SPECIAL FACILITIES AND PROGRAMS

Advanced Materials Characterization Laboratory

McNutt Hall and Straumanis Hall

F. Scott Miller (*Director*)

The Advanced Materials Characterization Laboratory was established in 2001 to provide advanced materials characterization instrumentation and expertise to UMR researchers as well as technological industries in Rolla and the state of Missouri. The laboratory combines advanced analytical resources from several departments on campus, as well as the Materials Research Center to provide a centralized point of contact for researchers.

The characterization equipment available in the AMCL includes: four scanning electron microscopes (SEM), and a transmission electron microscope (TEM), all of which are combined with energy dispersive x-ray spectroscopy (EDS) systems, three x-ray diffractometers, scanning tunneling and atomic force microscopes, auger electron and x-ray photoelectron spectrometers, and instruments for thermal analysis, including thermogravitimetric analysis and differential scanning calorimetry. Training in these methods and assistance in the use of the equipment are provided to faculty researchers, graduate and undergraduate students by the director and staff of the AMCL. E-mail smiller@umr.edu or visit our website at campus.umr.edu/amcl.

Biochemical Processing Institute

Schrenk Hall

Athanasios I. Liapis (*Director),* Neil L. Book, Roger F. Brown, Ronald L. Frank, Daniel Forciniti, Paula M. Lutz, Barbara R. Patterson, Donald J. Siehr, and Oliver C. Sitton.

The Biochemical Processing Institute promotes instruction and research in process involving bio-chemical separations, and microbial and enzymatic technology. It serves as a resource for the state of Missouri by supporting the industrial development of biochemical processes. The Institute is multidisciplinary in nature and brings together faculty members from several engineering and science departments at UMR.

Bioseparation research studies include the areas of freeze drying, affinity chromatography, chromatography, perfusion chromatography, liquid-liquid extraction, ultrafiltration, membrane separations, adsorption, ion exchange, and gross protein separations. All of these processes are used by the chemical, pharmaceutical, food, energy, and other biochemical industries and will provide for increased interaction between these industries and UM-Rolla.

Research in enzyme technology includes isolation and purification of enzymes of commercial interest from microbial sources, and the use of immobilized enzymes and microorganisms for the production of chemical feed stocks from biomass. Also, research studies in cell cultivation and biomaterials are currently conducted by members of the institute.

The institute enhances the opportunities for successful research in biochemical processes through increased interaction of UMR students and faculty with industry. E-mail address is ail@umr.edu.

Wei-Wen Yu Center for Cold-Formed Steel Structures

Butler-Carlton Civil Engineering Hall

Wei-Wen Yu (*Founding Director)*

Roger A. LaBoube (*Director)*

To meet an ever-increasing demand for technical assistance from steel and construction industries and to create more economic designs and applications, the UMR Center for Cold-Formed Steel Structures (CCFSS) was established to provide an integrated approach for handling research, teaching, and technical services on cold-formed steel structures at the University of Missouri-Rolla. The Center brings together technical resources from universities, trade associations, research laboratories, steel producers, manufacturing companies, consulting engineers, building officials, governmental agencies, and others.

The Center is currently co-sponsored by the American Iron and Steel Institute, Metal Building Manufacturers Association, Metal Construction Association, Rack Manufacturers Institute, Steel Deck Institute, Steel Stud Manufacturers Association, and the University of Missouri-Rolla.

Since 1968 UMR has conducted numerous research projects on cold-formed steel structures. These projects have been supported by the American Iron and Steel Institute, National Science Foundation, the American Society of Civil Engineers, Metal Building Manufacturers Association, Metal Lath/Steel Framing Association, the Steel Deck Institute, the Chromium Centre in South Africa, The Nickel Development Institute in Canada, the Specialty Steel Industry of the United States, and individual companies.

With regard to teaching, UMR is one of few universities to offer a graduate course on cold-formed steel structures. In addition to the regular course, UMR has regularly conducted short courses and international specialty conferences to provide continuing education programs for the engineering profession. Visit our website at www.umr.edu/~ccfss.

Center for Aerospace Manufacturing Technologies

318 Engineering Research Lab

Ming C. Leu *(Director)*

Tim Comerford *(Assistant Director)*

Internet Home Page: http://campus.umr.edu/camt/

Faculty: K. Chandrashekhara, J. Choi, L. Dharani, F. Dogan, J. Drewniak, R. Dubroff, W. Fahrenholtz, G. Galecki, G. Hilmas, M. Koledintseva, K. Krishnamurthy, R. Landers, F. Liou, R. Mishra, S. Murray, S. Neal, J. Newkirk, M. O'Keefe, T. O'Keefe, D. Pommerenke, J. Sarangapani, C. Saygin, R. Schwartz, J. Stanley, J. Stoffer, D. Summers, H. Tsai, D. Van Akin, R. Zoughi

The mission of the Center for Aerospace Manufacturing Technologies (CAMT) is to serve as a center of excellence to research, develop, evaluate and demonstrate new and optimal methodologies and tools for the rapid and cost-effective manufacture of aerospace components and products and to promote new education and training programs for the evolving aerospace manufacturing workforce, resulting in significant technological advancement and national economic impact.

CAMT was established in May 2004 at UMR in partnership with Boeing Phantom Works in St. Louis, Missouri through major funding from the Air Force Research Laboratory in Dayton, Ohio, with the following objectives:

- Research, develop, evaluate, demonstrate and transfer advanced technologies of critical importance to the Air Force and the aerospace supply chain in the United States.
- Create knowledge, methodologies and tools to improve affordability, rapidity, quality, productivity, reliability, and safety in aerospace manufacturing.
- Disseminate the generated results to the aerospace supply chain through direct technology transfer as well as education, training and outreach activities.
- Serve as a role model of university-industry-government collaborative relationship.

CAMT involves thirty faculty members and over fifty research staff and students from several academic disciplines including mechanical engineering, electrical engineering, metallurgical engineering, ceramic engineering, mining engineering, engineering management, and chemistry.

The ten Research Thrust Areas for CAMT are:

1. Advanced Simulation
2. High Speed Machining
3. Abrasive Slurry Cutting
4. Rapid Prototyping
5. Laser Materials Processing
6. Friction Stir Processing
7. Non-Chrome Coating
8. Non-Destructive Evaluation
9. Composites Manufacturing
10. Electronic Materials Processing

Center for Entrepreneurship & Outreach (CEO)

US Bureau of Mines. Bldg.

Amy Light Mills *(Executive Director)*

The Center for Entrepreneurship and Outreach extends the research-based knowledge and problem-solving resources of the university to meet the needs of the state, nation, and international community. Programs to be administered by the Center for Entrepreneurship and Outreach include the MoFast SBIR/STTR, MO PTAC, BRIDG, and University of Missouri Extension.

The Missouri Federal and State Technology Partnership (MoFAST) is a unique partnership among the U.S. Small Business Administration, University of Missouri Outreach and Extension and its partners to bring government research and development awards to your small business. MoFAST staff can help you seek out, apply for and win government Small Business Innovative Research (SBIR) awards that will provide you money to develop and potentially commercialize your innovations. The SBIR program is designed to 1) stimulate technological innovation; 2) partner with small businesses to meet federal research and development needs; 3) encourage the participation of disadvantaged businesses and minority-owned firms in technological innovation; and 4) increase private sector commercialization derived from federal research and development funding. The program offers small technology-based companies the opportunity to obtain seed capital for research and development early in the innovation process.

Dealing with regulations and red tape can be frustrating. In fact, those obstacles often keep highly qualified suppliers from selling to the government. The Missouri Procurement Technical Assistance Centers (MO PTAC) assist businesses-including small, disadvantaged and women owned firms-in obtaining federal, state and local government contracts. Procurement specialists will help you in identifying opportunities and understanding the government contracting process so you can take advantage of government sales dollars.

Business Research & Information Development Group is a University of Missouri initiative to provide research-based information to those who help and support small business. BRIDG researchers create new knowledge, develop applications for existing knowledge and assist in the dissemination of that information throughout the state. BRIDG creates an institutionalized mechanism for examining small business trends, creating curriculum and services offered to small business owners and entrepreneurs and provides information to assist Missouri companies in remaining competitive. BRIDG also serves as the research arm of the Missouri Business Development Network (MoBDN), a statewide coalition of the Missouri Department of Agriculture, the Missouri Department of Economic Development, and the University of Missouri Outreach and Extension, which has been formed to provide comprehensive small business technical assistance to start-up and existing businesses, high-growth firms, and agriculture-related businesses throughout the state.

University Missouri Extension provides research-based knowledge and problem-solving resources from the University of Missouri to citizens, communities and businesses at the local level. Specialists in each county center can assist you directly or put you in touch with statewide experts and resources to serve your needs. The Business Development Program seeks to provide a seamless network of business support services that are

proactive in anticipating needs, responsive to Missourians, effective in assistance and efficient in delivery to Missouri entrepreneurs and businesses, with outcomes that result in maximizing Missouri's economic viability, individual capacity, families, communities and environment. E-mail umrceo@umr.edu or visit our website at www.umrceo.net.

Center for Environmental Science and Technology

105 USBM Building

Virgil J. Flanigan, Ph.D.; P.E. (*Director)*

Senior Investigators: K. Chandrashekhara (*Mechanical Engineering)*, D.E. Hagen (*Physics),* S. Kapila (*Chemistry*), J.W. Sheffield (*ME & AE and EM),* Gerald Wilemski (*Physics).*

Research Investigators: N.L. Book (*Chemical Engineering),* N. Ercal (*Chemistry)*, M.W. Fitch (*Civil Engineering),* D. Forciniti (*Chemical Engineering),* R. Frank (*Biological Sciences),* N.L. Gale (*Biological Sciences),* A.W. Hatheway (*GE and Pet. Eng.),* P.M. Lutz (*Biological Sciences*), D.B. Manley (*Chemical Eng.),* C. Merrow (*Chemistry),* B.R. Patterson (*Biological Sciences),* K.D. Peaslee (*Metallurgical Engineering),* C.W. Ramsay (*Metallurgical Engineering),* M.E. Schlesinger (*Metallurgical Engineering),* P.K. Terkonda (*Civil Engineering),* K.J. Westenberg (*Biological Sciences).*

The Center for Environmental Science and Technology (CEST) is an expression of commitment by the university to be a positive force in helping society deal with environmental problems and concerns. Its mission is to involve students in the resolution of real-world environmental problems by enlisting them in research programs at UMR. To this end CEST fosters academic (students and faculty), industrial, and government laboratory participation in interdisciplinary environmental research. This multi-faceted program brings to bear new and existing technologies to the solution of environmental problems.

CEST may, therefore, be considered a catalyst for environmental research and teaching. It brings together under a common umbrella more than 25 faculty as senior investigators, research investigators, and adjunct investigators. Represented are more than a dozen engineering, physical science, life science, mining, and metallurgical disciplines. CEST also brings together a wide array of extraordinary laboratories and institute. These have an impressive array of capabilities and unique expertise in cloud and aerosol sciences, materials research and recycling, environmental trace analysis, materials characterization, toxicology, coatings technology, environmental monitoring, and many other areas. To contact us e-mail CEST@umr.edu.

Center for Friction Stir Processing

234 McNutt Hall

Rajiv S. Mishra (Director)

The Center for Friction Stir Processing (C-FSP) was approved in Nov. 2002. The primary objective of the center is to enhance the science and technology of friction stir processes. Friction stir processing is the only solid state technology that is capable of producing wide-ranging microstructural modifications at localized regions of interest. Friction stir processing is an emerging technique based on the principles of friction stir welding (FSW). This relatively new joining process was developed initially for aluminum alloys, by The Welding Institute (TWI) of the UK. It is a solid-state joining method that is energy efficient, environmentally friendly, and versatile. It is considered by many to be the most significant development in metal joining in a decade. Several new concepts have been developed in the last few years to broaden the impact of friction stir technologies. These concepts make friction stir processing a generic tool for localized microstructural modification and manufacturing. The key technological areas are:

Friction stir welding
Friction stir processing for superplasticity
Friction stir casting modification
Friction stir microforming
Friction stir powder processing
Friction stir channeling

The C-FSP has state-of art facilities that include a three-axis friction stir machine, a six-axis robotic friction stir machine and a friction stir spot welding machine. E-mail rsmishra@umr.edu or visit our web site www.umr.edu/~fricstir.

Center for Infrastructure Engineering Studies (CIES)

223 Engineering Research Laboratory

Antonio Nanni (Director);

Staff: Jason Cox (Senior Research Specialist); Travis Hernandez (Research/Laboratory Technician); Gayle Spitzmiller (Administrative Assistant); Abigayle Sherman (Senior Secretary); Nestore Galati (Research Scholar)

Researchers: Ashraf Ayoub (CArE); Genda Chen (CArE); John J. Myers (CArE); Halvard Nystrom (Engineering Managament); Pedro Silva (CArE); Steve Watkins (Electrical Engineering); Abdeldjelil Belarbi (CArE); Susan Murray (Engineering Management); Norbert Maerz (Rock Mechanics); Gregorz Galecki (Rock Mechanics); Paul Worsey (Rock Mechanics); Richard Stephenson (CArE); Jason Baird (Rock Mechanics); Chandrashekhara, K. (Mechanical and Aerospace Engineering); Neil Anderson (Geology/Geophysics); Mohammad Qureshi (CArE); Thomas Petry (CArE); Richard Brow (Ceramics Engineering); Ronaldo Luna (CArE); Lokesh Dharani (Mechanical and Aerospace Engineering); Shamsher Prakash (CArE); Roger LaBoube (CArE)

The Center for Infrastructure Engineering Studies (CIES) was created through the University of Missouri's Mission Enhancement Program at the Rolla campus. The center provides research expertise in the area of buildings and civil infrastructure and infrastructure management.

The mission of CIES is to provide leadership in research and education for solving the problems affecting the nation's infrastructure systems. CIES is the primary conduit for communication among those on the UMR campus interested in infrastructure studies. The center provides co-

ordination for collaborative, interdisciplinary efforts with emphasis on:

Interdisciplinary research and development with projects tailored to address needs of federal agencies, state agencies, and private industry. Particular attention is devoted to addressing the needs of the State of Missouri. Undergraduate and graduate students are an integral part of the R&D efforts.

Technology transfer and continuing distance education to the engineering community and industry.

CIES is also the home of the University Transportation Center (UTC) which was established by the US Department of Transportation to advance technology and expertise in the many disciplines comprising transportation through the mechanisms of education, research, and technology transfer at university-based centers of excellence. The UMR UTC funds research proposals in the areas of advanced materials and non-destructive testing technologies with the objective of advancing the state-of-the-art of transportation structures. Three examples of such areas are: improvement of existing civil engineering construction materials, FRP composites, and non destructive testing.

Another integral part of CIES is the National Science Foundation Industry/University Cooperative Research Center entitled "Repair of Buildings and Bridges with Composites (RB2C)". The center focuses on addressing the needs of the construction industry in the areas of rehabilitation and strengthening of existing structures using the novel, untapped potential of advanced composite materials and technologies. The center makes possible the opportunity to integrate the knowledge, experience, interests and resources of industry partners with university research. Industry partners provide expertise and resources in the design and application of advanced composites; University partners provide technical expertise and research resources. The center creates a forum for technology development and transfer that could not be achieved by any of the individual participants. In 2002, RB2C became a multi-university center: North Carolina State University (NCSU) joined forces with UMR. In 2004, Washington State University became the third node of the Center.

The Natural Hazards Mitigation Institute (NHMI), also housed within CIES, is a multi-disciplinary program of research focused on evaluation of naturally-occurring phenomena and developing effective mitigation techniques utilizing new technologies and materials. NHMI draws on faculty expertise in civil and environmental engineering, geology, seismology, geophysics, and geological engineering. Email: cies@umr.edu

Websites:www.cies.umr.edu; www.utc.umr.edu; www.rb2c.umr.edu; http://web.umr.edu/~umrnhmi/

Phone: (573)341-4497

Cloud and Aerosol Sciences Laboratory

Norwood Hall

D. E. Hagen (Phys., Director); R. W. Alexander (Phys., Co-Director); D.J. Alofs (M&AE and EM); J.C. Carstens (Emeritus Prof. Phys.); N. Ercal (Chem); G. Gadbury (Math.); B.N. Hale (Phys.); S. Kapila (Chem.); U.O. Koylu (M&AE); P. Nam (Chem); J.L. Schmitt (Phys.); D.R. White (B.E.); P.D. Whitefield (Chem.); G. Wilemski (Phys.).

Global, regional, and local environmental concerns have propelled the atmospheric sciences to international prominence. Well known issues such as the local air quality, ozone, acid rain, photo-chemical smog, and global warming attest to the urgency of atmospherically related problems now facing society.

CASL is administered by the College of Arts and Science and is a multidisciplinary effort drawing on the solid base of engineering and sciences provided by UMR. Students from various academic departments perform their thesis research within the laboratory in partial fulfillment of the M.S. or Ph.D. degree requirements of their "home" department.

The program is directed toward a fundamental understanding of the role of aerosols, including clouds and fogs, in our atmospheric environment. Current studies focus on the generation and environmental impact of anthropogenic combustion aerosols, basic nucleation processes of water and ice, cluster structure both in the gaseous phase and on substrates, homogenous binary nucleation, neutron scattering measurements on nanodroplet aerosols, particle formation in supersonic expansions, and the heterogeneous chemistry and chemical composition of air borne aerosols and their impact on the atmosphere.

CASL provides leadership in international and national research programs. It is the home for the UMR-lead federal Center of Excellence for Aerospace Particulate Emissions Reduction Research, is a member of the FAA-NASA-Transport Canada Center of Excellence for Aviation Noise and Aircraft Emissions Mitigation, and leads the air related mission for the UMR Center for Emerging Contaminants. Its brief extends to particulate mitigation strategies for new combustor development.

The Laboratory houses a variety of instrumentation, much of it unique. This includes a finely tuned expansion chamber used to study nucleation phenomena, instrumentation designed to directly determine the chemical composition of particles on which droplets form, and an extensive mobile facility for both the on-ground and in-flight collection and analysis of combustion (e.g. jet exhaust) aerosols.

In addition to acquiring knowledge of cloud, aerosol, and atmospheric science, the laboratory imparts to students a familiarity with a wide variety of data acquisition, signal conditioning, and system engineering problems. Visit our website at http://campus.umr.edu/physics/acloud/.

Design Engineering Center: An Overview

Kenneth M. Ragsdell, *(Director)*

The Design Engineering Center is a unique industry, government, university research partnership. The purpose of the Center is twofold: to address the universal need for effective design and manufacturing methodology in support of efficient product development, and to provide quality educational opportunities to properly prepared and motivated students (undergraduate, graduate, and practicing engineers). The Center is a research activity in the Engineering Management and Systems Engineering Department. The current organization con-

sists of a director, a number of graduate and undergraduate students, and participating faculty. Current areas of research include total quality management, concurrent engineering, Taguchi Methods®, quality engineering, six sigma and design for six sigma, the product development process, and design optimization. E-mail ragsdell@umr.edu or visit our website at http://web.umr.edu/~design/.

Distance and Continuing Education

Mechanical Engineering Annex

This is a campus-based department which administers and coordinates a wide variety of credit and non-credit programs for UMR students and other audiences; local, national and international. Programming is available both live or on-line using the Internet and streaming video technology and provides access to programs at a time convenient to the users.

Credit courses can lead to a Certificate of Completion in a specific area of interest. Certificates can also serve as a way to qualify for subsequent admission to an appropriate Master's Degree program.

Credit courses are supplemented by a wide variety of activities and educational opportunities through non-credit short courses, conferences and technical seminars. Descriptions of currently available programs may be found on the web site at http://dce.umr.edu.

For further information, contact

Distance and Continuing Education
University of Missouri-Rolla
103 ME Annex
1870 Miner Circle
Rolla, MO 65409-1560
Phone: (573) 341-4132
FAX: (573-341-4992
e-mail: dce@umr.edu

Electronic Materials Applied Research Center (EMARC)

311 Materials Research Center

Harlan U. Anderson (Director)

Electronic Materials Applied Research Center (EMARC), a state/industry/university sponsored research program at UMR, is in its third year of developing new electronic materials technologies for the economic growth of industries in Missouri and throughout the nation. EMARC was formed through the support of the State of Missouri and the University of Missouri-Rolla due to an awareness of emerging technologies in piezoelectric sensors, actuators and emitters; fuel cells and oxygen permeable membranes; and thin film structures and devices.

The unifying theme for EMARC activities is the development of new ceramic and polymer materials and associated processing technologies for demanding applications where improved performance, yield, and reliability are desired. These activities build on the Center's core capabilities in molecular-level design and synthesis of materials, materials process, solid state materials analysis, and applications testing. EMARC also seeks to identify new areas where its R&D capabilities can be applied to industrial needs.

The Center is continually looking for ways to develop commercial applications from electronic materials and welcomes any inquiries you may have. Please contact Dr. Harlan U. Anderson, the Center's director, at (573) 341-4886 or by e-mail at emarc@umr.edu for additional information.

Energy Research and Development Center

R. Larry Grayson (*Interim Director*)

The University of Missouri-Rolla has a unique concentration of expertise providing a critical mass of research capability, which leads to innovative and sophisticated technological solutions to address a wide spectrum of energy issues. It is in the integration of innovative approaches to the solution of problems that UMR shines and can be of great service to Missouri and the nation in solving future energy needs. The Energy Research and Development Center's (http://campus.umr.edu/energyrd/) **mission** focuses on increasing the visibility of energy issues and enabling teams of university scientists and engineers, outside industrialists, and policy makers to prioritize, address and resolve key energy-related issues.

Supporting the strategic goals of the University of Missouri-Rolla and the Missouri Department of Natural Resources, the goals and objectives of the Energy Research and Development Center include the following:

- Assist the Missouri Department of Natural Resources by promoting alternative energy sources and encouraging energy conservation and efficiency;
- Research, develop and assist in commercializing environmentally friendly energy sources;
- Develop and deliver energy assistance programs, educational programs and technology transfer materials to Missouri residents, the University community and interested organizations and groups across the country;
- Develop and promote policies that integrate the nation's energy, environmental and economic goals, and inculcate energy-related issues among K-12 education throughout Missouri by working with teachers;
- From a 2001 base of $3.8 million in external energy-related research funding, facilitate growth in the amount of research funding and opportunities for faculty and students;

The University of Missouri-Rolla has numerous departments working on interdisciplinary energy-related research. General programmatic themes pursued in a diverse research portfolio follow:

- Advanced Exploration and Extraction Technology Development
- Advanced Technology for Refining and Transporting Energy

- Advanced Power Generation and Transmission Technology Development
- Renewable Energy, and Energy Conservation and Efficiency
- Environmental and Economic Policy Integration

These themes form the major research areas and frame significant energy-related issues. Sponsored research projects are funded from a variety of government and private sources. For more information, contact energyrd@umr.edu.

Engineering Research Laboratory

Engineering Research Lab

K. Krishnamurthy *(Director)*

The Engineering Research Laboratory (ERL) is an incubation environment for new and/or developing, interdisciplinary engineering research projects. It also offers space for projects too large for existing space in one engineering department and non-restrictive organization within which to develop new research ventures. The Applied Microwave Nondestructive Testing Laboratory, Center for Infrastructure Engineering Studies, Construction Materials Testing Laboratory, Embedded Systems and Networking Laboratory, Environmental Research Center on Emerging Contaminants, Intelligent Systems Center, Laser-Aided Manufacturing Processes Laboratory, Manufacturing, Automation and Control Laboratory, Power Electronics and Motor Drives Laboratory, and Trustworthy Systems Laboratory are housed in this facility.

The ERL helps School of Engineering departments in contacting with funding agencies, proposal development, graduate student recruitment, graduate program administration, and organization of interdisciplinary research initiatives. It also houses the Student Design Competition Center, Minority Engineering Program, Women in Science and Engineering Program, and Project Lead the Way Program. E-mail address is kkrishna@umr.edu.

Environmental Research Center

Butler Carlton Hall / 201

341-6908

C.D. Adams (*Director)*

The Environmental Research Center (ERC) was established in 1965. Its mission is to conduct fundamental and applied environmental research to find solutions to key environmental issues facing Missouri and the Nation. A second mission is to provide outstanding training opportunities to engineers and scientists in order that they may provide industry, consultancies, academia, and government with premier technological and scientific leadership.

ERC investigators conduct research sponsored by a wide range of entities including the National Science Foundation, U.S. Environmental Protection Agency, U.S. Department of Education, U.S. Geological Survey, Missouri Department of Natural Resources, American Water Works Association Research Foundation, as well as industry in Missouri and elsewhere. Examples of current research areas in the ERC include: occurrence and control of antibiotics and antibiotic resistant bacteria at concentrated animal feed operations (CAFOs) and in drinking water; occurrence, fate and removal of estrogenic and endocrine disrupting chemicals in drinking water and wastewater treatment plants; reactions of indoor air pollutants in home and business environments; phytoremediation technology for treatment of organic contaminants in soil and groundwater; nutrient control using struvite precipitation; control of heavy metals with constructed wetlands; control of odor emissions from CAFOs; fate of mercury in incinerator flyash; treatment of MTBE and alternative fuel oxygenates; and transport of lead and zinc in Missouri rivers in the Old and New Lead Belts.

Laboratories associated with the Environmental Research Center maintain state-of-the-art instrumentation including: a wide variety of gas chromatographs with mass spectrometer and other detectors; high pressure liquid chromatographs with mass spectrometer and UV detectors; ion chromatograph; total organic carbon analyzer; atomic absorption spectrometers with graphite furnace and flame combustion; inductively couple plasma mass spectrometer with laser ablation; a wide variety of ultraviolet and visible spectrophotometers; stopped flow spectrophotometer; molecular biology tools including polymerase chain reaction (PCR) instrumentation and denaturing gradient gel electrophoresis (DGGE) and clone libraries; microscopes; respirometers; and wide variety of other instruments. Specialized research equipment and facilities include temperature control rooms; a trailer-mounted experimental water treatment system; a trailer-mounted mobile air pollution analysis laboratory; a rooftop greenhouse; pilot-scale air stripping system; pilot-scale advanced oxidation and ozonation systems; laminar flow hoods; anaerobic microbiology facilities; and a variety of other research equipment.

E-mail address is ercnews@umr.edu or visit the website at http://campus.umr.edu/environ/index.html.

Experimental Computation Laboratory

Computer Science (Room 342-C)

Bruce McMillin (*Director)*

The Experimental Computation Laboratory (ECL) is an organization dedicated to research in advanced methods of distributed and parallel computation. The current focus is on the use of rigorous mathematics through formal methods to create fault-tolerant and secure real-time distributed computing systems applied to critical infrastructure protection. Interdisciplinary research is the cornerstone for the success of the ECL.

Graduate and undergraduate students and faculty are supported by several grants from Air Force Office of Scientific Research and the National Science Foundation which utilize the ECL. E-mail us at ff@umr.edu or visit our website at http://www.umr.edu/~ff/ecl.html.

Experimental Mine

Bridge School Road

J.C. Tien (*faculty member responsible)*

The Experimental Mine, situated on Bridge School Road 1.5 miles from the main campus, consists of 25 acres of surface and underground facilities which provide excellent opportunities for mineral engineering teaching and research. The surface land includes several dolomite quarries. The underground workings consist of four shafts and 1,500 feet of single-level drifts.

This excellent teaching facility is equipped with a variety of mine-related equipment which offer practical hands-on experience in critical topics. This includes air compressors, rock drills, mucking machine, slusher and motor, diamond core drill, blasting seismography, extensometers, and surveying instruments. A complete ventilating fan system is connected to the underground area, appropriately installed for experimental data collection. The mine classroom has internet access and is equipped with an overhead projector, surround sound, and other teaching facilities.

Recent faculty and students research has been conducted in the areas of rock blasting, mine ventilation and atmospheric control, rock mechanics, and pipeline transportation. The quality of facilities is indicated by the frequency of requests for government and industrial use of the premises. Student projects, however, retain priority on this equipment and the working areas.

E-mail mining@umr.edu or visit our web site at http://campus.umr.edu/mining/depexpmine.htm.

Graduate Center for Materials Research

Straumanis Hall

James L. Drewniak *(Director)*

Senior Investigators: H.U. Anderson (*Cer. Engr.)*; R. Brow, (*Cer. Engr.)*; F.D. Blum (*Chem)*; D.E. Day (*Cer. Engr.)*; L.R. Dharani (*M&AE & EM)*; W.J James (*Chem);* T.J. O'Keefe (*Met.)*; J.O. Stoffer (*Chem.)*; and J.A. Switzer (*Chem.) and D. Waddill (Phys.).*

Research Investigators: M. Bertino *(Phys.)*; R. F. Brown *(Bio. Sci.)*; D. R. Carrol *(Basic Engr.)*; C. Chusuei *(Chem.)*; H.L. Collier *(Chem.)*; W.G. Fahrenholtz *(Cer. Engr.)*; J. M. Gregg *(Geol. & Geophys.)*; G. Hilmas *(Cer. Engr.)*; D.E. Hoiness *(Chem.)*; S. Kim (*Nuc. Engr.*); S. Kirkby *(Chem.)*; A. Kumar *(Nuc. Engr.)*; R. S. Mishra *(Met.)*; S. F. Miller *(Met.)*; J. W. Newkirk *(Met.)*; M. J. O'Keefe *(Met.)*; P.D. Ownby *(Cer. Engr.)*; O. A. Pringle, *(Phys.)*; M. N. Rahaman, *(Cer. Engr.)*; C.W. Ramsay *(Met.)*; D.G.C. Robertson *(Met.)*; S. Roy *(M&AE and EM)*; M.E. Schlesinger *(Met.)*; T. Schuman *(Chem.)*; J. D. Smith *(Cer. Engr.)*; D. VanAken *(Met.)*; M.R. VanDeMark *(Chem.)*

The Graduate Center for Materials Research was established for the purpose of multidisciplinary research on materials and to provide improved centralized laboratories and specialized equipment for faculty and students involved in materials research. The Center provides graduate students in many academic departments (e.g. ceramic, chemical, civil, and metallurgical engineering, mechanical and aerospace engineering and engineering mechanics, chemistry, life sciences, and physics) with advanced training in materials engineering and science.

The research conducted in the Center ranges from fundamental science to applied engineering and includes the development, evaluation, application, and understanding of ceramics, metals, polymers, biomaterials, electronic materials and composites.

Major accomplishments from the Center include: glass microspheres for treatment of liver cancer, transparent composites for windows/armor, environmentally friendly corrosion coatings glasphalt road paving, ceramic materials (perovskites) for fuel cells, electrodeposited superlattices, epitaxial films, and chiral surfaces, quantum-confined materials such as tunnel diodes, nanolithography, asbestos-free brake lining, new permanent magnet materials, dielectric and piezoelectric properties of normal and relaxor ferroelectric and high frequency phased linear arrays for medical ultrasound. In 1985, the past achievements and continuing importance of the UMR materials engineering and science program were acknowledged when this program was declared one of only eight areas designated for eminence in the University of Missouri-system.

The Center is located in Straumanis Hall, a four-story building with 30,000 square feet of laboratory and office space. The Center contains the modern equipment needed for research on materials development, characterization and evaluation, and for measuring common mechanical, thermal, electrical, and optical properties. It contains specialized and adaptable experimental facilities for:

- ceramic superlattice electrodeposition
- electrochemical characterization for deposition and corrosion
- electronic materials
- ferroelectric ceramics
- glass melting (up to 1650°C), fiber drawing, flame spheroidization and property measurements
- nanomaterials
- plasma deposition of materials
- biomaterials
- composites
- structural characterization by x-ray diffraction, electron microscopy (including field-emission SEM), scanning tunneling microscopy and atomic force microscopy. Surface analysis is also available via x-ray photoelectron and Auger electron spectroscopy.

The Center has an active interest in industrial research and economic development which is suitable for graduate student education and which falls within the technical expertise of the staff.

E-mail UmrMaterialsR@msx.umr.edu or visit our website at http://web.umr.edu/~mrc/.

High Pressure Waterjet Laboratory

Rock Mechanics Facility

David A. Summers (*Director)*, Grzegorz Galecki, and A. Curtis Elmore.

The High Pressure Waterjet Laboratory (HPWL) has been established as a separate group within the Rock Mechanics and Explosives Research Center (RMERC).

For over three decades UMR has built an international reputation in the area of high-pressure waterjet cutting and cleaning. During that time the technology has moved out of the laboratory and into industry with a broad band of applications. In the past, through contracts that have been awarded, faculty researchers in the RMERC have pursued many of these applications. The establishment of the waterjet laboratory as a separate substructure provides a focus for research activities in the waterjet field and recognizes UMR's leadership in waterjet research.

Fields to be encompassed within the laboratory include the areas of waterjet cutting, surface preparation of concrete and steel structures, accelerated cavitation studies, prevention of material erosion, processes supported by waterjet, two- and three-phase flow, the mechanism of fluid jet generation and the physics of high speed jet impact. high-pressure jet cutting; high-pressure jet cleaning; high-speed fluid cavitation; the mechanisms of surface erosion; two-phase fluid flow, including the addition of particulates to the jet stream; the mechanisms of fluid jet generation; multi-axis milling in mining and manufacturing; and the surface physics of fluid impact. Applications include mining, civil engineering, industrial and military uses.

The Laboratory serves as an inter-disciplinary campus research facility. State-of-the-art equipment provides support to special needs of manufacturing, military and environmental industries.

E-mail dsummers@umr.edu or visit our website at http://web.umr.edu/~waterjet/.

Institute of Applied Mathematics

Rolla Building

Leon M. Hall (*Director).*

The Institute of Applied Mathematics brings together faculty and students from the Department of Mathematics and Statistics and other science and engineering departments to study applications of mathematics to a variety of scientific and technological problems. It provides educational opportunities and serves as a resource for the state in support of high-technology industrial development.

Research is conducted on both the graduate and undergraduate level. UMR's computer facilities provide support for research and give the campus state-of-the-art capabilities for doing experimental work in mathematics. E-mail address is mathstat@umr.edu.

Institute for Applied Chemistry and Nuclear Magnetic Resonance

Schrenk Hall

Frank D. Blum *(Director)*

The Institute for Applied Chemistry and Nuclear Magnetic Resonance was established by the Chemistry Department in 1990.

The purpose of this Institute is to provide a research group that can focus on problems relating to applied chemistry. In addition, of the funding partially supports the operation of the Nuclear Magnetic Resonance (NMR) Laboratory, supervised by Dr. Frank Blum. The NMR instrumentation is multi-disciplinary and is used by many researchers on campus.

Members of the Institute include: Dr. F. Blum; Dr. R. G. Brow, Dr. H. Collier, Dr. L. Dharani, Dr. Dr. E. Hoiness, Dr. N. Leventis, Dr. P. Neogi, Dr. T. Schuman, Dr. O.C. Sitton, Dr. L. Sotiriou-Leventis, Dr. J.O. Stoffer, Dr. J. Switzer, Dr. M. Van De Mark, Dr. K. Woelk.

The Institute promotes the study of chemical solutions to practical problems in the areas of polymers, coatings, solvents, surfactants, thin films, and environmental science. The Institute consists of faculty members involved in research. It has a good balance of science and engineering. The specific interest is the behavior of polymers and biopolymers, coatings, composites and conducting materials, as well as the discovery of new types of materials from chemical synthesis and novel techniques such as plasma treatment. The transport of molecules in colloidal and polymer systems is being studied by several researchers. The structure and dynamics of surfactant-based systems, including micelles, microemulsions, liquid crystals and colloidal dispersions, are being studied as well. The development of chemical processing methods and the production of nano-scale and ceramic materials are also of interest.

Institute for Chemical and Metallurgical Process Development

Straumanis Hall

T.J. O'Keefe *(Director)*

The structure, properties, and performance of materials are influenced by the processes used during synthesis and fabrication. Development of the theoretical and practical requirements of these chemical and metallurgical processes are the focus of the institute. Drawing upon traditional hydro, pyro, and electrometallurgical processing operations, the institute investigates a wide range of materials that are of technological importance. Emphasis areas include, but are not limited to, electrochemical processing, corrosion,.environmentally benign materials and processes, thin films and coatings, surface modification technologies, and packaging materials. Characterization and analysis of materials and processes using advanced experimental and computational techniques and state of the art equip-

ment are emphasized. E-mail address is: tokeefe@umr.edu.

Institute of River Studies Environmental Hydraulics and Hydrology

Butler-Carlton Civil Engineering Hall

C.D. Morris *(Director)*

Water and water-resources problems are often comprehensive in nature and their complexity is such that their resolution requires cooperative effort from individuals from a wide variety of academic backgrounds. The purpose of this institute is to encourage and to foster interdisciplinary team research directed toward resolution of the water and water-resources problems of Missouri and the nation.

The focus of institute activity is on the nation's natural waterways. In particular, the institute has a long record of research into problems related to major rivers in the midwest. The institute helps bring academics together with agencies, companies and industries to initiate research. The institute assists in assembling potential research collaborators and in preparation of proposals.

E-mail address is morris@umr.edu.

Intelligent Systems Center

320 Engineering Research Lab

Internet Home Page: http://www.isc.umr.edu

Ming C. Leu (*Director)*

Senior Research Investigators: M. Crow, K. Krishnamurthy, F. Liou, and D. Wunsch.

Research Investigators: L. Acar, V. Allada, D. Belarbi, F. Blum, J. Choi, B. Chowdhury, X. Du, D. Enke, C. Kim, R. Landers, X. Liu, S. Madria, B. McMillin, R. Mishra, A. Okafor, K. Peaslee, J. Sarangapani, C. Saygin, H. Tsai, and Y. Xing.

Affiliated Members: S. Agarwal, K. Chandrashekhara, G. Chen, M. Hilgers, M. Nelson, S. Sedigh-Ali, E. Tauritz, G. Venayagamoorthym, and F. Xia.

Description of Center and Research Focus Areas:

The Intelligent Systems Center (ISC) mission is to provide an interdisciplinary research environment in which faculty from various departments can cooperate and conduct research on sponsored projects involving real physical systems with special emphasis on an intelligent (smart) systems approach. ISC has integrated its primary research mission with UMR's commitment to develop internationally recognized graduate research programs focused on key technologies.

The approaches for accomplishing ISC's objectives consist of (i) developing interdisciplinary research programs to match the emphasis areas of sponsoring agencies with the expertise of UMR faculty, (ii) obtaining long-term federal research grants and industrial contracts, and (iii) developing multidisciplinary research facilities.

ISC considers the education of graduate students as one of its major activities and provides graduate research assistantships through the Center's investigators. The students supported by research grants choose their thesis topics to be closely related to the grant. The interdisciplinary nature of research provides an excellent opportunity for the students to interact with students from other disciplines. The students also gain valuable experience in working as a team and acquire communication and project organization skills. The interaction between graduate students and program managers from industries and federal agencies is very helpful in the application of their research to real-world problems.

Multidisciplinary research teams consisting of faculty members and graduate students from the departments of interdisciplinary engineering, chemical and biological engineering, chemistry, computer science, electrical and computer engineering, engineering management and systems engineering, mechanical and aerospace engineering, and material sciences and engineering have been established to conduct research in emerging technologies. The ISC has also developed state-of-the-art laboratories to conduct research on virtual reality, smart structures, neural networks, energy systems, agile manufacturing and automatic inspection, MEMS, robotics, and structural health monitoring. The Center provides advanced computing facilities (hardware and software) to its research investigators and graduate students working on research projects. Active research is in progress in the following interdisciplinary research areas

Intelligent Manufacturing Processes and Systems

- 1.1 Virtual and Rapid Prototyping & Manufacturing
- 1.2 Laser Based Deposition & Prototyping
- 1.3 Laser Micromachining
- 1.4 Friction Stir Processing
- 1.5 Composite Manufacturing
- 1.6 Liquid Metal Processing
- 1.7 Machining, Structural Health Monitoring & NDE
- 1.8 Integrated & Collaborative Design & Manufacturing

Integrated Control and Monitoring of Energy Systems

- 2.1 Reliability and Security of Power Systems
- 2.2 Power Electronics and Distributed Generation
- 2.3 Fuel Cells

Advanced Simulation, Sensing and Control

- 3.1 MEMS and Nanosensors
- 3.2 Wireless Sensor Networks
- 3.3 Intelligent and Adaptive Control
- 3.4 Virtual Reality and Advanced Simulation

Computational Intelligence and Embedded Systems

- 4.1 Data Processing, Fusion and Management
- 4.2 System Design and System Support
- 4.3 Trustworthy and Embedded Hybrid Systems

International Affairs

103 Norwood

Jeanie Hofer *(Director of International Affairs)*

The Office of International Affairs (IA) coordinates international activities, administers all matters involving immigration for international students and scholars and provides advisement services to the University's international population.

The International Affairs Office is responsible for the recruitment of international students and serves as a direct contact with U.S. government agencies, embassies, consulates, and the private sector concerning international activities. The office serves as the campus home for international student exchange programs and the majority of study abroad (see section on Study Abroad Programs). In addition, the Office assists faculty wishing to travel or work overseas, and offers educational and training programs, both domestically and abroad.

International Affairs coordinates and administers UMR's Applied Language Institute which houses the Intensive English Program. The Office of International Affairs is responsible for the organization of international protocol activities, and monitors the status of UMR international linkage agreements.

International Student Sponsored Student Program

A full range of services for sponsored international students is provided through the Office of International Affairs (IA). International students sponsored by international agencies receive special services and are required to pay $250 per semester administrative fees. Individual students desiring to take advantage of these special services may apply for them.

Details on the current Sponsored Student program and costs are available upon request from the Office of International Affairs, 103 Norwood Hall, Rolla, Missouri 65409-0160.

Mandatory Health Insurance for International Students

As a condition of their enrollment all international students are required to purchase UMR international student health insurance. This includes all F-1 and J-1 visa holders. In addition, the J-2 dependents of the J-1 visa holders are required to maintain the UMR international student health insurance. Premiums must be paid with in two weeks of the beginning of the Fall and Winter semester (Summer premiums are included in the Winter Semester).

For more information on the mandatory health insurance requirement, contact the Office of International Affairs, 103 Norwood Hall, 573-341-4208.

Policy for Tuberculosis Testing For UMR Students Adopted April 2004

The UMR campus takes reasonable steps to protect students from exposure to infectious diseases. Students from endemic areas account for about 95% of the risk of a tuberculosis (TB) outbreak on campus. Untreated TB can result in serious health problems for the student and for other people who come in contact with him or her. In order to ensure a healthy campus, beginning with the Fall semester 2004 and every semester thereafter, all international students shall be required to have a Mantoux skin test for tuberculosis administered in the United States and a reported reading in millimeters.

Testing with the Mantoux two step skin test must be done or verified, at no charge, at UMR Student Health. If a skin test is positive, a further test involving a chest X-ray must be administered to determine if active tuberculosis is present.

All students who test positive for tuberculosis shall be offered tuberculosis medication and must be directly observed taking their medicine at Student Health for the designated time period.

Enrollment is contingent upon completion of TB testing and possible treatment as described above.

Study Abroad Programs

The Office of International Affairs coordinates study abroad opportunities for UMR students. Students may choose from a variety of study programs. Credit toward the degree program may transfer back to UMR, with pre-approval. Some scholarships are available. The following provides a sample listing of institutions with which UMR has current study abroad agreements:

- Western Australian School of Mines (Australia)
- University of New South Wales (Australia)
- Hautes Etudes Commerciales Liege (Belgium)
- Provinciale Hogeschool Limburg (The Netherlands)
- Universidad de la Serena (Chile)
- Satakunta Polytechnic (Finland)
- Freiberg University of Mining & Technology (Germany)
- Fachhochschule Aachen (Germany)
- Universidad Autonoma Metropolitana Unidad Iztapalapa (Mexico)
- University of Regiomontana (Mexico)
- Akaki Tsereteli State University (Republic of Georgia)
- Kutaisi State Technical University (Republic of Georgia)
- University of the Western Cape (South Africa)
- Bilkent University (Turkey)

Intensive English Program (IEP)

The Intensive English Program (IEP) at the University of Missouri-Rolla provides intensive instruction in the English language for international students whose proficiency in the language is insufficient for admission into course work at the University.

The IEP offers 20 hours of non-credit course work per week in all aspects of language learning - pronunciation, reading comprehension, vocabulary development, grammar, writing, listening comprehension, speaking interaction, and note-taking. The program provides instruction at four proficiency levels: Beginning English, General English, Introduction to Academic English, and English for Academic Purposes.

All international students who have not satisfied the University's language-proficiency requirements are

required to complete IEP's assessment testing, which is comprised of four parts:

Michigan Test of English Language Proficiency (MTELP) A standardized test that evaluates abilities in grammar, reading comprehension, and vocabulary.

Test of Writing Proficiency (TWP) A locally developed test that evaluates abilities to write clear, well organized English based on nationally developed guidelines

Oral Proficiency Evaluation (ORE) A locally developed test that evaluates abilities to speak English clearly based on nationally developed guidelines.

Test of Listening Proficiency (TLP) A locally developed test that evaluates abilities to understand spoken English, especially in a classroom setting.

Students who perform well on all tests may be approved immediately for academic course work at the University. Other students are enrolled in IEP course work and may then complete the series of tests again at the end of the semester. Recommendations for promotion into a higher level of the IEP or for advancement into university course work are made by the IEP's academic coordinator based on student testing and faculty input.

Students who enroll in the IEP must complete that program to the satisfaction of its director and academic coordinator (i.e. satisfy all completion requirements) before being allowed to enroll full time in university course work. A student may enroll in a reduced university load (in conjunction with IEP course work) with the approval of both his/her academic department and the director of the IEP.

Ordinarily, the IEP is open only to students who intend to pursue study at UMR and who have been conditionally admitted to the University. If space exists, international students already admitted to UMR and already taking course work may enroll in IEP courses to improve their English. In addition, international persons with no academic affiliation with the University may be considered for admittance.

For more information on the IEP, contact the Office of International Affairs (IA), 103 Norwood Hall, University of Missouri-Rolla, Rolla, MO 65409-0160. Phone: (573) 341-4208 Fax: (573) 341-6356. E-mail address is ia@umr.edu.

Laboratory for Atomic, Molecular and Optical Research

Physics

Michael Schulz (*Director)*

The Laboratory for Atomic, Molecular and Optical Research is composed of UMR faculty members performing research in atomic molecular and optical physics. This scientific area is concerned with the few body problem, the structure of atoms and molecules and their interaction with each other, with electromagnetic fields, and with surfaces.

The laboratory provides an environment which enhances this research activity, and which fosters cooperation and collaboration. The laboratory also provides a structure for formal cooperative programs, group funding, and other collective scientific activities.

Basic studies in the atomic, molecular and optical sciences have made major contributions to many of the new technologies that exist today. Laboratory faculty and staff members continue to contribute to the development of advanced concepts in such wide ranging areas as femtosecond laser physics, atomic interaction dynamics for electron, positron, and ion impact, and atomic processes important in controlled nuclear fusion. E-mail schulz@umr.edu or visit our website at http://campus.umr.edu/physics/lamor.

Minority Engineering and Science Programs (MEP)

212 ERL

J.P. Fransaw (*Coordinator)*

The MEP program is designed to promote and support underrepresented minority (African American, Hispanic American, and Native American) students who are pursuing engineering or science degrees.

The MEP Office provides opportunities for professional development activities, networking events, and opportunities to participate in regional and national conferences. UMR is also a member of the National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc. (GEM) www.nd.edu/~gem. To learn details about these opportunities contact: J.P. Fransaw, Coordinator, Minority in Engineering and Science Programs, 212 ERL, (573) 341-4212, or visit our website at www.umr.edu/~mep.

NASA UMR Center of Excellence for Aerospace Propulsion Particulate Emissions Research

(UMRCOE) Norwood Hall G-11

Prof. Philip D. Whitefield, (*Director*)

pwhite@umr.edu

The UMRCOE is a university/industry consortium coordinated by the University of Missouri – Rolla conducting critical research that is providing the tools to characterize, measure, and predict propulsion particulate emissions in current and future aircraft. These tools will be validated both in the field and in realistic laboratory test environments that integrate propulsion altitude cells with state-of-the-art diagnostic systems and numerical modeling, and will be used as much-needed consistent standards for current and future engine design by the U.S. and for characterizing the aircraft component of combustion emission in the assessment of local air quality in and around our airports The consortium consists of the University of Missouri-Rolla, (UMR), Massachusetts Institute of Technology (MIT), the Boeing Company and Aerodyne Research Inc. (ARI), the University of Illinois, Georgia Tech, University of California Riverside (UCR) and South West Research Institute (SWRI).

NASA FAA TC Center of Excellence for Noise and Emissions.

UMR is the lead university for emissions studies in the recently established NASA FAA TC Center of Excellence for Noise and Emissions. Our objectives are to characterize the emissions (both small particles and condensable gaseous species) from aircraft and airports through measurements, understanding and model the microphysical processes associated with particle formation, and determine the health effects of emissions. The characterization of emissions from aircraft and airports requires comprehensive measurement of small particles and condensable gaseous species. In fact, it requires measurement of both the emissions of individual airplanes as they contribute to the total aircraft segment of the emissions budget of an airport, and the emissions at the fence line of the airport due to all airport operations. The major tasks of the COE are: 1: Analyze and Correlate Particle Concentration Data 2: Study quantifying emission indexes, 3: Develop Field Testing Data.

Natural Hazards Mitigation Institute

Neil Anderson, (*Director*)
nanders@umr.edu

The State of Missouri is subject to natural hazards that cause widespread damage to residential, corporate and public structures, and transportation facilities and other infrastructure. Natural hazards include earthquakes, floods, tornados, high velocity straight winds, forest fires, ground collapse, expansive soil failure, and dam and levee failure. Such hazards result in significant economic costs and even loss of life.

Many of these natural hazard events have common attributes:

- The onset of these disruptive natural forces occur within a short time frame, often with little immediate warning, threatening both lives and property.
- The widespread impact of the event extends over an area and its contents, whether people, domestic dwellings, transportation or civil infrastructure.
- The multiplicative influence of weaknesses in geology and soil stratigraphy can compound structural damage.
- The impact of man's activities can contribute to the problem or can impede access to the area, slowing the needed mitigation and remediation of damage.

The complex and multifaceted nature of these natural hazards, which nevertheless have a common central theme, requires a coordinated and multidisciplinary approach to develop a strategy to provide protection to people and vulnerable structures before an event, to minimize injury and damage during the event and to ease the requirements for remediation after it is over. This requires a deep understanding and awareness of the areas at risk, if mitigation, response and remediation procedures are to be effectively developed.

The UMR Natural Hazards Mitigation Institute (NHMI) is charged with mitigating and remediating the detrimental effects of natural hazards both within the State of Missouri and Nationally, through ***research, public service*** and ***education***. More specifically, the UMR NHMI is charged with the following responsibilities:

- Conduct, lead, coordinate and otherwise facilitate interdisciplinary ***research*** in the broad area of natural hazards including likelihood of occurance, cause, effects, mitigation and remediation.
- Provide and disseminate ***public service*** *i*nformation regarding probability of natural hazard occurences, their potential outcomes, and precautionary measures which can minimize detrimental effects of natural hazards.
- Prepare, sponsor, coordinate and otherwise facilitate the development and offering of ***educational courses*** (academic and training) in the broad area of natural hazards.

Rock Mechanics and Explosives Research Center

Rock Mechanics Facility

Senior Research Investigators: David A. Summers (*Director);* Paul N. Worsey, Grzegorz Galecki, Norbert Maerz, Leslie Gertsch and Jason Baird.

The Rock Mechanics and Explosives Research Center, organized in 1964, brings together leading investigators from different disciplines to research static and dynamic rock mechanics and explosives technology. The High Pressure Waterjet Laboratory of the Center has developed a world-renowned team of waterjet technology specialists.

Areas of current research capability are: mine design, strata control, rock stress measurement, centrifugal testing – simulation of stress in complex geological structures, properties of rock under confining pressures, similitude studies, rock mechanics and applied geology, dynamic rock mechanics, dynamic strain measurement, high-pressure waterjet rock cutting, constitutive properties of rocks, high-pressure waterjet long-wall mining of coal, deep mine problems, ultrasonic wave measurements in rock, dynamic creep in rock, wall breaking, cratering with explosives, fracture propagation in rock, explosives and blasting, explosive labeling and detection, rock penetration and disintegration for rapid excavation, coal mine roof stability, concrete cutting and scarifying with water, and waterjet cleaning. Center faculty work in the development of new methods and machines for excavation, and concurrently means to protect structures from blast and other methods of attack.

A substantial contract is currently held with the U.S. Navy for studies related to the demilitarization of military high explosives and rocket propellants; assessment of washout parameters using high pressure waterjets and analysis and treatment of the waste stream produced. Interdisciplinary scholars and researchers bring differing and unique views to problem solution in fields which benefit the area, state, nation and ultimately the world.

E-mail vsnelson@umr.edu or visit our website at http://campus.umr.edu/rockmech/.

Southwestern Bell Cultural Center (SWBCC)

The Southwestern Bell Cultural Center (SWBCC) promotes and supports diversity and cultural education within the University and Rolla community. Our mission is to educate UMR students about differences and similarities. We provide advocacy for African American, Native American, international and other minority groups, bringing people of all races together and facilitating their participation in campus organizations and programs such as Student Council and the Student Union Board. Various inter-cultural programs are provided for the student body in celebration of diversity.

In addition, SWBCC contributes to student retention and satisfaction of customers with high quality co-curricular opportunities and excellent customer service. Our goal is to be an active and visible partner in the campus and community. Furthermore, we provide safe, clean and affordable facilities for student and campus events. SWBCC is part of the Office of Student Life in the Havener Center. Visit our website at: http://campus.umr.edu/culturalcenter/ .

UMR Engineering Education Center

Telecommunity Center Building University of Missouri-St. Louis Campus

Victor Birman (*Director)*

The UMR Engineering Education Center, located on the UM-St. Louis campus, offers UMR courses and degrees to working engineers and scientists in the St. Louis area. The courses, offered in the evenings, are graduate credit courses, applicable to master of science or Ph.D. degrees. In addition, the Center offers graduate certificate programs. Most of the courses can also be taken by non-degree candidates for personal enhancement.

The MS may be earned in aerospace, civil, computer, electrical, manufacturing and mechanical engineering, information science and technology, and engineering management. Offerings may be expanded if warranted by interests and requirements of area students.

Requirements for the MS degree at the UMR Engineering Education Center are identical to those on the Rolla campus. Courses are taught by UMR faculty members, and by UMR-approved adjunct faculty (industrial research engineers and scientists).

The center was established in 1964, as a part of the continuing education programs at UMR. Over 2,600 engineers obtained M.S. degrees at the center. Further information can be obtained from the director, at One University Blvd., St. Louis, MO 63121, phone 314-516-5431. E-mail dbenenat@umr.edu. or visit our website at www.umr.edu/~umreec.

Video Communications Center

G-8 Library

Ross Haselhorst (*Manager)*

The Video Communications Center offers a variety of video production services to the campus community. This is achieved through several specialized video-equipped classrooms, teleconference rooms and a selection of recording and transmitting technologies.

For the student - especially those pursuing advanced degrees -- the VCC offers an array of communication tools for extending the traditional classroom and laboratory out into “the real world.”

Services include:

- Multimedia classroom use for thesis defense and project presentation
- Tape, DVD or web-streaming video recording of the above
- Video teleconferencing for project presentation to sponsoring companies, for student organizations meeting between campuses, and for job interviews
- Conversion of video tapes to and from the several international formats so the tapes can be played in the US, or sent overseas
- Assistance in set up, capturing and converting research lab project videos for documentation and presentation
- Participation in advanced coursework carried over and stored on the Web for later access
- The opportunity to take courses “at a distance” while away from or after leaving UMR

For more information on these and other services, contact the Video Communications Center at (573) 341-4526; or e-mail vcc@umr.edu or visit our website at http://www.umr.edu/~vcc>.

The Moeller Writing Studio / Writing Across the Curriculum Program

113 Campus Support Facility

Dr. Kate Drowne *(Director)*

The Dr. Beverley Bowen Moeller Writing Studio is located in 113 Campus Support Facility. Professors and Graduate Teaching Assistants in any course may refer undergraduate students to the Studio for help with writing in any field of study. The **Moeller Writing Studio** is staffed with undergraduate peer tutors who help students with general writing skills and with discipline-specific writing, such as proposals, technical memos, and laboratory reports. They see students both by appointment and on a drop-in basis. Tutors also maintain a collection of handbooks and other writing resources in both print and electronic media for students to consult. Open tutoring hours are posted early in the semester, and students can make tutoring appointments by phone or e-mail for a wide range of times. Writing Tutors are available to students without charge.

The **Center for Writing Technologies** is located in 114 Campus Support Facility, connecting with the **Moeller Writing Studio.** This is a Computer Learning Center linked to the campus network and specially equipped with writing, editing, and desktop publishing software, and with printers, a scanner, and a Smart Board. It is used for classes and workshops, and is available for general student use during Writing Studio office and tutoring hours, when not being used for classes.

The primary purpose of the **Moeller Writing Studio** and the **Center for Writing Technologies** is to support **Writing Across the Curriculum,** UMR's program to improve undergraduate students' writing abilities. In addition to required and elective writing courses in the English Department, all departments at UMR are developing writing emphasized courses to give students experience writing in their academic and professional fields. Although the **Moeller Writing Studio** focuses on undergraduate writing, graduate students are welcome to use the Center, to consult with tutors and to attend the various workshops the program offers. The Writing Center houses a seminar series on topics suggested by students and faculty.

For more information about **Writing Across the Curriculum** services and facilities, contact the Director of Writing Across the Curriculum, 113 Campus Support Facility, University of Missouri–Rolla, Rolla MO 65409; call (573) 341 4436; or e-mail wac@umr.edu.