



Applied Research & Technology Program NEWSLETTER



*Program of Distinction
Ogden College of
Science and Engineering*

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Western Kentucky University

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From The Director

**Dean--Ogden College of Science & Engineering
Blaine Ferrell**

In 1997, the Applied Research and Technology Program of Distinction was established by the Higher Education Reform Act (House Bill 1). As part of that act, a Trust Fund for Excellence was established by the Council on Postsecondary Education to encourage each comprehensive university to invest in one or two areas of excellence that had achieved national prominence or had the potential to achieve national prominence. Each comprehensive university had to submit proposals to the Council in order to be considered for funding. If selected as a Program of Distinction, the money from this trust fund had to be matched with money from the university or other sources.

Ogden College of Science and Engineering (at that time Ogden College of Science, Technology and Health) submitted a proposal involving 10 Centers, three of which were already nationally prominent. These 10 Centers form an interdisciplinary network of scientists, mathematicians and engineers who collaborate on applied research and technology projects. The unique feature of

this program is that students conduct the research under the supervision of a faculty mentor. Thus, students gain hands-on experience by applying knowledge acquired in the classroom setting to solve real world problems. In addition, students, in many cases, work as part of a multidisciplinary team. The benefits for student learning and for meeting the scientific and technical needs of constituents are tremendous. Graduates who have participated in the Applied Research and Technology Program have been accepted and received financial support from some of the best graduate schools in the country (e.g., Cornell University, Vanderbilt University, the University of Wisconsin, Caltech, etc.) Others have readily obtained employment in their discipline.

Another benefit from this program has been the improvements to infrastructure within Ogden College of Science and Engineering, and now, also the College of Health and Human



(Continued from Page 1—"From The Director")

Services. Funds that have been used for classroom and laboratory renovations have enhanced our competitiveness for federal research and development dollars. The Applied Research and Technology Program has experienced a return on investment of approximately \$6 for every dollar from the state.

The Biotechnology Center trains freshmen students in techniques related to molecular biology so they are able to participate in applied research projects early in their academic careers. This year 42 students applied to this highly competitive program that has only a limited number of spots. The equipment and technician associated with this Center has made this program possible.

Another example for infrastructure benefiting learning is the Geographical Information Systems (GIS) laboratory. This facility has made possible the development of a new certificate program. Students from a number of disciplines have taken advantage of this program. In addition, this facility has supported research by other Centers, such as, the Biodiversity Center and the Center for Water Resource Studies. Spatial representation of data made possible by GIS is becoming essential in many disciplines.

In addition to the synergy being achieved within the University, the Applied Research and Technology Program has reached outside the University to network with other agencies in order to provide more opportunities for hands-on experiences for our students. The Materials Characterization Center provides services for more than 130 companies and currently is working in partnership

with two external agencies to determine mercury emissions from coal-fired power plants. The data is critical to power plants attempting to meet stricter Environmental Protection Agency guidelines effective in 2006.

Several centers have joined the Southern Appalachian Cooperative Ecosystem Study Unit, a consortium of university and federal and state agencies. This consortium works to facilitate ecosystem studies and to marshal the assistance of experts from member institutions. A strong partnership between several centers and the National Park Service at Mammoth Cave National Park has led to many applied research opportunities for our students. Collaborations with the United States Department of Agriculture-Agricultural Research Service at Mississippi State University on projects searching for solutions to managing animal waste associated with chicken and cattle should help regional farmers with the growing problem of the disposal of animal waste. This collaboration has led to the placement of four research scientists in Bowling Green who will extend the capacity of our faculty to involve students in relevant research.

It is difficult to put in words the excitement generated in students for their discipline and the learning that takes place when they are involved in applied research and technology projects. At the same time, the community benefits from the engagement of these students in special research projects.. I invite all to visit and experience this excitement first hand.

—written by Blaine Ferrell, Dean , Ogden College
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The Kentucky Climate Center

at WESTERN KENTUCKY UNIVERSITY 

Precipitation variations over a small area can be significant. This is a fundamental challenge for atmospheric and hydrologic science. Dr. Rezaul Mahmood of Department of Geography and Geology and Kentucky Climate Center, in collaboration with the National Park Service, has established a dense rain gauge network (total 16 rain gauges) in and around the Mammoth Cave National Park (MCNP). The data from these sites will be used in the classrooms and will increase effective student learning in rapidly expanding meteorology, hydrology, and GIS programs at WKU. Using data from our



vicinity will be an added bonus for students since most of our students come from nearby communities. The data will also be available to everyone in the WKU community and can also be very useful for students in other disciplines [e. g., chemistry (e. g., environmental chemistry) and biology (e.g., aquatic biology)]. The project is largely funded by the Action Agenda Program of the KY CPE and partly supported by the Kentucky Climate Center, Hoffman Environmental Research Institute, OCSE, and Faculty Research Council.

—written by Dr. Rezaul Mahmood

APPLIED PHYSICS INSTITUTE



Applied Physics Institute Helps Clean Up White Oak Naval Surface Warfare Center

The Shaw Engineering Corporation had a large surprise as they were decommissioning and cleaning up the Naval Surface Warfare Center at White Oak, Maryland. They discovered what appeared to be 600 unexploded bombs and shells (UXO) in a landfill. These ordnance ranged in size from 155 mm to MK 82 size weapons. For the laymen, these UXO could contain anywhere from 100 lbs to 2000 lbs of high explosive (see Figure 1).

Historical records indicated that some shells were filled with concrete or plaster of Paris. Other shells were indicated to be empty. Due to their poor condition (see Figure 2 on Page 4), it was difficult to differentiate the shells. Furthermore, there was no numbering or labeling of the shells.

A large scale project (over \$1M) was instituted to destroy these munitions. Each one of the UXO would be cut in two with a special water cutting tool. Shaw Engineering contacted the US Navy Explosive Ordnance Disposal (NAVEOD) Technology division for equipment to determine the contents of the UXO prior to cutting.

NAVEOD contracted WKU's Applied Physics Institute (API) to assist them in determining the contents of these UXO. Previously, the API had developed the PELAN explosives detection system for this type of work. NAVEOD wanted the

API to set up the PELAN for the four week testing period.

API Personnel, Phil Womble, Jon Paschal, and Lindsay Hopper (See Figure 3) worked in 10-12 hour shifts at the Maryland site for a week, preparing the PELAN for this testing. They assembled a special cart for the device and worked out the ergonomics of how each shell would be tested. They also wrote an automated decision making algorithm for these tests to determine the contents of the UXO.

The tests were performed during July 14th to August 5th 2003. With the API's help, NAVEOD personnel were able to measure nearly 50 shells a day. In addition, API personnel monitored the data coming from the test to ensure that the PELAN was functioning properly.

One of the interesting findings was that some of the shells contained a large amount of water. One shell was estimated to hold approximately 11 gallons!

Based on the API's efforts, the tests were completed ahead of schedule with significant cost savings to the US Navy. NAVEOD personnel were very pleased with the performance of the PELAN and the API.

-Phil Womble, Applied Physics Director
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Figure 1. Lance Brown, an explosive specialist, stands in the testing area. These ordnance are approximately 10 ft. long, 2 ft. wide and could contain anywhere from 500 to 2000 lbs of explosive.



Figure 2. The PELAN examines a MK 82



Figure 3. From Right—Lindsay Hopper, Phil Womble, Jon Paschal with a MK 82 shell.

The Scott Center for Construction and Engineering

Concrete Canoe Team places 6th in National Competition

The Western Kentucky University Concrete Canoe Team continued to achieve national prominence by placing 6th overall nationally in the 2003 National Concrete Canoe Competition. This year's entry, "Illusion", also took home the coveted "Best Canoe" award, which is given to the team that the judges as well as fellow competitors feel is the best built canoe in the competition based on finish, appearance, durability, and overall design. The national sponsor of this annual event, Master Builders, liked "Illusion" so much they requested to keep the canoe on display in the main lobby of their world headquarters in Cleveland, Ohio.

The WKU team had some tough competition as the top engineering schools in the country compete in this annual event. This year's winner, The University of Wisconsin - Madison, is a perennial top 10 engineering school. Of the top 25 teams at the national competition, over half are in the top 20 engineering programs.

This is certainly a testament to the caliber of student that WKU attracts and highlights the strength of the new Engineering programs as well as Ogden College as a whole in its ability to prepare these students with the technical skills necessary to achieve at such a high level.

-written by Matt Dettman, Scott Center Director
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Top Left: The Boat—The "Illusion", the WKU's Concrete Canoe Teams 2003 winning boat.

Top Right: Canoe Judging—Left: Cody Henderson, Judge, John Sewell Team Captains.

Bottom: Racing—Left: Lindsay Preston, Right: Lindsay Parson



Concrete Canoe Team

Materials Characterization Center

The Materials Characterization Centers Multifunctional Laboratories

The multifunctional laboratories at the Materials Characterization Center on Western's South Campus provide an ideal learning situation for Ogden College students. Laboratory courses in analytical (CHEM 435 and CHEM 531), physical (CHEM 412, CHEM 451, CHEM 453), and materials (CHEM 425, CHEM 591) chemistry, and materials science (AMS 317) are routinely taught at the facility. Several classes (CHEM 475, OGDEN 295, ME 241, PHYS 403 and GEOL 399) either perform experiments and/or are given lengthy tours of the facility each year. In addition to the formal laboratory courses, students and faculty work together in the research courses (CHEM 299, CHEM 399, and CHEM 599) or in cooperative education classes (CHEM 369 and CHEM 389). Each year approximately 150 students perform experiments in these upper level classes or conduct research at the Center. All these courses are conducted in the same space that is used for the Center's research and service work projects. This space is used about 15

hours per day. The total work force at the Center includes 6 research associates, 6 visiting scholars (Ph.D.'s), 5 graduate students, (3 Ph.D. and 2 M.S.) and 5 undergraduate students. In addition to these employees at the Center, 8 faculty members regularly bring their students to the Center for classes and work on research projects. Students taking classes at the Center become quite familiar with the Center's instrumentation and get to work side-by-side with the young professionals working there. Several professionals and CEO's have called the Materials Characterization Center a "world class facility."

The research and service work projects provide "real world" problems to solve and samples for the students to analyze and characterize. The students employed at the Center work with these problems and samples as part of their work assignment. The same type of samples that have been collected through several years of research and service work are then used for experiments for the formal courses. Using state-of-the-art instrumentation and standard procedures (ASTM and EPA), several of which were developed by faculty and students at the Center, the students are taught how to solve real world problems with real world samples. It is an ideal learning situation for students and the experiences gained prepares them for immediate entry into the profession they have chosen.

*-written by John Riley, Director
Materials Characterization Center
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Students working in the Materials
Characterization Center .

**Top Left: Bridgette Sutton
Top Right: Ginger King
Bottom Right: Nathan Whitely,
Bridgette Sutton, Melody Taylor**





2003 Sand-in-the-City Contest

Team Stewart-Richey was awarded the "Best Architectural Design" in the 3rd annual Sand-in-the-City Contest in which twenty-one teams competed. The architect who worked with Stewart-Richey's team was Neal Downing, AIA, professor in the Architectural & Manufacturing Sciences Department. This sculpture was based on the theme, "Light a Child's Way" and featured all metaphors of light; the sun, a lighthouse with a rotating beacon, a lantern and luminary, and a Disney character. The team had a fantastic time participating in this wonderful charitable event.

-Neal Downing, Architectural Center Director
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According to the Behavioral Risk Factor Surveillance Survey (BRFSS, 1996), 55 percent of Kentuckians reported they did not have a dental insurance plan. In addition, the BRFSS data show that Kentucky has the second highest rate of endentulism for persons over 65 years of age, and many of the dental problems faced by Kentuckians could be treated through water fluoridation, and education. Furthermore, data recently obtained by the University of Kentucky College of Dentistry and the Barren River District Health Department show that the proportion of Kentucky school children with untreated tooth decay is 56 percent. The Centers for Disease Control (CDC) reports that tooth decay is the single most common chronic disease of children 5-17 years, five times more than asthma (59% versus 11%). Untreated tooth decay causes problems in eating, speaking and learning.

The Institute is committed to improve the oral health status of Southcentral Kentuckians. Initially, the WKU Mobile Health and Wellness Unit's oral health initiative began visiting schools providing oral health promotion and dental screening. In the Fall 2002, the Institute enhanced the oral health services to include a school-based dental sealant program, *Smile Southcentral Kentucky*.

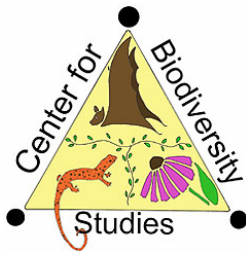
The Institute chose four of the ten Barren River Area District Development counties to receive

dental sealants and oral health education. Allen, Butler, Edmonson and Hart counties were selected. Sealants were offered to every 2nd and 7th grader that attends public schools in these counties. For the first year, 688 students were screened for sealants and 563 (82%) received sealants. Forty-six percent were referred for further dental work, primarily decay treatment. All students that were screened received oral health education and promotional oral health items such as toothbrush, toothpaste, and floss.

In August 2003, the Institute participated in the Bach to School Bash in Warren County where immunizations and health promotion were offered. At this event, 79 children were screened and 17 received sealants.

Finally, the mobile unit traveled to the Kentucky State Fair and worked collaboratively with the Kentucky Dental Association, University of Louisville, and University of Kentucky to participate in the *Smile Kentucky* program aimed at improving the oral health condition of Kentucky's children. In this ten-day event, 5,600 children received educational information and 2,600 children received dental sealants. The Institute is seeking funding through grants and private donations to continue the program.

-written by Staci Simpson, Center Director
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A few seconds ahead of the angry but still groggy buffalo, the last of six WKU students slipped through the foot-high space under the logs of the boma, or pen. In the next boma, a buffalo bull rammed the fence, displacing the ten-foot high structure of eight inch logs by several feet, and raising a cloud of African dust. The students were assisting veterinarians of Provett Wildlife Services of South Africa in testing the buffalo for bovine tuberculosis before the animals were entered into a disease-free wild buffalo breeding program. This experience was part of Biology 485, Field Biology: Conservation and Management of African Wildlife, a course offered by the WKU Biology Department and Center for Biodiversity Studies in partnership with Parawild, a South African game management company. Each year, Dr. Mike Stokes of WKU's Biology Department leads ten students on a journey to South Africa to explore the science, economics, and social



issues surrounding the conservation of big game in that diverse and fascinating corner of the continent. The South African model of game management is very different from that in the U.S., in that game is the property of the state in the U.S., whereas in South Africa, the opposite is



true. Privatization of game management has led to development of game ranches and reserves as one of the fastest growing economic activities in that country, but may be

leading to even greater economic disparity. These are the sorts of issues on which we want the students to concentrate. Their favorite part of the course, though, is the hands-on experience with game capture and treatment. This year, in addition to working with buffalo, the students

helped treat giraffe, and also participated in a giraffe capture. The course is taught in the wildlife-rich bushveld of Limpopo and Mpumalanga provinces and in Kruger National Park, where on-site instructors include top professionals in wildlife capture, transport, rehabilitation, veterinary medicine and wildlife epidemiology. The students who take the course typically will pursue careers in ecology, wildlife management, or veterinary medicine. This course and similar workshops offered by Parawild are also taken by veterinarians for continuing education purposes. The course typically fills a year in advance. Those with questions about the course may contact:

—michael.stokes@wku.edu.



Extra Pictures from BIODIVERSITY “Africa Trip” from Page 7





WKU Conference Draws International Cave Science Crowd

In June 2003, WKU's Hoffman Environmental Research Institute and Center for Cave and Karst Studies, along with the Cave Research Foundation and Mammoth Cave National Park hosted *Karst2003*, the International Conference on Karst Hydrogeology and Ecosystems. Well known to residents of south central Kentucky, *karst* refers to the types of limestone landscapes where caves, sinkholes, and underground rivers are common features. Drawing about 90 participants from 16 countries and supported by United Nations and WKU funding, *Karst2003* was the primary meeting this year for the four premier international karst research groups including the Karst Commissions of UNESCO's International Geological Correlation Program, the International Geographical Union, the International Association of Hydrogeologists, and the International Union of Speleology. The meeting proved to be informative and enjoyable, even in the face of several timely challenges in organizing such a conference: the downturn of the global economy made funding travel difficult for many; new procedures associated with U.S. Homeland Security made visas more difficult or impossible for some to get; and sadly,

travel problems with the 2003 SARS epidemic meant that only four out of 22 of our Chinese colleagues were able to attend the meeting.

The gatherings were largely held on campus, with three days of research program business and scientific sessions, and a poster session/social at the Fine Arts Center Art Gallery. Of course, hosting such a meeting in south central Kentucky meant a fun field trip to the Mammoth Cave System, on and below the surface, where the world's top karst scientists had a chance to argue about various ideas concerning this world-renowned landscape's evolution. There were parties and dinners throughout the week, at the beautiful entrances to Lost River and Hidden River Caves.

Despite a frantic week for the organizers who seemed to be rushing from one crisis to the next, the meeting went very well and the conference's stated goal of increasing international communication was certainly achieved. We hope and expect that the new friendships and potential collaborations made between individuals at the meeting will lead to a better understanding of karst science.

*-written by Chris Groves,
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Picture Caption: Scientists (left to right) from Germany, Slovenia, and the Slovak Republic listen to Park Service hydrologist Joe Meiman discuss the Green River within Mammoth Cave National Park. Photo by Chris Groves.

(Hoffman Institute—Continued Article #2)

Hoffman Institute Cooperates with US Forest Service to Protect Sensitive Karst Areas in Southeastern Alaska

For several years, the Hoffman Environmental Research Institute has worked with the US Forest Service (USFS) on several research projects to better understand the nature of limestone karst (cave) areas within Tongass National Forest in southeastern Alaska. Located largely on remote islands along the Pacific coast, Tongass is well known for protecting one of the most extensive old-growth forests remaining in North America. Starting in the 1980's, spectacular caves have been explored there that contain remarkable biological, fossil, and archeological resources, possibly including direct evidence of the first migrations of humans from Asia into North America more than 10,000 years ago. The karst areas have hydrologic and ecological significance as well, as the large springs draining from them provide the headwater areas for the region's most productive salmon spawning rivers. At the same time, these sensitive resources are being impacted by widespread clear cut logging in the national forest, causing increased sedimentation in the caves that in some cases alters the system's hydrology and chemistry.

Bill Curry, the Hoffman graduate student, recently completed a thesis research project where he made the first direct measurements of post-logging sedimentation rates in caves on Prince of Wales Island in the national forest. Working in conjunction with WKU's Applied Physics Institute, Bill brought several hundred pounds of cave sediment back to WKU, where he measured levels of radioactive cesium remaining from open-air testing of hydrogen bombs during the 1950's and 1960's that is attached to the sediment particles, determining the rates at which the sediment has been washed into the caves since that time.

Earlier this year, Chris Groves traveled to the area to work with USFS geologist Jim Baichtal to study the hydrology and geochemistry of groundwater (pictures), in order to better understand how interaction of acidic peat bog waters with the limestone bedrock in the caves is impacting water quality and in turn, productivity of the area's salmon spawning rivers. They also developed language for a cooperative agreement between the USFS and WKU that is leading to increased student opportunities for education and research in Alaska.

-written by Chris Groves, Hoffman Institute Director



Top Left Photo: Floatplanes provide the primary means of transportation within the largely road less areas of Alaska's Tongass National Forest. *Photo by Chris Groves.*

Top Right Photo: A WKU/Forest Service team enters Beaver Falls Cave to collect water quality data to assess geochemical processes impacting the productivity of key salmon spawning rivers. *Photo by Chris Groves.*

Bottom Right Photo: Chris Groves negotiating a tricky climb (unfortunately in 38 degree water) from the deeper parts of Beaver Falls Cave. *Photo by Jim Baichtal).*





WKU Students Participate at National Conference

On September 30 through October 3, 2003, eleven WKU students participated in the National Conference of the American Water Works Association, held at the University Plaza Conference Center in Bowling Green. These students volunteered to assist the staff of the Bowling Green Municipal Utilities, who is the local sponsor of the conference.

The American Water Works Association provides assistance to Small to Medium Water Utilities and Districts through various methods including technical sessions on customer service, emergency response, field activities and water management. The WKU students assisted the moderators of 41 technical sessions with lighting, laptops, projectors, handouts and, in general, helped

to keep the conference running smoothly.

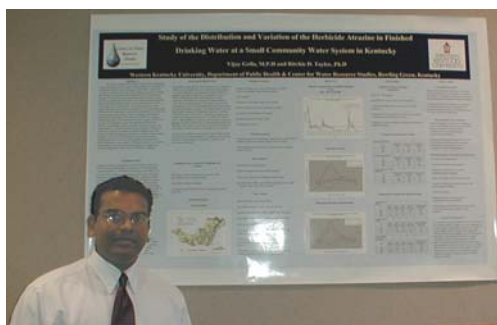
Dr. Andrew Ernest, Director of the Center for Water Resource Studies, believes that student participation in professional conferences benefits both the businesses involved and the students. Students have an opportunity to learn about the newest techniques and make invaluable contacts with businesses.

Students also toured the exhibit hall to visit a vast array of booths and talk to knowledgeable representatives about the future of technology in the water industry.

-written by [Marsha Wallace](#), Office Associate
Center for Water Resource Studies



From Left: Srikanth Lakkarsu, Mithun Gaddam, Naveen Midde, Gopi Kallepalli, Vijay Golla, Joey Willcox



Center for Water Resource Studies Students Win Poster Contest

Vijay Golla and Joey Willcox, both graduate students in Public Health, were asked by the AWWA to participate in their poster contest for the 75th Annual Meeting of the American Water Works Association, Kentucky/Tennessee Section, held in Bowling Green September 30th through October 2nd, 2003. The students presented posters on the effects of the agricultural herbicide, Atrazine, in drinking water. Both were winners in their division with an award of \$150.00 each.

Congratulations to
Both Vijay and Joey!



ARTP Directory



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