Auburn hosts Alabama’s first SAE competition

It could have been mistaken for a football weekend except it was April. The license plates and banners of RVs and trailers parked on the Auburn campus proudly proclaimed which part of the country they came from. All of this excitement could mean only one thing — the much-anticipated Mini Baja event was finally here.

Students from 65 colleges in the U.S. and Canada competed head to head as the Samuel Ginn College of Engineering hosted Alabama’s first Society of Automotive Engineers (SAE) competition, Mini Baja East 2006 (MBE06), April 13-15. Founded in 1976, Mini Baja is an annual SAE student competition to design, build and race a prototype of an off-road, all-terrain vehicle.

“A lot of detail went into the planning of the terrain for the events,” says Peter Jones, faculty advisor to AU’s Mini Baja team and the organizer of MBE06. To organize the multiple facets of the competition, Baja alumni from Auburn and other universities got together with members of interested businesses to form the Competition Planning Committee (CPC). CPC members all over the state used SharePoint, a web-based team collaboration system, to keep in touch.

Through a course project, Auburn’s civil engineering students were consulted to help develop the most effective ways to ready the National Center for Asphalt Technology (NCAT) site and carve out good Baja courses. The students presented their ideas, concerns, suggestions and recommendations to help organizers plan the event.

The CPC and numerous other organizers visited the NCAT site to collect data for planning the technical aspects of what will eventually become a new class of Baja competition. Course areas were marked off, photographed, and discussed, and the many factors of the event management strategies were evaluated.

Preparation of the site began in November 2005. By mid-March, event captains Jeremy Belcher, Emily Johnson, Marc Jarmulowicz, Darrell Krueger, Taylor Owens and Rachel Weatherly were putting finishing touches on their challenging events, including testing with Baja cars from previous years.

On April 13, the teams met at the AU Student Activities Center for technical inspection and design judging. On the 14th, the teams moved to
the NCAT test site in nearby Opelika for the acceleration, log pull, water maneuverability, land maneuverability, and suspension and traction events. The competition culminated on the 15th with a five-hour endurance race on a newly constructed off-road track.

The Baja vehicles traversed the course built especially for the event and featuring moderate ravines on cleared eastern woodland forest floor, and man-made and natural obstacles. For land maneuverability, the course featured a tight series of gates anchored by trees. This event measured the cars’ ability to get around trees, not the usual cones, and the drivers were expected to recover from any tree strikes without getting out of their cars.

The East competition is considered the most challenging of the three annual regional Baja events (others being Midwest and West) because of the water maneuverability test in which vehicles must float and propel through water. At the MBE06 course, water maneuverability took place in a pond created for the event. At approximately 120 feet by 120 feet, the pond is contained by gravel banks at a 1:5 incline descending to the bottom, with depth varying from 3.5 to 5 feet. The course was a tight slalom around buoys.

The endurance course had the classic Baja obstacle elements of creek crossings, mud holes, hill climbs, hairpin bends and a chicane. According to Darrell Krueger, endurance race event captain, the 2.2-mile course with a net elevation change of 90 feet was built to be challenging and creative, “to test man and machine.”

The terrain, an accurate representation of east Alabama, has soils ranging from red Alabama clay to sand to loose organic dark soil to rocks. Vehicles had to be capable of safe operation over rough land terrain including obstructions such as rocks, sand, jumps, logs, steep inclines, mud and shallow water, in any or all combinations and in any type of weather.

The Auburn University Mini Baja and the Auburn Lady Tigers Mini Baja teams combined this year to produce a single contender at MBE06. The Auburn team brought home a fifth place overall finish out of 65 teams, including first place in the highly-technical land maneuverability event. The team includes Bolton Tucker, captain, Chris Blackwell, Nathan Greer, Jared Healy, Jeremy Hrdy, James Manasco, Christie Mardis, Janine Mask, Caleb Merritt, David Palmer, Franklin Pierce, Carl Schmidt, Christa Soutullo, Christine Taylor, Michael Thompson and Calvin Winston.

The Mini Baja East 2006 top five overall winners are Tennessee Tech University, Clarkson University, Universite De Sherbrooke, Queen’s University and Auburn University. For event photos and final results, please visit the competition Web site at east.minibaja.org.
Message from the chair

We have been publishing this newsletter biannually for more than 10 years. The sole reason for its existence is to enhance the participation of our alumni in the department and in its future development. The participation of our alumni is not just about money. The collective experience and wisdom of our alumni is an extremely valuable resource in guiding the department's future course.

Alumni are part of a network to resources the department needs. They have knowledge of emerging frontiers in engineering, knowledge of opportunities to participate in both industrial and governmental research, and knowledge of outstanding prospective students. They are central to the continuous quality improvement of our program. We are trying to provide a number of avenues that will allow our alumni to easily participate in this vital process.

One of these avenues is our Industrial Advisory Board. Currently, we have the following members on the board: Otto Bohnenberger, Wendell Dallas, Jim Dowdy, Don Hendry, Dan Kohilhaas, Jim Martin, Richard Quina, Dan Shabo, and Martin Stap. Recently, the board has become much more organized with its own charter. Dan Kohilhaas has been elected as chair. The board desires to be much more proactive in providing assessment and advice for the department.

Another very important avenue for alumni participation is the Annual Alumni Mechanical Engineering Conference October 22-23, following homecoming weekend. For details, updates and online registration, please log on to www.eng.auburn.edu/me.

The conference is an excellent forum for learning about and having input into our program. It is also set in an ideal place for a reunion with former classmates and an opportunity to network. The Auburn Marriot Opelika Hotel and Conference Center at Grand National is a beautiful setting which offers championship quality golf amenities at the Robert Trent Jones Golf Trail and other recreational opportunities. Of course we are always interested in hearing from you outside of these two avenues ... just call or e-mail us.

In this issue you will read about special achievements of both faculty and students. In addition, you will see some very special achievements of two alumni, Dwight Wiggins and William Reed, who were inducted into the State of Alabama Engineering Hall of Fame. I want to especially commend Dwight for this accomplishment and his leadership in helping the College of Engineering in alumni development for the new Mechanical Engineering Building scheduled for completion in 2009. Not only has he contributed his time but also has made a personal substantial gift toward the new building.

The Department of Mechanical Engineering also received a substantial gift from William Walker, former dean of engineering and former Auburn University president (see article within).

All of these contributions will help advance the department’s ability to provide a top-notch educational experience to our students. Please remember that you can either give to the university general fund or designate your contribution to a college or department.

David Dyer
Since September 11, 2001, security for both civilian and government facilities has become a major concern around the world. Along with this increased awareness comes the need for more security personnel. Manpower has been stretched due to the military actions and unrest in Afghanistan and Iraq. A pressing need exists to develop ways to augment direct human surveillance and inspection, particularly in situations that have a high risk of violence.

David Bevly of the mechanical engineering faculty has received a three-year Young Investigator Program grant from the Office of Naval Research (ONR) for the autonomous navigation and control of a K-9, administered by the Expeditionary Warfare and Combating Terrorism Department of the ONR. One of only seven selected this year out of 238 proposals, the project will look at using GPS sensors and a micro-controller to automatically guide trained dogs (K-9s from Auburn’s vet school) to specific locations.

“There has been a great deal of development over the past few years with regard to robotic vehicles for security applications,” explains Bevly. “However, robotic vehicles suffer from lack of artificial intelligence, obstacle detection, and mobility. Alternatively, dogs have been used for many years to assist in security applications, in tracking suspects, and in detection of the presence of people, drugs, and explosives. For these applications, their highly developed sense of smell coupled with the ability to interact with humans and accept training has worked to make them the animals of choice.”

Bevly says the idea for the project came from Tony Overfelt and George Flowers of mechanical engineering and Paul Waggoner and Kevin Mullins of the vet school’s Canine and Detection Center, who proposed the use of GPS and inertial sensors to determine the dogs’ position and orientation.

“We have done similar work in our lab but this time we will be working with a different platform, a K-9,” he adds. “It has already been shown that dogs can be trained to follow sound or vibration commands in order to direct their paths.” The research will investigate the interaction between the capabilities of a trained working dog, augmentation devices, and an autonomous controller to provide a highly mobile “smart” platform for remote sensing and operations to support security and intelligence gathering activities.

Bevly will develop methods that will allow autonomous guidance of a dog utilizing technology originally developed for autonomous vehicles (such as GPS and micro-controllers). Together, the navigation, control, and adaptation will allow an autonomous controller to guide the dog to GPS waypoints, similar to methods used for unmanned ground vehicles. According to Bevly, this would provide a technological impact of being able to understand how to model and autonomously command animals in order to perform tasks too dangerous or difficult for humans.

“This award is a testament to the contributions and achievements of my graduate students who have accomplished a lot in a short period of time,” adds Bevly. “William Travis, Rob Daily and Adam Simmons helped with technical parts of the proposal, Ben Clark built the GPS system and recorded and processed data that was in the proposal, and Michael Newlin, John Wall and others performed a literature survey that was critical for the proposal.”
Auburn alumni inducted into Hall of Fame

In a February ceremony in Huntsville, four Auburn University alumni, Charles Griffin ('75, civil engineering), William Reed, David Scobey ('78, electrical engineering) and Dwight Wiggins were inducted into the State of Alabama Engineering Hall of Fame, and LBYD, Inc. of Birmingham, of which alumnus Dale York ('76, civil engineering) is president, was the only corporation/institution inducted.

William Reed, a Birmingham native, earned his bachelor's degree in mechanical engineering from Auburn in 1950. For 19 years he trained and specialized in steam turbine engines at General Electric Company. The expertise he gained in this area played a vital role in his contributions to GE's sales management organization. The foundation of his career still serves to advance the field of engineering.

Reed, who joined Southern Company Services as executive vice president, was made president in 1976. Using his technical and managerial skills, he led overall improvements in engineering, construction, and basic operations, serving a significant role in the history of one of the world's premiere utility companies. When he retired in 1984, the company had become a multi-billion dollar operation.

Upon his retirement, he founded Reed Consulting, which has contributed to improvements in Alabama's engineering firms for more than 20 years. He also served as chief executive officer of the Fine Wire Company in Selma, Ala., during a period of management instability and financial strife. The company was sold after four years of successful operation under Reed's purview.

Since 1966, he has been dedicated to excellence in education through scholarship support. He is a life member of the Auburn Alumni Association; serves on the Auburn Alumni Engineering Council; and is a member of the Samford Society, an elite group of benefactors whose cumulative gifts have reached the $100,000 level.

The Birmingham resident continues to contribute to the betterment of the state of Alabama, as both an engineer and a management executive, by applying his omnipresent leadership skills as president of the Birmingham Country Club, the Shoal Creek Country Club, The Club, the Birmingham Monday Morning Quarterback Club, and the Southern Seniors Golf Association. He is also a member of the Birmingham Rotary Club.

Dwight Wiggins, a native of Frisco City, Ala., received his Auburn bachelor's and master's degrees in mechanical engineering in 1962 and 1967, respectively, then served in the U.S. Army Corps of Engineers.

Wiggins spent nearly three decades with Exxon, becoming an expert in production challenges. He joined Tosco Corporation in 1993 as president of Bayway Refining Company. In 1996, when the corporation was restructured, he became president of Tosco Refining Company and was later named executive vice president of Tosco Corporation. Wiggins consistently generated positive cash flow and after-tax profits through a strong focus on safe, reliable and environmentally sound operations combined with relentless expense control and well defined individual accountability.

By 2001, his responsibilities included refining and distribution facilities in New Jersey, Pennsylvania, Louisiana, Illinois, California and Washington. At the time of his retirement, Wiggins had helped the company rise to become the third largest refinery operation in the United States. Since leaving Tosco, he has participated in several financial ventures including residential construction projects in Scottsdale.

Wiggins has served as chair of the Auburn Alumni Engineering Council’s development committee and has been named by the dean of engineering as a special counselor for fundraising in the college’s efforts to upgrade its engineering facilities. He works with Auburn Engineering students as a mentor and advisor to the college’s Formula SAE student team, accompanying the group to Australia in 2003 where it placed fourth in international competition. He has served on the National Petrochemical Refiners Association executive board and is past chairman of the Western States Petroleum Association. In April 2005, he received the Department of Mechanical Engineering’s Outstanding Alumnus award.

Throughout his career, Wiggins has been active in numerous civic and charitable organizations. He and his wife, Sally Price Wiggins (’62), have two children and reside in Basking Ridge, N.J.

**Walker establishes scholarship endowment**

William Walker, former Auburn University president, and his wife Myrna have established an endowment for engineering scholarships in the Samuel Ginn College of Engineering. The William F. and Myrna Walker Family Endowment for Scholarships at Auburn University for the Department of Mechanical Engineering is made possible through a gift of $500,000. The scholarship will be available to juniors and seniors. The endowment will support the continued vision of the College of Engineering to attract outstanding students.

Walker retired in fall 2005, leaving behind a rich legacy. In addition to president, he served as a professor, dean and provost at Auburn. As dean of the Samuel Ginn College of Engineering from 1988 to 1998, Walker was a leader who developed core fundraising tools that have since served as a university model and helped create the BellSouth Minority Engineering Program, a recruitment program that has driven black freshmen retention rates from 33 percent to 70 percent within the college.

“With this endowment, Dr. Walker leaves a legacy that displays his commitment to education and to excellence,” says Larry Benefield, dean of engineering. “We are deeply appreciative for his vision in making this scholarship available and assisting in the success of engineering students. Auburn University is a better place because Bill Walker was here.”

Private giving to Auburn University rose to an all-time high of $101.2 million in the fiscal year ending September 30, 2005, topping the previous year’s total of $70 million. Of the $101 million contributed to the university last year, $34 million went to student support, $3 million to faculty, $7 million to facilities, and $57 million to programmatic support.
Students, faculty, alumni honored for excellence

Each spring, the Samuel Ginn College of Engineering hosts a reception to honor students, faculty and alumni who have distinguished themselves through exceptional service, and academic and professional achievement.

Allen Craven, Stuart Jones, Christine Taylor and Erin McMullin were recognized as Pumphrey Outstanding Pre-Engineering Students.

Allen Craven, Pierre-Olivier Gourmelon, John Gulick, Stuart Jones, Christine Taylor, and Erin McMullin were inducted as members of Pi Gamma Tau.

Benton Derrick was named outstanding mechanical engineering student. A native of Centre, Ala. and a graduate of Cherokee County High School, Derrick has also won the O'Neal Austin Best Student award an unprecedented seven times. The award instituted in 2003 in honor of an alumnus, the late O'Neal Austin, recognizes outstanding student performance in individual mechanical engineering courses.

Derrick chose to study mechanical engineering at Auburn because of its reputation as the top engineering school in the state and one of the finest in the nation.

"The best four years of my life," says Derrick, describing his time at Auburn. He graduated in May and is working on his Auburn master’s degree studying direct adaptive control. A John Deere 8420 in Auburn’s GPS and Vehicle Dynamics Lab will be used as a test bed for this research, and Derrick will be developing an algorithm that will be used to give the tractor suitable control in a variety of environments, including variable hitch loading conditions.

Todd Dorough, a senior from Birmingham, was selected outstanding materials engineering student. In addition to numerous extracurricular activities, he is helping with undergraduate student recruitment through mentoring and speaking at the freshman engineering orientation class, ENGR 1100.

An active member of the Auburn student community, Dorough serves as treasurer of the Student Government Association. Other achievements include president of the Student Alumni Association, director of the SGA’s Student Emergency Loan Fund, assistant director for the Blood Drive, Camp War Eagle counselor, Phi Gamma Delta fraternity, Student Alumni Association board of directors, Cupola Engineering Society, Foy Student Union Board, Lambda Sigma Honor Society, and Cardinal Key Honor Society. He was one of 100 Auburn students (seven in engineering) selected for 2005-2006 Who’s Who Among Students in American Colleges and Universities. More than 1,900 schools in all 50 states and the District of Columbia confer this exclusive honor, and individual schools make selections each fall.
Philip Zettler, a 1961 mechanical engineering graduate, was honored as outstanding alumnus for his career as an engineer and entrepreneur. While at Auburn, Zettler co-oped with Stockham Valves and Fittings. After graduation he worked for Woodward Iron Company as a foundry engineer and in 1970 founded Vulcan Engineering Company in Helena, Ala., with a couple of partners and a handful of employees with the purpose of providing quality foundry components.

The company is now recognized as the world leader in lost foam technology, a casting process that eliminates the need for sand binders and cores. After getting its start in supplying simple equipment and systems for the foundry industry, the company moved into the arena of robotic control of processing in foundries.

According to Zettler, keeping costs down in an increasingly competitive casting market was crucial to long-term success. "We moved to totally robotic control of casting finishing, and I am proud to say that we sold our equipment to Japan," he adds.

The company also sold equipment to automotive manufacturers such as Saturn, General Motors, BMW, Renault, and other European and Chinese automobile manufacturers. In the mid 90s, Vulcan Engineering expanded its operations in Europe as Vulcan Europe in Leicester, England.

"Selling in the European Common Market required our presence there, so we bought foundry industry in England," says Zettler. "Vulcan grew from being a small operation into one that hires more than 400 employees worldwide."

After his retirement, Zettler sold the company and bought the Stillwaters Golf Courses in Alexander City. In 2000, he bought Riverwood Properties in Hoover, Ala. He resides in the Willow Point community at Lake Martin.
Program connects students to real world

Engineering educators nationwide are concerned about engineering freshmen moving to other fields of study after their initial foray into engineering. According to PK. Raju of the mechanical engineering faculty, nearly 40 percent of these students do not perceive any relevance between their curriculum and solving real-world work problems.

To retain students in engineering programs, educators initiated changes in how and what students learn in classrooms, and a novel idea began to take root at Auburn. Raju, in collaboration with Chetan Sankar of the College of Business, established the Laboratory for Innovative Technology and Engineering Education (LITEE).

In early 1997, Raju and Sankar started what would become a successful experiment worthy of application in other situations. They developed a course that would incorporate engineering and business management principles to solve real-world problems. A group of mechanical engineering and business seniors got an opportunity to tackle a problem situation involving an electric generating plant. The study revolved around the question of how Crist Power Plant in Pensacola, Fla. should handle a planned maintenance shutdown of a turbine generator unit.

Also involved in LITEE are Nels Madsen and Dan and Daniella Marghitu of the College of Engineering, Gerald and Glenelle Halpin of the College of Education, and Jeffrey Katz of the College of Liberal Arts. With the help of graduate and undergraduate students and the faculty team, Raju and Sankar have developed 11 case studies designed to enhance learning through direct participation in the decision-making process and the development of higher-level cognitive skills. LITEE’s repertoire includes case studies involving Chick-fil-A, PowerTel, Vogtle Hot Water and Della Steam Plant.

“The studies have been prepared in such a way that the material may be used by trained faculty to teach engineering, business ethics, or even psychology,” says Raju. They have been adopted in schools including the University of Virginia, Illinois Institute of Technology, Harvard, Massachusetts Institute of Technology, Alabama A&M, and Morgan State University, to name a few.

Since the National Science Foundation (NSF) first funded the experiment, LITEE has obtained nearly $2.6 million in grants from NSF, industry, and Auburn University. The first grant helped develop and test the case studies. “We now have a grant to disseminate our case studies nationally,” adds Raju.

The grant is also used to bring reputed engineering educators to conduct workshops and deliver keynote addresses at LITEE-organized conferences. LITEE has been selected as an Implementation Network Affiliate of the National Academy of Engineering’s Center for Advancement of Scholarships on Engineering Education. Identified as an innovative teaching tool, it has been included in the recommendations developed by the National Academy of Engineering for training the engineer of 2020.

According to Raju, students learn professional communication, engineering analysis, business management, and administrative procedures, adding, “They learn that it takes a team to accomplish any task.”
Research takes grad students to new heights

Continuing our series, we feature three graduate students and their research. From autonomous control of unmanned vehicles to the study of friction and wear in machinery to microelectronics cooling, Auburn grad students are applying their knowledge in emerging technologies and enriching their educational experience.

Microelectronics cooling

Microelectronics cooling involves heat transfer from microchips to a medium that keeps the unit performing optimally. Since 1940, when the first electronic computers were introduced, the development of faster and denser circuit technologies and packages has been accompanied by increasing heat fluxes at the chip and package levels. Significant advances have been made in the application of cooling techniques to manage increased heat fluxes. One of the giant leaps in modern technology was made in the past decade when the idea of phase change heat transfer in micro heat pipes was directed to focus on the thermal control of electronic devices.

Omkar Nadgauda, a master's student from Pune, India studying under faculty member Daniel Harris, works at the Auburn TherMal Management Laboratory (AuTherMML) in advanced cooling solutions and thermal management strategies. Nadgouda received his bachelor's degree in 2004 from the University of Pune. His work on micro heat pipes etched in silicon involves the fabrication of 5x10 mm silicon chips with 20-40 embedded channels.

"These channels are micro heat pipes that carry fluid, have a tremendous capacity to transfer heat, and do not use external power," says Nadgauda. This innovative technology is being increasingly used in thermal management in various scientific applications.

Tribology

Tribology, the study of friction, lubrication and wear, has long been of both technical and practical interest, since the functioning of many mechanical systems depends on friction and wear values. It is of great importance that bearings, which are designed to decrease the friction and wear between contacting mechanical components, perform to a level acceptable for their specific application.

Manoj Mahajan, a master's student from Nashik, India working with faculty member Robert Jackson, graduated from the University of Pune, India, with a bachelor's degree in mechanical engineering in 2002. He enrolled in Auburn's master's program in fall 2004 and works on the experimental and analytical investigation of gas squeeze film bearings. Mahajan will focus on experimental techniques and quantitative relationships in friction and wear.

Says Jackson, “The goal of my research is to investigate and model the physical phenomena that distress and govern contacting components through experimental and numerical techniques.” These bearings might be applied to MEMS in the future to levitate and separate surfaces, and to reduce wear and friction. Mahajan plans to graduate in the summer and work as a research engineer or in project engineering.

According to Jackson, Mahajan has helped work on a finite element model to predict friction between sliding
surface contacts. He presented his findings at the Society of Tribologists and Lubrication Engineering’s Annual meeting in Calgary, Canada. Mahajan recently placed third for his research presentation in the AU Graduate Student Council Forum, an annual competition organized by the council.

**Lateral force of tires**

The subject of ATVs is close to Darrell Krueger’s heart. As an undergraduate, the Roswell, Ga., native was captain of the Auburn University Mini Baja all-terrain vehicle (ATV) student team from 2003 to 2005. As a master’s student working with faculty member Peter Jones, he will focus on the performance of ATV and other off-road tires and their applications to military Unmanned Ground Vehicles (UGVs).

“Most ATVs and UGVs are designed to navigate over rough terrain, climb large obstacles, and continue operating after accidental rollovers,” says Krueger, “and a majority of all off-road studies deal with large military or agricultural tires, mostly in the longitudinal direction (e.g. front to back) and involving traction (acceleration) and braking (deceleration).”

But according to Krueger, military and agricultural vehicles have been more concerned with being able to go across something rather than handle well.

“My work will attempt to shed more light on the lateral direction, and to link performance to the soil structure,” he explains. “Lateral forces generated by the tires generally enable the vehicle to steer and change direction. In recent years, the lateral forces generated by off-road tires have become more important as the military wants small, fast, maneuverable UGVs. My research will aid vehicle dynamics, especially as applicable to the flexible nature of ATV tires.”

To better understand the area he will be working in, Krueger will be taking courses in mechanical, civil and biosystems engineering. A Yamaha Rhino fitted with a rig to accept various tire sizes, sensors and force transducers will resolve the forces acting on the tires, along with associated velocities, and slip percentages.

Krueger graduated from Georgia’s Roswell High School in 2000 and received his bachelor’s degree in mechanical engineering from Auburn in 2005. He served a crucial role as an event director in the Society of Automotive Engineers Mini Baja East competition hosted by Auburn in April.


**Department dynamics — research update**

*David Beale,* along with Roy Broughton of polymer and fiber engineering, is working on NASA-sponsored research to develop structures for a lunar base.

"Structures on earth are made of steel, wood and cement, none of which are available on the moon and all but impossible to transport," says Beale. The research will involve building structures such as berms, garages and habitats made from interconnected fabric bags to be filled with lunar soil (regolith).

According to Beale, challenges include methods of erecting the structures, assuring that the structures are stable and will not collapse, and methods and machinery to fill the bags automatically.

"The major issue is to get them erected and standing," he adds. "If they are not correctly designed and the bags strategically loaded with regolith, they can collapse." Structures being simulated using CAD and FEM software will be 3 to 12 feet tall. "We are concentrating on the berms and garages now, and making them from high strength synthetic fibers like Kevlar," says Beale. Several structures have been built in Auburn, and others are in the planning stages.

*Sushil Bhavnani* presented an invited lecture on “Multi-Phase Transport and Cooling” at a National Science Foundation-sponsored Workshop on Thermal Design and Management in Electronics in Bangalore, India, January 10-11. The aim of the two-day workshop was to provide an overview of the state of the art in electronics cooling to employees of multinational corporations such as Intel and General Electric that have recently expanded operations into India’s burgeoning information technology sector.

*David Bevly* received a three-year Young Investigator Program grant through the Expeditionary Warfare and Combating Terrorism Department of the Office of Naval Research to study the autonomous navigation and control of a K-9.

*ZhongYang Cheng* was selected by the National Natural Science Foundation of China as an Outstanding Overseas Chinese Scholar. Nominated by the Electronic Materials Research Laboratory of Xian Jiaotong University, China, the honor also includes up to six all expense paid visits to China (paid by the Chinese Foundation) for the next three years to participate in joint research, workshops or international conferences.

Cheng was also selected to receive the 3M Non-tenured Faculty Award. Vivek Bharti of the Corporate Research Materials Laboratory of the 3M Center in St. Paul, Minn. nominated Cheng for the honor. Accompanying this recognition is a 3M non-tenured faculty grant that provides $15,000 in unrestricted funds to be used as designated by the winner.

Cheng’s paper on the use of piezopolymer diaphragm as a high performance biosensor platform, published in the Materials Research Society’s “Symposium Proceedings on Electroresponsive Polymers and Their Applications,” has been selected as the Outstanding Paper of the Proceeding.

Another paper from Cheng’s group, “Biosensor Based on Magnetostrictive Cantilever,” which was published in *Applied Physics Letters 88*, 073507 (2006), has been selected for publication in the *Virtual Journal of Nanoscale Science & Technology*. Papers published in this journal are selected from more than 60 journals to cover a focused area of leading edge research.
**Jeff Fergus** was elected chair of the Professional Registration Committee of The Metal, Minerals and Materials Society (TMS). He will be responsible for organizing semiannual Writer’s Workshops and Committee Meetings. The committee develops and reviews the Professional Engineering examination and addresses other related issues related to professional registration. “The committee is currently working on expanding the scope of the exam from Metallurgical Engineering to Metallurgical and Materials Engineering to reflect the increasing use of materials other than metals in engineering applications,” explains Fergus.

Fergus also serves as an alternate representative for TMS to the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology. The EAC makes accreditation decisions based on site visits. As an alternate, in addition to being available to substitute for or replace one of the representatives, Fergus will attend EAC meetings in preparation for becoming an EAC representative.

**Robert Jackson** received a donation of test rigs for the multi-scale tribology laboratory from the Timken Company, a global leader in friction management and power transmission located in Canton, Ohio. The donation consists of two rod-on-wheel rolling contact fatigue test rigs, and four ring-on-ring rolling contact fatigue test rigs.

“The rigs will be used to monitor bearings and surface interactions operating at a controlled load and speed, and altered to test certain configurations,” says Jackson. “They provide the foundation to test bearings and other tribological components under various conditions, and to achieve correlation between experimental conditions and simulations. The rigs will make an excellent addition to the department’s research capabilities and help future research efforts in the area.”

Adds Mike Kotzalas, technical group leader of application and design engineering at Timken, “Innovation is a core value at Timken, and we value the relationships we have with world-class research universities like Auburn. We’re pleased to be able to make a contribution to the work Professor Jackson and his students are doing in tribology.”

**Dong-Joo (Daniel) Kim** received three grants this year. A gift from a California firm, International Radiation Detectors, Inc. (IRD), provides unrestricted money for potential advancement of silicon semiconductor-based EUV (extreme ultraviolet) photodiodes. These devices are used as detectors (or sensors) for high resolution imaging of X-ray sources, astronomical sources, etc.

“Silicon semiconductor-based EUV photodiode devices require high quality thin metal layers coated on devices,” says Kim. “For some applications, indium or tin metal layers are required, and controlling their microstructure is difficult by conventional deposition (coating) technique.” IRD asked Kim to apply his unique coating technique called cryo-deposition. The process involves coating thin films at cryogenic temperature down to 77 K (about -196° C).

“The ability to coat at such low temperature helps us to better control microstructure of thin metal layers, which eventually affects the properties of devices,” Kim adds. “A typical sample size for an individual device (a detector) is about 1 cm by 1 cm. If successful, it will provide a much better signal compared to current devices in use. Based on this data, I expect the technique can be utilized cost effectively in industries.”

**Jeff Fergus** and **Jong Wook Hong** joined Kim in receiving a grant from the Federal Aviation Administration (FAA) to evaluate commercial off-the-shelf (COTS) sensor systems. The project will provide the FAA with experimental data to assess the current ability of COTS sensor systems for use in airliner cabin environmental monitoring. Sensors from various companies that
produce sensor systems to detect airborne physical or biological particles will be evaluated. The focus of the team will be on sensors developed to identify biological threat agents.

A third grant Kim received, along with Thomas Baginski of electrical and computer engineering, is from Sandia National Laboratories to study a triggered high voltage switch. The project will evaluate and develop new MEMS high voltage switches by adopting sputter deposited carbon as a key component. Fabrication of such a device requires high conductive carbon material as a trigger for electrical current (like a metallic fuse). “We consider carbon the best choice for circuit design,” says Kim.

Pradeep Lall, who joined the Department of Mechanical Engineering in fall 2000, received tenure and was promoted to full professor effective in October. Lall serves as associate director of Auburn’s Center for Advanced Vehicle Electronics and was recently appointed associate professor at the Thomas Walter Center for Technology Management, a center managed jointly by the College of Business and the College of Engineering.

Nels Madsen was promoted to full professor effective in October. In addition to his teaching responsibilities, Madsen, who joined Auburn in 1978, serves as the college’s associate dean for assessment.

Tony Overfelt, along with Wendi Weimar of the Department of Health and Human Performance, received a three-year grant awarded through the Marine Corps Systems Command as part of their Non-lethal Weapons Program. The project on bioeffects of precision electrical shocks to peripheral nerves will investigate precise stimulations of the radial, ulnar, and median nerves of the human body that are known to be susceptible to such stimulation.

“Transient compressive pressures on the peripheral nerves of the body are known to numb and weaken muscles locally,” explains Overfelt. “Everyone knows the tingling sensation of hitting your ulnar nerve at the ‘funny bone.’ In the last 10 years or so, a small but growing number of modern martial arts practitioners have begun essentially trial and error studies of the effects of precise mechanical stimulations on multiple pressure points of the nerves of the human body to produce transient states of selective muscle inhibition — often accompanied by reduced mental alertness and/or dizziness and sometimes apparent loss of consciousness. The results of this three-year project will further our scientific understanding of these interesting neurological phenomena and perhaps lead to a new generation of precision TASER type devices.”

Bart Prorok and William Gale acquired an analytically-based field emission scanning electron microscope through a grant from the NSF. According to Prorok, the nanolithography tool it possesses is capable of writing lines as small as 10 nanometers (a nanometer is one billionth of a meter).

“It is small enough to be written nearly 16,000 times on the head of a pin,” adds Prorok. This new capability is expected to enhance numerous research activities on campus.

Aleksandr Simonian and his students wrote an article that has been named to ScienceDirect’s TOP25 Hottest Articles list. “Nanoparticle-based optical biosensors for the direct detection of organophosphate chemical warfare agents and pesticides,” by Simonian, A.L., Good, T.A., Wang, S.-S., and Wild, J.R., was included in the journal Analytica Chimica Acta, Volume 534, Issue 1, April 1, 2005. The article details a strategy
for the detection of pesticides and chemical warfare agents using gold nanoparticles and fluorescent beacons. In order to determine its TOP25, ScienceDirect tracks the number of times scientific articles are downloaded from its informational Web site. A list is made quarterly of the articles that are downloaded the most in each of 24 categories. This research work was sponsored by Simonian’s NSF individual investigator grant.

Partnering with O. Oyarzabal from the Department of Poultry Science, Simonian received a research grant from the Alabama Agricultural Experiment Station for the development of a biosensor for rapid identification of Campylobacter jejuni in poultry products. The study will allow for increasing safety procedures in the poultry industry, thereby helping to prevent the introduction of food-borne pathogens into the food supply.

Simonian also received a three-year grant from the National Center of Biotechnology of the Republic of Kazakhstan for research and development of sensitive biosensor systems for the monitoring of bacteria and toxic compounds. The scope of this grant includes development and testing of novel biosensor systems for real-time detection of multiple pathogens. “The developed system has an application to food safety, biotechnology, homeland security, and environmental monitoring,” says Simonian. “Another facet of the project includes training of scientists from the Republic of Kazakhstan, to provide knowledge in modern technology.”

**Hareesh Tippur** received a grant through the Department of Defense’s Defense University Research Instrumentation Program. Tippur and Brian Thurow of aerospace engineering received the only such awards in Alabama this year. Tippur’s research will focus on developing sophisticated facilities for high-strain rate testing of materials, with failure characterization being a main component. The award will provide equipment, such as a high speed camera capable of capturing failure events at up to two million frames per second, and augment a high velocity gas-gun already operational in his laboratory.

Tippur received an exploratory research grant from NSF to study scale effects in dynamic fracture of polymeric heterogeneous materials. The research will investigate the possibility of bridging micro and macro measurements in composite materials and structures fracturing due to impact loading.

Tippur recently delivered the keynote speech on the influence of microstructure on dynamic fracture behavior of particulate polymer composites at the 2005 International Conference on Computational and Experimental Science in Chennai, India. The presentation was based on his research with his student Rajesh Kitey.
The O’Neal Austin Best Student Award honors the late O’Neal Austin, a former Auburn mechanical engineering student who passed away in July 2003 and received his bachelor’s degree posthumously in December 2003. Established by Austin’s mother, Trudy Craft-Austin, the award recognizes outstanding students of individual mechanical engineering courses.

At a luncheon held on campus, awards were given to the fall 2005 recipients pictured here with Trudy-Craft Austin (center). Back row, left to right: Benjamin Davis, Bruce Robert Shue, Nigel Morrissey. Front row, left to right: Robert Mansell, Stephen Potts, Christa Soutullo, Michael Buder.

Focusing in on student achievements

Madhu Kirugulige, a doctoral student from Shimoga, India working with faculty member Hareesh Tippur, was selected for Auburn University’s Merriwether Fellowship Award, an honor bestowed annually by the Graduate School to recognize grad students’ outstanding performance and potential.

Kirugulige received his bachelor’s degree from Bangalore University in 1997, and obtained his master’s degree from the Indian Institute of Science, Bangalore in 2001. His research involves development of techniques for dynamic failure characterization of novel materials like sandwich structures and functionally graded materials that have the potential for use as high-performance materials in automotive, naval and aerospace structures.

“During impact or shock loading, cracks grow in materials at very high speeds, typically at 1000 m/sec,” says Kirugulige. “Such events are not only difficult to track but measuring stresses and strains during the event is very challenging.” According to Kirugulige, understanding this phenomenon will help to design better materials for shock loading environments.
Suiqiong Li, a doctoral student from Beijing working with faculty member Z.-Y. Cheng, was selected to participate in a summer research experience in Interfacial and Condensed Phase Chemical Physics at the Pacific Northwest National Laboratory (PNNL).

The PNNL in Richland, Wash., invites graduate students and young scientists for the 8 to 12 week program tailored to meet the individual education and training needs of applicants.

The Summer Research Institute emphasizes personalized, hands-on approaches to research by participant-mentor teams. Participants work alongside internationally known scientists on research projects.

These projects are structured to maximize the participant’s experience with advanced interfacial and condensed phase chemical physics theoretical and experimental techniques. Traveling and equipment usage fee are paid by the PNNL.

Li also won first place for her paper, “A Cost Effective Method for Real-Time Monitor of Water Quality,” in the Student Poster contest at the Alabama Water Resources Conference in Mobile. The award includes a check for $300.
One of the many things graduate students are required to do is present their research results to peers at conferences and symposia. Auburn’s Student Government Association helps prepare graduate students through the Graduate Research Forum, a multidisciplinary exhibition of student research sponsored by the Graduate Student Council. The forum allows graduate, professional and undergraduate students to present their research in a public setting. The War on Hunger research category is a new addition to the forum, designed to stimulate thought on how each grad student’s research can relate to hunger issues at home and abroad. The 16th annual forum was held at Auburn University …

Cai Liang, a doctoral student from Singapore working with faculty member Bart Prorok, won second place for his presentation, “SiC thin film growth and characterization for microsensor applications,” at both the Auburn University Annual Research Forum and the War on Hunger Forum. The presentation was based on research sponsored by the U.S. Army Space and Missile Defense Command.

Liang received his bachelor’s and master’s degrees in metallurgical materials science and engineering from China and a master’s degree in mechanical materials engineering from the National University of Singapore. Prior to working at the Singapore Institute of Manufacturing Technology, a government-funded R&D institute, Liang worked from 1986 to 1992 at Baosteel Corporation in Shanghai, China’s largest Iron & Steel Corporation.

In 2000, he moved to Austin, Texas to work as a principal engineer heading an R&D group and production line in the microelectronics packaging fabrication area for Focus Interconnection Technology Corporation. He moved to Atlanta to work as a packaging engineer in the areas of opto-electronics assembly for Cirrex Corporation until his move to Auburn in 2003 to start his doctoral studies with Prorok.

Dongna Shen, a doctoral student from Beijing working with faculty member Daniel Kim, received second place for her research presentation on power scavenging from ambient vibration using piezoelectric power generation devices. She received her bachelor’s and master’s degree from the Beijing University of Technology in 2000 and 2003, respectively.

Shen worked for a semiconductor manufacturing unit of Semitool, Inc. in China before coming to Auburn. The focus of her research is to develop piezoelectric power generators to convert ambient mechanical energy to electricity, and replace batteries in devices such as wireless sensors.

Sang Hoon Yoon, a doctoral student from Seoul also working with Kim, received a second place award for his research presentation on the development of micro fabricated flexural plate wave devices for sensor applications.

The focus of his research, which is sponsored by the Auburn University Detection and Food Safety Center, is the development and commercialization of a flexural plate wave device using zinc oxide and piezoelectric transducers, including optimization of the materials, the design, and device performance.

Yoon received his undergraduate degree from Kookmin University in Seoul in 1991. After working at Kookmin University as a teaching associate from 1994-1996 and a technician at Duri-Metal in Ansan, Korea, from 1997-1999, in 2002 Yoon received his master’s degree in material science and engineering from the University of Florida.
Faculty investigate new class of polymers

The chemistry, physics, molecular mechanisms and applications of conductive polymers have been discussed in many research and technological journal articles. According to Auburn’s Mrinal Thakur, conventional polymers or plastics are insulators, but conductive polymers represent an entirely novel class of polymeric materials.

“It has been the general perception in the conductive polymers research community that nonconjugated polymers having no delocalized electrons cannot be formed as light emitting devices,” says Thakur, professor of mechanical engineering. “Therefore, it is totally unexpected and surprising to be able to obtain significant light emission using nonconjugated polymers.”

Thakur joined Auburn in 1990 after serving as a materials physicist in GTE Laboratories, Inc. from 1983 to 1986 and AT&T Bell Laboratories from 1986 to 1990. After receiving his bachelor’s degree in physics from Visva-Bharati University in India in 1978, he earned his master’s and doctoral degrees in physics from Case-Western Reserve University in 1981 and 1983, respectively.

As director of Auburn’s Nonlinear Optics Laboratory, Thakur studies nonlinear and electrooptical properties of novel materials and microstructures that have potential applications in future electronics and photonics technologies. A variety of optical techniques, including time resolved four wave mixing, excitation-probe, non-linear interferometry, waveguiding, and frequency conversion and z-scan, are utilized to measure nonlinear optical properties and dynamics of excited states over a very short period of time (less than 10-12 seconds).

The laboratory is equipped with a high power laser with picosecond pulses and other required data acquisition systems for picosecond optics. Thakur is interested in the study and preparation of single-crystal films of unique organic nonlinear optical materials, investigating excited-state dynamics using femtosecond laser pulses (femtosecond: one millionth of a nanosecond, a measurement sometimes used in laser technology), nonlinear optical waveguiding, light emission, high-speed all-optical and electro-optic modulation.

Reports by Thakur’s research group show that a nonconjugated conductive polymer forms a nanometallic structure after the polymer is treated with a dopant. The group’s recent articles on electrical and nonlinear optical properties of specific and novel nonconjugated conductive polymers (polysoprene and poly (8-pinene)) have appeared in Macromolecules (2004), Journal of Polymer Science (2005) and Applied Physics Letters (2006).

According to Thakur, although work on conjugated conductive polymers has been recognized through the Chemistry Nobel Prize of 2000, nonconjugated conductive polymers are yet to get their due recognition. Various applications, including novel elastomers, sensors, electronic and optical devices, have been demonstrated using nonconjugated conductive polymers.

Thakur was honored as outstanding faculty member in Auburn’s materials engineering program in 1993 and 1995. He is a member of the American Chemical Society, American Physical Society, Materials Research Society, and Optical Society of America.
Fourth Annual ME Conference

Registration has begun for the fourth annual Mechanical Engineering Conference October 22-23 at the Auburn Marriott Opelika Hotel and Conference Center at Grand National in Opelika, Ala. For more information and to register please visit www.eng.auburn.edu/me.