THE UNIVERSITY OF NEW MEXICO SCHOOL OF ENGINEERING

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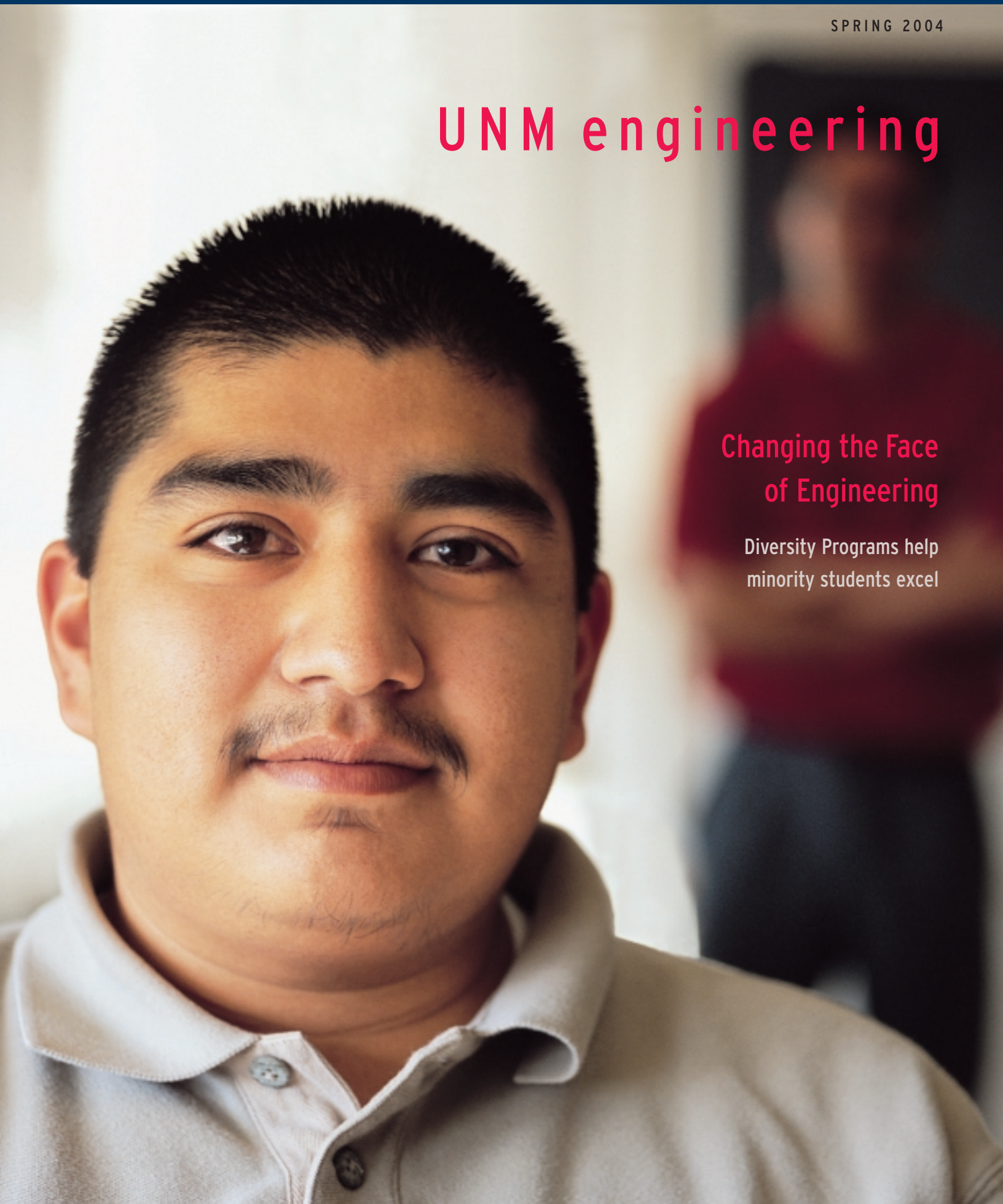
UNM engineering



Changing the Face of Engineering

Diversity Programs help minority students excel

From the Dean

What's new?

A Dean's Perspective

I am frequently asked, "What's new in engineering at the University of New Mexico?" Most people are intrigued by new technology. And engineering is well known for continual and rapid advancement, so curiosity is understandable. It is certainly an appropriate question to which there are many good answers, especially at UNM where many exciting, new things are happening.

However, focusing on what is new can tend to obscure a great deal of what is going on in engineering here and elsewhere that isn't *new*, but is nevertheless extremely valuable to society. It is important to realize that engineering is very broad, and to not lose sight of the significance of what might be called the "sustaining" areas of engineering and computer science. Many of the students we educate will go on to work in sustaining engineering fields, and for that reason we make sure that our curricula correctly reflect this.

Of course, virtually all of engineering and computer science benefit from technological advances, particularly those in information technology. So, even in the sustaining fields, the way that engineers and computer scientists actually get their work done does change over time and reflects new capabilities. For this reason, we ensure that our curricula include the tools that our graduates need to practice at the forefront of whatever area of engineering or computer science they choose.

Outstanding engineering and computer science education demands a symbiosis between excellent teaching and cutting-edge academic research. Often, new disciplines blend well with ongoing activities, such as our continuing dual commitment to pursue cutting-edge research and to provide strong support for students from underrepresented groups. Over the past year, the research expenditures for the approximately 100 faculty members of the School of Engineering totaled more than $25M and included some of the most exciting current research areas. One new area is the high-powered microwave research of Professor Edl Schamiloglu, detailed in this issue.

Few academic fields benefit more from diversity than engineering and computer science. The School's diversity programs provide recruitment, bridging and support for our students from underrepresented groups to ensure their success in their academic work and their careers. At present, more than 48 percent of our undergraduates come from underrepresented groups. One new effort is a project with the Zuni Pueblo Indians to increase diversity among Native Americans within engineering and computer science.

As for things that are completely new, with this issue of *UNM Engineering*, we are inaugurating a new look and new name. Please enjoy.

Joseph L. Cecchi
Dean of Engineering

Points of Pride

Many exciting things are happening in the School of Engineering including:

■ **Joseph Cecchi**, dean of the School of Engineering, and **Judy Jones**, UNM Vice President for Advancement, were in attendance as **Senator Pete Domenici** recently received the Engineering Dean's Council of the American Society for Engineering Education appreciation award. The award was presented at a Capitol Hill reception.

■ **Timothy Ward**, professor and chair of Civil Engineering, received the Excellence in Construction Education 2003 Award from the New Mexico Building Branch of the Associated General Contractors.

■ **Ed Angel**, professor of Computer Science, Electrical and Computer Engineering, and Media Arts, is working with computer science students and artists to create content for the LodeStar Astronomy Center dome in Albuquerque. The team uses a multi-projector digital system and a computationally-intensive process to create immersive environments for museum visitors.

■ As part of a collaborative effort between the **Xilinx Corporation** and the **University of New Mexico**, the Electrical and Computer Engineering department has received a grant to build eight-layer printed circuit boards for student coursework and projects.

■ **Randy Truman**, professor of Mechanical Engineering, received the 2003 American Institute of Aeronautics and Astronautics (AIAA) Sustained Service Award, one of 20 awardees across the country and the world.

■ For the fourth consecutive year, **students from the Department of Chemical and Nuclear Engineering** flew experiments on board the "Weightless Wonder," a micro gravity KC-135 airplane at Johnson Space Center in Houston. **Robert Busch**, Chemical and Nuclear Engineering professor and lecturer, is the faculty advisor for the project.

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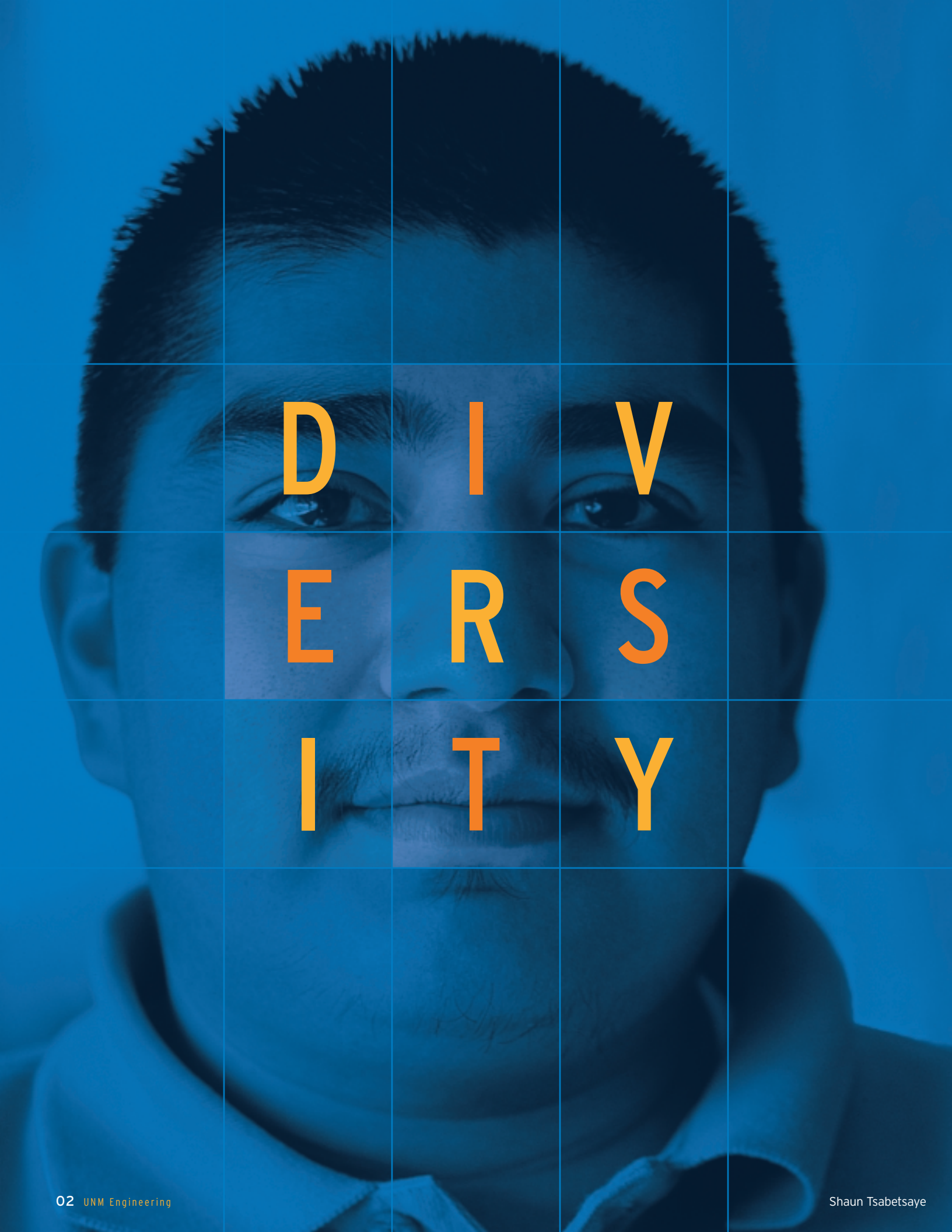


Shaun Tsabetsaye

"No discipline benefits more from diversity than engineering. The different world views and approaches to life that are reflected in our high degree of diversity are at the heart of finding creative solutions to real-world problems, which is what engineering is all about."

Joseph L. Cecchi

Dean and Professor
School of Engineering

Changing the Face of Engineering

Diversity Programs help minority students excel

Walk the winding pathways between the many buildings at the University of New Mexico's School of Engineering (SOE) and you will see students from Native American tribes, Hispanics, African Americans, students of Asian descent and many other cultures. This diversity reflects New Mexico's rich cultural heritage, but it also represents a trend in education, says Steve Peralta, director of Diversity Programs in the School of Engineering. "There are some interesting statistics showing that in the next ten years, the number of Hispanics graduating from schools is going to be well above 50 percent. UNM really needs to position itself to meet the needs of those students. Having a program like ours makes a big difference and makes it more community based."

UNM's student body and the demographics of the SOE are on the leading edge of that trend. In fact, 46 percent of the SOE student body is from a minority population. "In terms of diversity, this is a very high percentage for a school of engineering," notes Peralta.

The SOE has had support programs for minority students for decades. But in 1998, the school formalized its services into one comprehensive effort called Diversity Programs. Today, free mentoring services, one-on-one advising, special scholarship opportunities, professional

Steve Peralta

Students enjoy studying at the computer lab

↓

"The biggest benefit to being involved with Diversity Programs is the sense of family you get ... The staff is very concerned about our success and they go out of their way to help us achieve our goals."

Pedro Ramos

development workshops, and even a computer lab are available for minority students in engineering, math and science. The programs extend well beyond support services to also include student organizations, conferences, recruiting efforts, outreach and career development opportunities with corporations and government organizations.

And the programs are working. A formal tracking system is being developed, but anecdotal evidence suggests that students who participate in Diversity Programs stay in school longer and do better than those who do not. "In the SOE, around 70 percent of first-year students continue on to the second year. If students are involved with Diversity Programs, that number goes up," explains Peralta.

Building Social Bridges

Improved grades and student retention are key outcomes. But the programs also help minority students overcome social and cultural barriers that stop them from achieving their full potential, says Peralta. "Sometimes students are a little afraid to seek out the help themselves. The program helps students figure out a place to go and how to be able to connect with other students."

Some students receive assistance long before they arrive on campus. Shaun Tsabetsaye, an electrical engineering senior from Zuni Pueblo, New Mexico and President of the American Indian Science & Engineering Society (AISES), has benefited from Diversity Programs since the eighth grade. Each summer since then, Tom Cummings, a Diversity Programs coordinator, has mentored Tsabetsaye. "Not only have the programs opened many possibilities for me, but they've also enabled me to create footholds to establish myself and achieve my goals," says Tsabetsaye. Next year, he will enroll in UNM's graduate school to study optics and, appropriately enough, K-12 educational outreach.

The Summer Introduction to Mathematics, Engineering & Science (SIMES) program is another successful outreach effort. SIMES, an intensive "bridge" program designed for minority students but open to all incoming freshmen, prepares students interested in science and engineering for college. During the month-long program, students live on campus, take classes for college credit and gain valuable familiarity with the school.

As an experiment, Diversity Programs staff organized students from last summer's SIMES program into cohorts. The groups met on a volunteer basis during the fall semester for workshops, special presentations and socializing. At the end of the first semester, more than half of the students had GPAs above a 3.0 and all remained in the program ... a good result, according to Peralta.

Unique Populations, Unique Programs

The Diversity Programs staff makes special recruiting and retention efforts for certain populations. For instance, they are working with the New Mexico Tribal Higher Education Commission to develop outreach programs for Native Americans. "We're working with the communities and the Commission to establish what we think is best for the students and determine how we can go after grant money to provide services to these students," says Peralta.

The first goal is to establish a five-year program that would provide enriched education for high school students in tribes around New Mexico. The first tribe to participate is Zuni Pueblo, two hours west of Albuquerque. The proposal includes upgrading Zuni High School's technology and adding more advanced placement classes for students. Once the program is in place at Zuni Pueblo, Peralta plans to roll out similar efforts to one new tribe each year.

Organized Opportunity

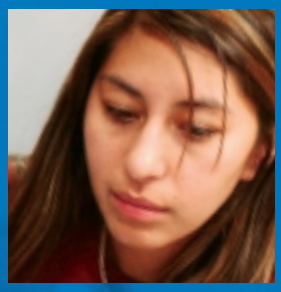
Three very active student organizations function as extensions of Diversity Programs and provide additional professional development opportunities, service projects and social outlets. About 30 percent of minority students join either AISES, the National Society of Black Engineers (NSBE), or the Hispanic Engineering & Science Organization (HESO). Benito Martinez III, a fifth year chemical engineering student and president of HESO, says that being a part of the student organization has enhanced his education. "It has opened many doors and helped me develop leadership skills. HESO has also provided me the opportunity to learn beyond academics and taught me about myself," says Martinez.

National conferences held by engineering societies offer valuable exposure to students and the SOE. Last year, more than 100 students attended conferences around the country where they received scholarships, made presentations, participated in competitions and met potential employers.

Peralta and his staff use the conferences to network with other schools and corporations, and to recruit students into UNM's graduate program. "These conferences not only provide terrific professional development opportunities for students, but they also heighten UNM's presence," says Peralta.

That networking has paid off. Diversity Programs collaborates with more than 20 companies including Intel and the Ford Foundation. The longest-term relationship has been with NASA. "We've had a good relationship with NASA. They've been very valuable partners to us for years – funding a lot of our scholarships, creating mentoring programs and then recruiting many of our students," comments Peralta.

Educational support, career guidance and volunteer opportunities are all available through Diversity Programs, but for many students, the most valuable benefit is the most intangible. Pedro Ramos, a junior in mechanical engineering, SIMES participant and NASA Training Project Scholarship recipient, sums it up by saying, "The biggest benefit to being involved with Diversity Programs is the sense of family you get ... The staff is very concerned about our success and they go out of their way to help us achieve our goals."



Getting WISE

Program increases women's involvement in technical fields

Almost 2000 women are enrolled in the University of New Mexico's engineering, science and math programs. As a percentage of total students, that number puts UNM in the middle nationally for female enrollment in engineering and science majors. Elaine Borrelli, director of engineering student programs, and her staff work to increase women's interest and involvement in science careers through the Women in Science and Engineering Program (WISE).

"Women have historically been underrepresented in technical careers. In fact, they represent about 20 percent of the workforce in these fields. Our objective with WISE is to get more young women involved in technology," says Borrelli, who is also director of WISE.

The campus-wide program is designed to attract and retain women in science, engineering and mathematics majors. While WISE started as an initiative for women, men are also invited to participate. Through the program, undergraduate and graduate students can access career development services that include job shadowing, mentoring and workshops, as well as opportunities to volunteer and socialize.

Learning from the Land

A bird's-eye view of Albuquerque reveals a bright green ribbon that bisects the high desert as far as the eye can see. That ribbon is the Rio Grande and the cottonwood forest that borders the river for 160 miles. The river and the forest, known locally by its Spanish name *bosque*, are key to the history and environmental stability of the city and the region.

OUTDOOR LAB OFFERS UNIQUE OPPORTUNITIES FOR STUDY AND SERVICE

But through the decades, urban development, non-native plant growth and river management policies affected the health of the river and the bosque. Now, University of New Mexico civil engineering students and faculty are learning from the land and using those lessons to help shape strategies that will restore and protect the river and the bosque for generations to come. →

Julie Coonrod

Examining soil samples

John Stormont and his class

A Wild Lab

The Department of Civil Engineering adopted a 10-acre patch of the bosque through a city program in 2002 and named it the Bosque Lab. The idea for the lab came from Dr. Julie Coonrod, P.E., assistant professor in the Department of Civil Engineering. She was attending a meeting where city representatives were encouraging local organizations to adopt sites and restore them after a fire raged through the area. "I thought that this was a perfect opportunity for us. It's a win-win, situation providing volunteers for the city and educational opportunities for our students. The soils class learns about in-situ soil testing, the surveying class provides surveys, the fluid mechanics students measure three-dimensional velocity in the river, and many hydrology students make the site the focus of their class projects. In addition, the site complements the current Rio Grande research in which several of us are involved," she says.

The first step was to clear the site. Faculty, students, city workers and volunteers collaborated to remove invasive species including salt cedar and Russian olive trees that had grown back since the fire. Members of student organizations, including the student chapter of the American Society of Civil Engineers, continue to volunteer their time to clear the site several times a year.

The site is now an integral part of UNM's civil engineering curriculum. "Our mission at UNM is to educate students so that they are well-equipped to participate in the world as productive and enlightened individuals. There is no better way to do this than through experiential learning. We practice this approach in civil engineering at several levels. The Bosque Lab is an extremely important facility for providing this experiential learning environment," says Dr. Tim J. Ward, P.E., professor and chair of the Department of Civil Engineering.

While the official goal of the site is to control non-native plants and monitor the effort required to do so, the opportunities have proven to be much greater than the original goal.

Summer On the River

With the sun blazing overhead, a group of undergraduates wades waist deep in the Rio Grande, holding velocity meters in the current. Other students crouch down along the riverbank inserting erosion pins, long metal rods that help measure soil loss, deep into the earth. They will visit the site numerous times over the next nine weeks as part of the National Science Foundation Research Experience for Undergraduates (NSF-REU) program.

Civil engineering students from around the country come to UNM to participate in this unique program, which has been funded by a grant from the National Science Foundation and organized by the university for the past 14 years. The students are immersed in an intensive research experience that culminates in a final report, a presentation and a poster. Projects have covered the full range of civil engineering interests, but in the last two years, the curriculum has focused on the Rio Grande.

Last summer, several NSF-REU students conducted a riverbank stability study at the Bosque Lab. They also evaluated the effectiveness of non-native tree removal methods, checked new cottonwood trees for the presence of beetles and monitored groundwater levels.

Kristopher Morrison, a senior civil engineering student at North Carolina State University, participated in the program last summer. He and his team were in charge of monitoring the erosion pins. "I think that getting to understand the different environmental problems of the Southwest and applying that information to a civil engineering perspective was the most beneficial aspect of working at the Bosque Lab.... The NSF-REU program gave me a whole new perspective on why we, as civil engineers, do different

"Our mission at UNM is to educate students so that they are well-equipped to participate in the world as productive and enlightened individuals. There is no better way to do this than through experiential learning." → TIM J. WARD

Professor and Chair
Department of Civil Engineering

types of research and lab work. Now I'm applying that experience to the research I do here at NC State," says Morrison.

UNM civil engineering senior Michelle Romisher worked with Morrison during the summer, then continued monitoring the erosion pins throughout the fall semester. "I chose to continue the research because I became quite excited about the project over the summer. I was also anxious to find out if dramatic changes would take place during different times of the year. The study of the erosion along the Rio Grande has the potential to provide years of data that can be compiled and compared over time," she says. Both Morrison and Romisher say that their experience in the program and at the Bosque Lab played a role in their decision to go on to graduate school.

Seasons of Learning

But the Bosque Lab is not just a summertime destination. Each season presents a different learning opportunity at the site. The autumn brings litter fall to count, in the spring, new vegetation must be cleared, and the river level fluctuates with snowmelt and the monsoons. Throughout the year students in courses ranging from surveying to open channel flow visit the Bosque Lab to conduct experiments including soil coring, installing tensiometers, and measuring river velocity. "This is real world. I think students need something besides the classroom…They can survey anywhere but this gives them some exposure to the area and lets them learn a little bit about what's going on in a natural setting," says Coonrod.

Coonrod and fellow civil engineering professor Dr. John Stormont, P.E., are conducting a number of research studies at the location. Stormont, a geoenvironmental engineer, specializes in the vadose zone, or the unsaturated part of the soil above the water table. He is a co-principal investigator with Coonrod on a research project called The Bosque Soil Evaporation Monitoring and Modeling study. Their goal is to monitor soil water evaporation as a function of various conditions including soil type, shade, mulch, climactic conditions and more. To do this they installed experiments near towers along the bosque that were previously erected by the UNM Biology Department.

"Our goal is to take all the data we collect and analyze and make it available to people who are making decisions about restoration strategies for the bosque. But the knowledge we gain will be applicable to many other locations," explains Stormont.

Coonrod has another research project that uses satellite imagery to estimate riparian evapotranspiration, or the loss of water from trees and the soil. This study, along with others conducted at the lab, is especially important in light of growing concerns around the country about drought and the need to conserve water.

Growing Potential

While the department uses the Bosque Lab frequently, Stormont says that they have only just begun to tap the site's potential. "We're hoping that this is the nucleus for more involvement and that it develops momentum. That way we can establish a local, regional and even a national reputation as having expertise working with a unique urban river and all the interesting engineering related problems that are associated with it."

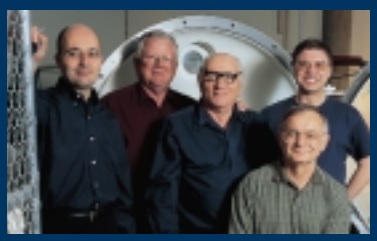
Coonrod adds that the department's use of the Bosque Lab mirrors the University's overall mission, "The University's mission is education, research and service, and I think that it's really great that we're able to achieve all of those things at this site and tie it into who we are as a department." ✦

Edl Schamiloglu

Making Wave

Pulsed power lab earns worldwide recognition

Imagine devices that harness high power pulses of energy to treat cancer, extract oil from wells or even disable an enemy's communications systems. A team of researchers at UNM's Department of Electrical and Computer Engineering (ECE) not only imagines these devices—they are helping create them.



It takes a team. Pictured from left: Edl Schamiloglu, Ralph Lee Terry (Laboratory Supervisor), Mikhail Fuks (Research Professor), Andrey Andreev (Ph.D. Student) and John Gaudet (Research Professor) at bottom right.

Edl Schamiloglu, laboratory director and Gardner-Zemke Professor in the ECE department, leads an interdisciplinary team of scientists and researchers studying pulsed power-driven high power microwave sources. Through their research, the team is helping develop new devices that use high-power microwaves for a variety of purposes.

The UNM team has worked diligently on their research for 15 years and is now receiving worldwide attention for their efforts. "Day in and day out we've been doing our jobs, pursuing our line of research and staying close to our skill set and our expertise. And it just so happens that we're now seeing the net results of all this work," says Schamiloglu.

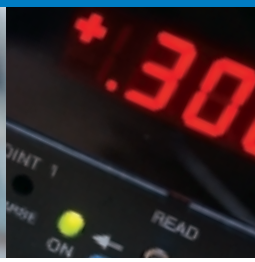
Pulsed power technology—and Schamiloglu—have received extensive media attention in the past year because researchers in the U.S. Department of Defense are developing weapons that use high power microwaves to disable computer and communications systems. According to media speculation, some of those non-lethal devices may have been used in Iraq.

Pulsed Power At Work

While the defense systems have received a lot of attention, Schamiloglu is quick to point out pulsed power's versatility. "The technology behind what we're working on has many different applications that are non-defense oriented. I think, increasingly, a lot of these applications will find their way into our daily lives."

"The largest amount of pulsed power research in the United States goes on in New Mexico. . . . It's something we're good at. And it's an opportunity to be among the best in the country and among the best in the world."

EDL SCHAMILOGLU
Professor



For instance, Schamiloglu collaborated with a doctor and physicist at UNM's Cancer Research and Treatment Center to use pulsed power to help treat patients with brain tumors. Doctors were using a linear accelerator to image and treat tumors. The machine was effective at "zapping" tumors, but its extremely high energy levels created blurry pictures for verification before treatment. Schamiloglu suggested mounting a pulsed power device on top of the linear accelerator, like the scope on a rifle. The pulsed power device created crisp images that were more useful for lining up the linear accelerator. After reviewing the new, clear images, doctors used the linear accelerator for treatment without moving the hardware or the patient. Schamiloglu, who along with his colleagues patented the solution, says that while not in regular use today, the technology may find its way into clinical settings in the future.

A world away from UNM, deep in the Russian oil fields, pulsed power's potential is literally earthshaking. There, oil companies lower pulsed power-driven shock generators into dormant wells to shake extra oil from the ground. The process, which is akin to tapping the bottom of an almost-empty ketchup bottle, creates localized shock waves within the wells, and draws out oil that cannot be extracted cost-effectively by using conventional drilling methods.

Pulsed power technology is also used in materials science applications where high-energy beams create metals with smoother surfaces, harden machine tools for longer life and prepare material surfaces for bonding to different agents. Other pulsed power applications include purifying municipal water systems and deactivating potential biological contaminants. With the nation's interest focused on homeland security, these applications have received renewed attention.

Indeed, the possibilities for using pulsed power in a variety of applications are top-of-mind for companies and scientists around the world. National and international organizations, as well as scientists from Japan, Israel, Germany, Singapore and other countries have contacted Schamiloglu and his team about their research.

The team at UNM is now looking to the future of the technology. "This research is putting UNM in the top two or three universities that have the capability to study the future effect of this technology. We're now in a position to turn the tables and use our research to help protect buildings in the civilian infrastructure – like hospitals and airports – that house sensitive electrical equipment," says Christos Christosdoulou, professor and chair of the ECE Department.

A Directed Energy Powerhouse

UNM is one of a handful of universities that has both a research and education program in pulsed power. Schamiloglu says that collaboration between other university laboratories in the U.S. and around the world that conduct pulsed power research has been critical to his team's success. "The nature of the problems that we're addressing is so complex that no one institution has all the resources and skill sets to be able to make an impact. That's why it's always good to leverage complementary skills with another university."

However, most pulsed power research is centralized in New Mexico because both Sandia National Laboratories and Los Alamos National Laboratory have ongoing programs in high energy density plasma physics research, including high power microwave generation. Says Schamiloglu, "The largest amount of pulsed power research in the United States goes on in New Mexico. It's important to our state. So it only makes sense that UNM maintain a very strong program in this area. It's something we're good at. And it's an opportunity to be among the best in the country and among the best in the world." ✦

by Greg Johnston

Academic excellence and athleti-

When Sean Murray graduated at the top of his class from Albuquerque Academy in 2000, he knew he wanted to go on to combine his math and science skills with his interest in communication. He said he had heard good things about the UNM School of Engineering. So he chose the field of mechanical engineering because he thought it was the most interdisciplinary of all engineering fields, combining aspects of civil and electrical engineering.

Four years later, as Murray nears graduation, he thinks about combining his knowledge of engineering with law, government or business. Murray has applied for and received the competitive, prestigious Truman scholarship, which will fund graduate school and allow him to pursue a masters in engineering and public policy simultaneously. The award came to Murray as a surprise this spring, when UNM President Louis Caldera appeared in one of Murray's classes to announce the scholarship.

But the 22-year-old is also drawn to his other love in life – baseball. Murray is right fielder and co-captain of the UNM Lobo baseball team. Last season he led the team in hitting with a commanding

.383 batting average. He created a mentorship program on the team, where an experienced player will adopt a freshman to help him through the first season. Murray and a teammate have also put together a baseball camp for low-income Albuquerque children, where Little League registration and equipment are already covered, creating a gateway to the sport for children who may not be able to afford it.

When the 2004 baseball season began in February, Murray was covering the bases academically, maintaining a 4.27 GPA while working on his honors thesis. Tariq Khraishi, assistant professor of mechanical engineering and one of his instructors, said that Murray's organizational skills are excellent. "He probably has the best time management skills of any student I've seen. His commitment to playing Division I baseball doesn't keep him from getting an A+ consistently." Khraishi says that Murray has the highest GPA of any of his students. "In engineering, that is pretty tough to get," he said.

Murray says he has never had the self-discipline that he is experiencing in his senior year. "Academics has been my focus, but baseball is right behind," he said. "In these four years here, I've been able to get as much out of the University as I can." In addition to extensive time allocated for classes and studying, Murray logs 25 to 30 hours a week on the baseball diamond.

In the mechanical engineering department, Murray has been creating a model to study atom movement in metallic crystals. Murray meticulously stacked one-inch pieces of drinking straws to replicate the arrangement of atoms in aluminum. The model demonstrates how atoms respond when force or loads are applied on a scale of

Sean Murray has been named a 2004 Truman Scholar, the sixth UNM student to receive this national scholarship since 1998. He was elected by 20 independent selection panels on the basis of leadership potential, intellectual ability and likelihood of "making a difference." The $26,000 award will allow Murray to attend graduate school in preparation for a career in government or public service.

nanometers, or a trillionth of a meter. The study demonstrates that atoms respond differently on a nanoscale.

Last summer, Murray traveled to Washington D.C. to participate in the Washington Internships for Students of Engineering program. He and 12 other students were required to choose an engineering topic pertinent to public policy. Murray was interested in energy policy, but his advisor told him that field was too broad. He suggested looking into hydrogen fuel cell vehicles – a hot topic.

So Murray set out to study what later became the subject of his UNM senior honors thesis: how policies that will determine how hydrogen is produced a century from now need to go into effect immediately. He wrote that hydrogen could be produced from natural gas early on to make vehicles as inexpensively as possible, in order for them to be mass-produced. Murray stated that when natural gas is no longer abundant, hydrogen would need to be produced from nuclear energy or renewable energy – sources that do not depend on something carbon-based.

"I don't think hydrogen fuel cell vehicles are practical yet," Murray said. "But the reason that I became interested is that hydrogen divisions are popping up in oil companies and auto companies. They want to appear more environmentally friendly. I think they realize that in the future there could be some real investment opportunities."

Murray said the creative process has always intrigued him. He sees creativity as a vital component to mechanical engineering. "Even though engineering is a rigid science, it's actually one of the most creative things you can do," he said.

"Creativity is at the heart of design." He adds, "I can eventually build something that is functional that originated as a thought. But through engineering knowledge, practice and design, it becomes a reality."

Murray credits the enthusiasm of mechanical engineering faculty Ron Lumia, John Russell and Randy Truman for grabbing his attention and increasing his interest in the field. "When I started in the program, I thought the faculty might be involved with important research, and not as concerned with teaching. I found that to be completely untrue," he said.

Lobo baseball coach Rich Alday says Murray is an outstanding leader and that when he speaks everybody listens. Alday would like to see Murray go on to play professionally, but knows he has other goals. "He's had four wonderful years playing collegiate baseball. And if it doesn't work out, I know he's going to be very successful with what he's doing in the engineering program," he said.

Murray's instructor Khraishi, a native of Jordan, has never seen a baseball game and knows little about the sport. Through his relationship with Murray, he has become intrigued and said that once Murray explains the sport to him, he and his wife plan to take in a game.

Khraishi considers Murray to be one-of-a-kind. "I've been at so many higher education institutions," he said. "I've never seen a student that sharp and professional and dedicated; all the good things together in one package."

Chemical and Nuclear Engineering

The **National Science Foundation** has awarded a $2 million, five-year grant to a multidisciplinary team of UNM researchers from the School of Engineering (SOE), Arts & Sciences, the School of Medicine and the Center for High Technology Materials. The team is studying biosensor development.

Gabriel López, associate professor of Chemical Engineering and Chemistry, is managing the project for the SOE. He and his team are creating a biosensor that uses fluorescence to signal the presence of different chemical components in aqueous solutions. The applications of the research are wide-ranging, from medicine to the environment. Ultimately, the sensor could analyze a blood sample for early disease detection or identify pollutants in water sources.

Chair: Julia E. Fulghum
505-277-8670
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Faculty: 18
Graduate students: 89
Undergraduate students: 81
Annual Research Expenditures: $1,875,292

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Plamen Atanassov, Assistant Professor
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Joseph L. Cecchi, Professor and Dean
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Richard W. Mead, Associate Professor
H. Eric Nuttall, Professor
Anil K. Prinja, Professor and Associate Chair
Norman F. Roderick, Professor
Taro Ueki, Assistant Professor
Timothy L. Ward, Associate Professor
Ebtisam S. Wilkins, Professor

Research Areas
Chemical Engineering: Advanced materials including synthesis, processing and characterization, particles (catalysis, colloidal transport of radioactive wastes, particles in plasma etching), biomedical sensors and bio-materials, separation processes, fuel cell development, semiconductor fabrication technology and waste management.
Nuclear Engineering: Nuclear reactor engineering (reactor heat transfer, applications to space nuclear power and propulsion), criticality, fusion and plasma technology.

Civil Engineering

For the past five years, a team of UNM researchers led by **Arup Maji**, professor of Civil Engineering, has been testing how materials used to insulate pipes in power plants can disintegrate and transport in water. Meanwhile, **Kerry Howe**, professor of Civil Engineering, has been researching how the water chemistry of power plants influences the results.

In February, a team of eight international delegates from Germany, France, Canada and Belgium, and ten members of the Nuclear Regulatory Commission (NRC) visited the hydraulics test facilities in the SOE Civil Engineering Department to meet with Maji, Howe and other researchers in the department. The international team is trying to bring about a resolution to NRC's Generic Safety Issue 191, which will enhance safety of the emergency core cooling system of pressurized water reactors. Maji says this blend of engineering technology has important safety implications. "This relatively new application of civil engineering knowledge in nuclear engineering is a good transition of technology from one area of engineering to another. Our research is going to help power plant owners enhance safety in their plants," says Maji.

Chair: Timothy J. Ward
505-277-2328
civil@unm.edu
Faculty: 16
Graduate students: 68
Undergraduate students: 98
Annual Research Expenditures: $1,181,121

Faculty
James D. Brogan, Professor
Susan Bogus, Assistant Professor
Julia A. Coonrod, Assistant Professor
Deborah Fisher, Associate Professor
Walter Gerstle, Professor
Jerome Hall, Professor
Kerry Howe, Assistant Professor
Arup K. Maji, Professor
James Matthews, Assistant Professor
Tang-Tat Percy Ng, Assistant Professor
Timothy J. Ross, Professor
Jerald Rounds, Professor
John C. Stormont, Professor
Mahmoud Reda Taha, Assistant Professor
Bruce Thomson, Professor
Tim J. Ward, Professor and Chair

Research Areas
Finite element analysis, micromechanics, mesomechanics, geomechanics, radioactive and hazardous waste management, highway safety and design, shock analysis and testing, pavement testing, expert systems, construction project management, groundwater remediation, open-channel hydraulics, random vibrations, structural reliability, system identification, and arid regions hydrology.

Computer Science

Computer Science assistant professors **Darko Stefanovic** and **Cris Moore** have received a $3 million award from the National Science Foundation's Information Technology Research program. They are collaborating on a study of enzymatic networks based on deoxyribozyome logic gates with researchers at Columbia University and the Hospital for Special Surgery in New York City. The study focuses on enzymes that can sense the presence or absence of some small molecules that are markers for disease. That information can then be used to develop intelligent drug delivery methods. The UNM team will focus on modeling the kinetics of the chemical reactions of specific enzymes and synthesizing models of logic gates that can one day work in living cells.

Computer Science graduate students **Ben Andrews, Aaron Clauset, Clint Morgan, Jenny Sanger** and undergraduate students **Lisa Glendennning** and **Marlow Weston-Lee** are also participating in the project. "We have built logic gates, adders, and an automaton for tic-tac-toe. But the true applications that we're aiming for are diagnostic and therapeutic uses in a clinical setting," says Stefanovic.

Chair: Deepak Kapur
505-277-3112
csinfo@cs.unm.edu
Faculty: 16
Graduate students: 242
Undergraduate students: 185
Annual Research Expenditures: $2,415,137

Faculty
David H. Ackley, Associate Professor
Edward S. Angel, Professor
Patrick G. Bridges, Assistant Professor
Stephanie Forrest, Professor
Paul A. Helman, Professor
Jeanine A. Ingber, Lecturer II
Deepak Kapur, Professor and Chair
Terran D. Lane, Assistant Professor
George F. Luger, Professor
Arthur B. Maccabe, Associate Professor
Christobal Pedregal Martin, Assistant Professor
Cristopher D. Moore, Assistant Professor
Bernard M. E. Moret, Professor
Jared C. Saia, Assistant Professor
Darko Stefanovic, Assistant Professor
Robert L. Verof, Professor
Lance R. Williams, Assistant Professor

Research Areas
Adaptive computation, artificial life, computational biology, computer immunology, physics and computation, new paradigms of computing, artificial intelligence, machine learning, computer vision, automated reasoning, formal methods, symbolic and algebraic computation, data mining, experimental algorithmics, scalable systems, and run-time systems, high performance networks, memory management, recovery of data base transactional systems, security, and scientific visualization.

Electrical and Computer Engineering

Mohammad Jamshidi, professor of Mechanical Engineering, Electrical and Computer Engineering, and director of the Center for Autonomous Control Engineering, will receive an honorary Doctorate of Engineering degree from the University of Waterloo in Ontario, Canada at the spring convocation ceremony in June.

Chair: Christos Christodoulou
505-277-6580
info@ece.unm.edu
Faculty: 32
Graduate students as of 12/03: 285
Undergraduate students as of 12/03: 260
Annual Research Expenditures: $3,001,279

Faculty
Chaouki T. Abdallah, Professor and Associate Chair
David A. Bader, Associate Professor
Steven R. J. Brueck, Professor
Thomas P. Caudell, Associate Professor
Christos G. Christodoulou, Professor and Chair
Lawrence T. Clark, Associate Professor
Peter Dorato, Professor
Charles B. Fleddermann, Professor and Associate Dean
Mark A. Gilmore, Assistant Professor
Charles F. Hawkins, Professor
Majeed M. Hayat, Associate Professor
Gregory L. Heileman, Professor
Manuel Hermenegildo, Prince of Asturias Chair in Information Science and Technology
Stephen D. Hersee, Professor
Diana L. Huffaker, Associate Professor
Ravinder K. Jain, Professor
Mohammad Jamshidi, Professor
Ramiro Jordan, Associate Professor and Associate Chair
Sanjay Krishna, Assistant Professor
Luke F. Lester, Associate Professor
Kevin J. Malloy, Professor
Marek Osinski, Professor
Marios S. Pattichis, Assistant Professor
L. Howard Pollard, Assistant Professor
Andres C. Salazar, PNM Chair in Microsystems, Commercialization and Technology
Balu Santhanam, Assistant Professor
Edl Schamiloglu, Professor
Wei Wennie Shu, Associate Professor
Thomas W. Sigmon, Microelectronics and Optoelectronics Chair
Christopher E. Smith, Assistant Professor
J. Scott Tyo, Assistant Professor
Min-You Wu, Associate Professor

Research Areas
Electrical Engineering: Adaptive and optimal control, nonlinear systems, robotics, control systems, optical switching networks, optical communication systems, digital signal processing, photonics, microelectronics fabrication, high speed and high power semiconductor lasers, RF and Optical MEMS, antennas, wireless and multiuser communications systems design, pulsed power, high power microwaves, plasma science, remote sensing, sensor networking.
Computer Engineering: High performance computing, parallel computation, image processing, neural networks, virtual, machine vision, robotics, genetic algorithms, information theory, machine learning, pattern recognition, networking, computer architecture, software engineering and cybersecurity.

Mechanical Engineering

Thanks in part to the efforts of **Andrea Mammoli**, assistant professor in the Mechanical Engineering Department, Santa Fe was a hub of international discussion on fluid mechanics, materials science and everything in between for three days last fall. Mammoli and Carlos Brebbia, director of the Wessex Institute of Technology in the UK, co-chaired three conferences on multiphase flows, moving boundaries and materials characterization. The meetings, which attracted more than 150 researchers from around the world, featured internationally recognized keynote speakers sponsored by UNM. "The conferences were extremely successful because researchers who have been in mechanical engineering for years joined those new to the field to share ideas and research," says Mammoli.

Chair: Marc S. Ingber
505-277-6289
lsandve@unm.edu
Faculty: 17
Graduate students: 119
Undergraduate students: 189
Annual Research Expenditures: $1,115,603

Faculty
Nader D. Ebrahimi, Assistant Professor
Larissa Gorbatikh, Assistant Professor
Robert Greenlee, Lecturer III
Marc S. Ingber, Professor and Chair
Tariq Khraishi, Assistant Professor
James R. Leith, Associate Professor
Ronald Lumia, Professor
Andrea Mammoli, Assistant Professor
Arsalan Razani, Professor
John Russell, Professor and Associate Chair
Yu-Lin Shen, Associate Professor
Gregory P. Starr, Professor
Herbert (Bert) Tanner, Assistant Professor
Hy D. Tran, Assistant Professor
C. Randall Truman, Professor
Peter Vorobieff, Assistant Professor
John E. Wood, Professor

Research Areas
Small scale fluid mechanics for drug discovery, rheological modeling of multiphase flows, vorticity dynamics, experimental fluid mechanics, nonlinearity, instability and chaos, optical diagnostics for turbulent shear flows, computational methods for flow control technologies, noise-induced phase transition, stochastic fractal and fractional growth processes, thermal systems design and optimization, thermal characterization of cryocoolers, multiscale modeling of mechanical behavior of materials, thermo-mechanical phenomena in microelectronic devices and packages, modeling of irradiation damage, dislocation dynamics, robot manipulator dynamics and trajectory design, grasping with multifingered robot grippers, and parallel boundary and finite element methods.

Development

Development efforts continue for a variety of initiatives within the SOE. As we move forward with our major fundraising, our focus is on capital improvement and program development that will enhance our facilities and further strengthen UNM's leadership position among engineering programs in the U.S.

Funds raised in the past year have supported numerous scholarships, fellowships and valuable research. A new endowment initiative is underway to fund a biomedical engineering program, which we are developing jointly with the School of Medicine and the College of Arts & Sciences. We are grateful for the generous support we have received from corporations and individuals over the past year. Specifically, we would like to acknowledge our top 2003-2004 donors:

Boeing

James & Helen Boyd Trust

CH2M Foundation

Emcore

Ford Motor Company

Stanley E. Harrison, 1962 MS EE

Honeywell

Intel

Lockheed Martin/Sandia

Steve Matthews, 1961 BS CH

NASA

William and Mary Reed Trust

Semi Conductor Research Corporation

Van Dyke Software

Jim Warne, 1952 BS CE; 1957 MS CE

To make a donation to the SOE, or for more information on development initiatives, please contact Tim Davis, director of Development, at 505-277-5541 or twdavis@unm.edu. Or, write to him at: 107 Farris Engineering Center, MSC01 1140, University of New Mexico, Albuquerque, NM, 87131.
Also, visit the Giving to UNM section on the university's web site: www.unm.edu.

Paul Shirley is chairman and CEO of Qynergy Corporation, an Albuquerque-based technology start up that develops cutting edge energy solutions. Following is an excerpt from his convocation address at the SOE graduation in December 2003.

passion

I've struggled with the key thought that I want to share with you. Words like *hope, trust, values, competence, innovation* and *opportunity* are important, but I chose the word that resonates most strongly for me: *passion.*

As an entrepreneur who loves technology, I find that passion is difficult to describe to engineers. Sometimes it's too "touchy feely." So, being a disciplined engineer, I turned to my reference materials for a good starting point.

I looked up "passion" in the dictionary and was surprised to find that the first definition is: "the sufferings of Jesus Christ between the night of the Last Supper and his death." The second definition is simply the word "suffering." Given that part of my motivation today is to be upbeat, I continued until I found a definition that I felt comfortable with. When I came across the definition, "an ardent affection: love," I became nervous and decided to abandon my systems engineering approach.

Instead, I looked at the end of the system of interest – that system of interest being you. It took awhile to determine what the final system requirements should be for each of you. I wondered, "If graduation day is the beginning, then where is the end?" Then it struck me. For all of us the end is death. Typically, death isn't a popular commencement speech topic, but I decided to follow through on the concept. I asked myself, "Where do you go to understand 'the end' or at least to get a measure of the end state…the final conditions of the system?" Leaving no stone unturned, I looked to the Albuquerque Journal obituaries.

There, I found what you would expect – facts. Good systems engineering often starts with facts. Date of birth, date of death, cause of death, jobs, surviving relatives. But I found something more. I found testimonies about the people, their passions and how others felt about them. One testimony for an elderly lady named Mercy said: "She enjoyed music, playing her violin, making beautiful rosaries, writing poetry and baking. Above all else, she enjoyed spoiling her five grandchildren. The best moments of her life were having her children and grandchildren around her for festive occasions." There were many other passionate testimonies, but I stopped after reading one for a 15-year old named Michael, who "loved basketball, playing the guitar, and spending time with his family and friends. He will always be remembered for his bright smile and cheerful disposition. He will be greatly missed."

When the end comes for each of us, some things will stand out more than others. I don't understand why people don't take the time to figure out what is important to them and to identify their passions. What is it that causes you to be excited about getting out of bed in the morning? What is it that drives you to reach for the heavens and the stars? We each have a finite time on this planet and with our loved ones. Yet, all too often we wait until near the end – if ever – to identify what our passions truly are. We need to instill a passion in our kids. We need to instill a passion in ourselves. A passion for the things that bring joy…a passion for life.

I'll close with a simple exercise. Consider it your "final quiz." Here's your story-problem: you have just passed away and your loved ones have gathered to give their testimony about you. What do you want them to remember most about you?

I challenge you to go forward and live your life through your passions. Find them, embrace them, and live them to the fullest. In the end, you'll be happy that you did.

To read Paul Shirley's complete address please visit: www.soe.unm.edu/unmengineering/shirleyaddress.html

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