Mechanical insulation systems are installed around cold pipes to limit the heat gain and to prevent moisture condensation on the pipe wall surface. Insulation jackets, vapor retarders, and vapor sealing of the joints and fittings are normally adopted to create a barrier to the moisture ingress into permeable insulation. However, experience shows that mechanical pipe insulation systems are not completely vapor tight and inevitably moisture accumulates in permeable insulation. This research involves measuring the thermal conductivity of six pipe insulation systems at below-ambient temperature and in wet condensing conditions with moisture ingress allowed into the insulation material.
Sponsor: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
PI/PD: Lorenzo Cremaschi

CAREER: Fundamental Studies on Ultrasonic Vibration Assisted Laser Surface Modification (UV-LSM) of Materials
This project investigates basic phenomena associated with *ultrasonic vibration-assisted laser surface modifications* (UV-LSM) and advances this knowledge for engineering surface microstructures and properties of advanced materials. The central theme of this CAREER proposal is that the attenuation of ultrasonic vibrations in the melt pool created during laser-material interactions will induce microscopic (interdendritic) and macroscopic (within melt pool) hydrodynamic flows in the melt influencing subsequent microstructure evolution (grain refinement, homogeneity, and defect-free surfaces). The effect of ultrasonic vibrations on rapid solidification behavior will be investigated during three laser surface engineering approaches: Laser surface melting, laser composite surfacing, and laser surface densification.
Sponsor: National Science Foundation
PI/PD: Sandip P. Harimkar

Revise Load Calculation Applications Manual
It's highly desirable that the LCAM (Load Calculation Applications Manual) incorporate new data and new procedures from recent ASHRAE (Application Manual for Non-Residential Load Calculations) research as well as be consistent with the Fundamentals Handbook. Accordingly, the primary objective of this project is to revise the LCAM and produce a second edition, in both IP and SI versions.
Sponsor: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
PI/PD: Jeffrey D. Spitler

Failure via Three-Dimensional Cracking in Fuel Clad for Advanced Nuclear Fuels
The project investigates crack initiation and propagation in fuel cladding material. Both experimental and numerical analysis will be undertaken. Nuclear fuel cladding is made of materials, such as stainless steels and ferritic steels, with various alloying elements added to increase its stability under irradiation conditions and hence durability. Fuel cladding is subjected to water, chemicals, fission gas, pressure, high temperatures, and irradiation in service. Understanding fuel cladding behavior is essential for improvement in the performance and life of fuel cladding which will increase the fuel burnup.
Sponsor: University of Texas at Dallas for Batelle Energy Alliance for Dept. of Energy
PI/PDs: Sandip P. Harimkar, Raman Singh
Industrial Engineering and Management: Satish Bukkapatnam

Phase II DOE SBIR Program - Vortical-flow, Direct-Contact Heat Exchanger for Geothermal Cooling
Advanced Cooling Technologies, Inc. is developing a Vortical-flow, Direct-contact Heat Exchanger for HVAC systems, particularly those coupled with Ground-Source Heat Pumps (GSHP), under a Department of Energy SBIR program. OSU will support this effort by providing expertise on GSHP systems and conducting testing. In support of Phase II of the program, OSU

will provide the following: Consultation regarding component design for GSHP systems and systems-level considerations; Information regarding testing requirements for design of the VDHX prototypes; Testing of 2 VDHX prototypes with a GSHP or simulated system; Modeling and energy analysis study of GSHP with integrated VDHX.
Sponsor: Advanced Cooling Technologies, Inc. for Department of Energy
PI/PDs: Jeffrey D. Spitler, Lorenzo Cremaschi

Platelets and Endothelial Cell Responses to Coronary Blood Flow
Platelets and vascular endothelial cells (EC) play important roles in hemostasis and thrombosis. Their functions and activities are closely related to blood flow induced mechanical stresses. It is important to understand how the flow features and the stress field can affect the functions of platelets and vascular EC, as well as disease development. However, blood flow is time dependent and experimental measurements of shear stress applied to circulating platelets and vascular wall EC could be problematic. Numerical simulation provides an alternative way to obtain detailed flow patterns and shear stress distribution.
Sponsor: American Heart Association
PI/PDs: Wei Yin, David A. Rubenstein

Measurements of Oil Retention in Micro-channel Heat Exchangers
This research focuses on measuring the volume of oil that is held up in microchannel heat exchangers adopted in systems for commercial refrigeration and air conditioning applications. The proposal represents experience in oil retention measurements for fin-and-tube heat exchangers. A refined test setup for injecting the lubricant into microchannel heat exchangers in a controlled fashion will be designed, built, and calibrated. Then, oil retention will be directly measured for microchannel heat exchangers working at different temperatures.
Sponsor: Delphi Automotive Systems LLC
PI/PDs: L. Cremaschi, D.E. Fisher

Modeling and Analysis of Composite Web Transport Systems
The project deals with a systematic investigation of the transport behavior of composite webs through Armstrong's processing machinery. Project activities include: 1) development of mathematical models for formation and transport behavior of composite webs, 2) determination of the mechanical and physical material properties of composite webs through testing, 3) analysis of models to determine machine and process changes required to improve regulation of key process variables that will result in elimination/reduction of material waste, 4) validation/refinement of models through extensive experiments, and 5) implementation of proposed changes and testing to evaluate the effectiveness of the developed guidelines and controller designs.
Sponsors: Oklahoma Center for the Advancement of Science and Technology, Armstrong World Industries
PI/PDs: Prabhakar R. Pagilla, Karl N. Reid

Next Generation Composite Materials for Aerospace and Exploration Systems
This NASA EPSCoR project will develop next-generation composite material systems that exhibit enhanced long-term durability under exposure to terrestrial and space environments. The project will develop composites that incorporate fundamental nanoscale and molecular changes to existing polymer-matrix resins, provide new strategies for improving the fiber-matrix interface, and address critical issues of barrier properties and composite bonding.
Sponsor: University of Oklahoma for NASA
PI/PDs: Raman Singh, Kaan Kalkan
Materials Science and Engineering: Ranji Vaidyanathan
College of Arts and Sciences: Kevin Ausman

Collaborative Research: Ion Irradiation-Induced Nanocrystallization of Metallic Glasses and Its Effects on Their Mechanical Properties
Metallic glasses have superior hardness and high resistance to wear and corrosion, however they are generally brittle due to the absence of internal obstacles to arrest shear band propagation. The

research objective of the proposed work is to develop an understanding of the mechanisms responsible for nanocrystal phase formation when metallic glasses are subjected to ion irradiation, and to quantify the resulting effects on the materials' mechanical behavior.
Sponsor: National Science Foundation
PI/PD: D.A. Lucca

Collaborative Research: Composite Surfacing of Amorphous Materials by Laser Interference Nanopatterning
The primary objective of this research is to develop a new class of laser surface engineered amorphous materials characterized by enhanced ductility. The enhancement of the ductility of such amorphous materials is expected due to the formation of an array of periodic lines or spots of modified regions on the surface of amorphous material by laser interference nanopatterning. The regimes of laser interaction with amorphous materials will be selected such that periodic modified regions (lines or spots) will be characterized by localized nanocrystallization and/or residual compressive stresses.
Sponsor: National Science Foundation
PI/PD: Sandip Harimkar

MRI: Acquisition of a High Performance Computer Cluster for Multidisciplinary Research
Oklahoma State University High Performance Computing Center (OSUHPCC) will acquire, deploy and maintain an HPC cluster supercomputer, to be named Cowboy, that will support computing-intensive research and research training across a broad variety of Science, Technology, Engineering and Mathematics (STEM) disciplines. As a campus-wide shared resource, Cowboy will be available not only to all of OSU's faculty, staff, postdocs, graduate students and undergraduates, but to researchers across Oklahoma.
Sponsor: National Science Foundation
PI/PDs: R. Singh
Electrical and Computer Engineering: S.A. Sohoni
Arts & Sciences: Dana Brunson, Lan Zhu
Division of Agricultural Sciences & Natural Resources: Peter Hoyt

Development of a Biomimetic Composite Scaffold to Promote Vascular Network Growth
The proposed project is important to the success of the tissue engineering field because after the successful completion of this project we will have developed a method to rapidly fabricate vascular networks within complex composite biocompatible biomimetic scaffolds. The proposed research has relevance to public health because we will gain the ability to tissue engineer multiple products with incorporated vascular networks and facilitate chronic wound healing.
Sponsor: National Institutes of Health
PI/PDs: D.A. Rubenstein, W. Yin
Veterinary Medicine: P. Lloyd

Comparison of the Energy Performance and Capacity of an Air Conditioning System that Uses Low GWP Refrigerants
The overall scope of this research is to study the energy efficiency and cooling performance of an air conditioning (AC) system that uses new low GWP refrigerants manufactured by DuPont. OSU will conduct the performance tests in its large scale climate control chamber and will experimentally measure the energetic coefficient of performance (COP), cooling capacity, evaporator and condensers heat transfer capacity, and the refrigerant thermodynamic state points for the vapor compression cycle. A commercially available air-source AC system will be used in these experiments.
Sponsor: E.I. du Pont de Nemours and Company
PI/PD: Lorenzo Cremaschi

Development, Optimization and Support of the EnergyPlus Central Plant Simulation
This proposal includes a 5 year plan to provide critical support to a broad EnergyPlus program development effort led by Florida Solar Energy Center. The Oklahoma State University research

team provides model development and implementation expertise in the EnergyPlus zone, system and central plant simulations. The proposal is organized by the following tasks: project management and maintenance, development and user support and training.
Sponsor: University of Central Florida for United States Department of Energy - National Renewable Energy Laboratory
PI/PD: Daniel E. Fisher

SBIR Phase II: Commutational Ramp Load Disk Drive Actuator
The proposed research investigates the design and construction of a commutational ramp load disk drive actuator and associated control algorithms to improve servo controller performance while maintaining shock resistance, improving product quality, and providing cost reduction. The OSU portion of the proposed work involves computer simulations (3D modeling and FEA) and experimentation to evaluate certain aspects of the commutational ramp load actuator that are mimicked by a conventional commercial disk drive actuator. The Polytec vibrometer system and other optical instrumentation will be used to conduct disk drive experiments.
Sponsor: Bluewater Technology, LLC for National Science Foundation
PI/PD: Prabhakar R. Pagilla

Oklahoma Space Grant Consortium
This project is supported by the Oklahoma Space Grant Consortium (OSGC), which has its headquarters at the University of Oklahoma. Congress authorized the National Space Grant College and Fellowship Program to develop and/or enhance university research infrastructure to support basic and applied NASA-related research and technology development. In 1991, NASA awarded the State of Oklahoma a grant for OSGC consisting of the University of Oklahoma, Langston University, Cameron University, and Oklahoma State University. Since then, more than $100,000 in fellowships has been awarded at these universities to promote the goals of the National Space Grant College and Fellowship Program.
Sponsor: University of Oklahoma for NASA
PI/PD: Andrew S. Arena, Jr.

MRI: Acquisition of a SELDI ProteinChip Reader
The project involved acquisition of a Surface Enhanced Laser Desorption/Ionization ProteinChip reader from Bio-Rad Life Inc. This system is an extension of the conventional matrix-assisted laser desorption ionization time of flight mass spectrometry. With a minute sample volume, it can determine the precise molecular weights of multiple proteins from various biological samples.
Sponsor: National Science Foundation
PI/PDs: Wei Yin, David Rubenstein

Development of Design Tools for Surface Water Heat Pump Systems (SWHP)
Surface Water Pump systems are widely used, yet there is a paucity of design data and documented design procedures. Existing design procedures provide a workable framework for most systems, if augmented by better knowledge of design water temperatures and convection correlations. For the heat extraction and rejection from the heat exchanger it will be necessary to model, at some level, the surface heat exchange along with the heat extraction/rejection and perhaps inflows and outflows, to determine the design water temperature. Objectives of this proposal are to develop as accurate and usable set of design data and design tools as possible.
Sponsor: American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
PI/PD: Jeffrey D. Spitler

Surfactant-templated Polyurea–nanoencapsulated Macroporous Silica Aerogel, a Potential New Biomaterial
In 2002, Leventis developed a method to nanoencapsulate 3D silica nanostructures under a conformal polymer coating without clogging the pores. Using this method, a novel class of polyurea–nanoencapsulated surfactant-templated bi-continuous meso- and macro-porous silica aerogels was synthesized. The most impressive property of this new class of aerogels, termed X-aerogels, is their exceptional mechanical strength. Combined, these observations lead to the

novel hypothesis of this proposal: X-aerogels have a good biocompatibility with the cardiovascular system and they can be used to manufacture blood implantable devices such as artificial heart valve leaflets. This hypothesis will be tested through three specific aims.
Sponsor: National Science Foundation
PI/PDs: W. Yin, D.A. Rubenstein

Regulation of Placenta Growth Factor by Hemodynamics and Reactive Oxygen Species
The hypothesis is that rescuing endogenous PlGF expression will enhance arteriogenic potential in diabetes. The rationale for the proposed research is that the results of these studies will identify specific targets for therapeutic interventions aimed at promoting collateral growth in diabetics.
Sponsor: National Institutes of Health
PI/PDs: W. Yin
Veterinary Medicine: P. Lloyd

GOALI: Modeling and Design of Composite Web Roll-to-Roll Systems
The goal is to develop fundamental dynamic models of web behavior for Roll-to-Roll (RTR) systems containing multiple unwind rolls, laminator rolls, and a single rewind roll. These RTR systems are required in applications where a composite web is formed from dissimilar individual flexible material layers or through application of a thick gel material onto a base layer. In addition to developing models, a related objective is to design the configuration (selection of location of driven rollers, web guides, sensing systems, and process sections) of the RTR systems and associated coordinated control strategies that would enable manufacture of quality composite webs.
Sponsor: National Science Foundation
PI/PDs: Prabhakar R. Pagilla, Karl N. Reid

US-Germany Cooperative Research: M4 - High Resolution Surface Zone Analysis and Ion Beam Processing
In previous phases of this research, the research team utilized a range of high resolution surface techniques to quantify the mechanical and chemical nature of newly developed mold coatings for use in optical component production. The team found that ion irradiation is an effective means to convert hybrid sol-gel films to their final hardened state. The project focuses on the use of high resolution surface zone techniques to aid in the development of new advanced mold coatings based on ion irradiated sol-gel films, and to enable the near surface mechanical and chemical characterization of both mold surfaces and optical components.
Sponsor: Foundation Institute for Materials Science IWT - STB/TR4
PI/PD: Don A. Lucca

Frequency Response of Longitudinal Behavior and Sensing of Tension of a Web
The objective of this project is development and experimental validation of mathematical models of primitive elements of web transport systems. A significant part of the project activity also includes a user-friendly graphical software called “Web Transport System” that can be used to simulate web process lines and contains the state-of-the-art model and control developments.
Sponsor: Web Handling Center
PI/PD: Prabhakar R. Pagilla

Web Transport Systems
The objectives of this research are: 1) to expand the range of static and dynamic models in WTS to include models for new elements identified by sponsors, 2) to refine the models for viscoelastic effects and web-roller slip effects, 3) to develop new models for the precise control of tension in each section in a multi-span web transport system, and 4) to develop guidelines for selection of the control algorithms which best meet the defined performance objectives for a given application.
Sponsor: Web Handling Research Center
PI/PDs: Karl N. Reid, Prabhakar R. Pagilla

Mechanical Behavior of a Web during Winding

The objective of this project is to develop algorithms for wound-on-tension for various types of winding in which nips are involved in the winding configuration, to study varying nip winding conditions and parameters so that the mechanics of nip winding can be quantified and incorporated into winding and defect models, and to study and develop models for nip related defects.
Sponsor: Web Handling Center
PI/PD: Keith Good

Web Wrinkling - Prediction and Failure Analysis
Web quality degradation can occur if wrinkling takes place across the rollers or inside (or upon) wound rolls. This research is concerned with determining how wrinkles form as a function of web line and web material parameters.
Sponsor: Web Handling Center
PI/PD: Keith Good

New Product Development Center

CaCl2 Prilling
The project is a collaboration between Magnesium Products, Inc. (MagPro), the New Products Development Center (NPDC) and OSU's Department of Chemistry. MagPro has identified a market for crystallized, highly pure, pharmaceutical grade calcium chloride crystals, CaCl2. Since there are four primary chemistry combinations to evaluate, the laboratory scale processes will define the best candidate to scale up and take into production. Dr. Apblett and his students will define the best process chemistry with assistance from the NPDC Design Engineer. Together, they will define the process prototyping equipment and run the preliminary experiments to determine which chemistry to utilize in scale-up.
Sponsor: Magnesium Products, Inc. for OCAST
PI/PDs: Robert Taylor
Arts & Sciences: Allen Apblet

Safety Cabinet Next Generation Design
Justrite Manufacturing Company, a leading producer of safety cabinets, is working with OSU to extend its product analysis and testing. The New Product Development Center (NPDC) and Fire Service Training (FST) at OSU will work with Justrite to engineer and test innovative concepts that will cement Justrite as the market leader in safety cabinet design and manufacture. NPDC and FST will provide modeling, analysis, and testing of new safety cabinet design concepts which will allow Justrite to meet and/or exceed the current legislative requirements and standards, as well as gain a competitive advantage in the marketplace.
Sponsor: Justrite Manufacturing Company, LLC
PI/PDs: Robert Taylor
Fire Service Training: Ed Kirtley

Manufacturing Improvement Program for the Oil and Gas Industry Supply Chain and Marketing Cluster
Comprehensive improvement in manufacturing requires a review of a manufacturer's facilities, equipment, processes, product line, people, finances, markets and customers. The goal is to increase the innovation capacity and improve profitability of small- to medium-sized manufacturers in the oil and gas industry cluster. This will result in job creation in 44 low-income Oklahoma counties. Objectives are to help manufacturers 1) access current competency, 2) develop plans to reduce energy use and improve manufacturing processes, 3) innovate product lines, 4) train a diverse workforce, 5) manage financial consequences and outcomes, and 6) identify and meet the needs of customers and markets.
Sponsors: U.S. Department of Commerce Economic Development Administration, U.S. Department of Labor Employment and Training Administration, U.S. Department of Commerce

National Institute of Standards and Technology, U.S. Small Business Administration, Department of Energy
PI/PDs: Robert Taylor
Division of Agricultural Sciences & Natural Resources: Daniel Tilley

Next Generation Green and Sustainable Manufacturing in Oklahoma
The overarching objective of the project is to improve the top line growth, viability, profitability, and global competitiveness of Oklahoma manufacturers. This project will accelerate manufacturers' realized capacity to absorb new, and when appropriate, green technology. Manufacturers that successfully complete the new product development process will increase their capacity to continuously improve and produce new products, processes, and services that are better adapted to evolving market opportunities, address environmental issues, and enhance their global competitiveness.
Sponsor: Oklahoma Alliance for Manufacturing Excellence, Inc. for NIST
PI/PDs: Robert Taylor
Division of Agricultural Sciences and Natural Resources: Daniel Tilley

Oklahoma Inventors Assistance Service Program
The Inventors' Assistance Service (IAS) provides information, education, and assistance to Oklahoma inventors navigating the process of transitioning an idea into a product. The IAS offers workshops; maintains a website, a resource database, and a roster of contacts; offers informational materials; and offers general assistance to persons navigating the invention process. The IAS operates the Selected Inventions Program to organize inventor efforts to successfully bring an invention to the point where the process transitions to licensing, manufacturing, or recruitment of capital.
PI/PDs: Robert Taylor
Division of Agricultural Sciences & Natural Resources: Daniel Tilley

Manufacturing Innovation and Revitalization Partnerships: Universities, Manufacturers, Government and K-12 Teachers (MIRP)
This project transforms innovation activities in the manufacturing sector and integrates three programs that address innovation education and implementation in manufacturing, universities, and K-12 education: 1) The Manufacturers Innovation Leadership Program (MILP) is for managers within small- and medium-sized manufacturing firms. MILP participants learn to lead manufacturing innovation, write proposals, work with university innovation scholar teams, and mentor K-12 teachers; 2) The NSF Innovation Scholars program will create teams of college students and faculty who will produce and process innovation projects with small manufacturers; 3) The Innovation Program for Teachers provides K-12 teachers with an internet-delivered class on manufacturing innovation.
Sponsor: National Science Foundation
PI/PD: Robert Taylor

Oklahoma Transportation Center

University Transportation Center
As a designated National University Transportation Center (UTC), the Oklahoma Transportation Center (OTC) addresses critical transportation infrastructure problems using the collaborative efforts of the University of Oklahoma, Oklahoma State University and Langston University, in conjunction with transportation professionals in government and industry. The emphasis on transportation infrastructure focuses on service monitoring and life extension of bridge and foundation systems, vehicle-bridge interactions, pavement materials and mechanics, and intermodal freight logistics. The OTC's goals are to find ways to mediate structural load limitations, increase traffic capacity and mobility, and enhance safety and security.
Sponsor: United States Department of Transportation - Research and Innovation Technology

Administration
PI/PD: D. Alan Tree

Division of Engineering Technology (TECH)

Collaborative Research: Study of Flammability, Mechanism and Heat/Mass Transfer Associated with Burning of Flame
The objective is to understand the mechanism and to quantify the synergistic fire retardant effect of the nanofillers that form a physical barrier and the nanofillers that cause catalytic charring of the burning polymer. This will be achieved by studying the kinetics and the mass and heat transfer processes involved in the pyrolysis of the polymer with and without the nanofillers. The work is transformational because it will for the first time quantify the synergistic fire retardant effect of nanofillers in polymer nanocomposites.
Sponsor: National Science Foundation
PI/PD: Q. Wang

Development of Coil-Type Geothermal Heat Exchangers and Installation System
The Korea Association of Industry, Academy and Research Institutes (KAIRI) will conduct patent search and analyses, design and fabricate new coil-type geothermal heat exchangers, and send them to OSU for testing. A design calculation program will be developed based on the test results and installation guidelines that will be provided by OSU. The calculation program will be used by geothermal system designers to determine the required number of coil-type heat exchangers and their arrangement. KAIRI will also develop a new installation method (two-grout method) and assist EST to design an installation device.
Sponsor: Korea Association of Industry, Academy and Research Institutes (KAIRI)
PI/PDs: Y.B. Chang, J.E. Bose

Performance Assessment of a Folded Coaxial Ground Source Heat Exchanger
The Charles Machine Works, Inc. was awarded a grant under the OCAST Oklahoma Applied Research Proposal Support program for research to develop a folded coaxial pipe ground heat exchanger. The proposed new heat exchanger could potentially reduce installation costs and provide better heat exchange between the ground and the heat pump. OSU's Dr. Beier will be involved in performing in-situ thermal response tests on several boreholes for the study. He will model the thermal performance of the ground heat exchangers boreholes. The Charles Machine Works, Inc. will install and operate the ground heat exchangers.
Sponsor: The Charles Machine Works, Inc. for OCAST
PI/PD: R.A. Beier

DHS Homeland Security HS-STEM Career Development Grant
The award provided a number of DHS scholarships and fellowships.
Sponsor: Department of Homeland Security
PI/PD: M. Larrañaga