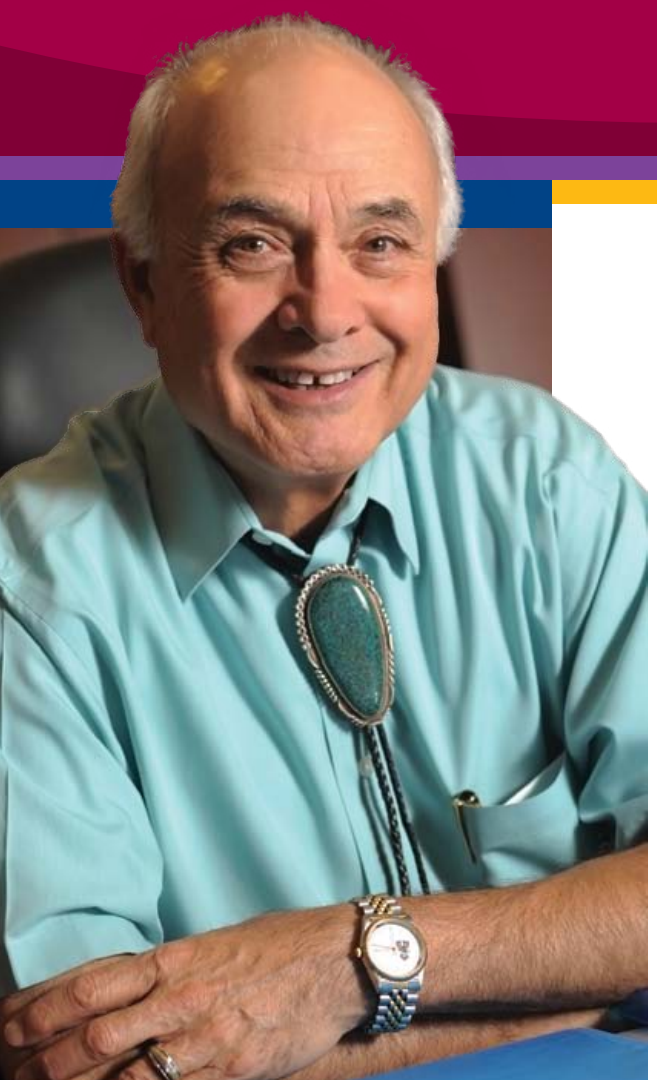
NM STATE UNIVERSITY

College of Engineering

2010–2011: Highlights of the Year

Live, Learn and Thrive.™

A Message from the Dean



This missive marks the end of my first year serving as dean, one I have found to be rewarding and challenging and an inspiration to continue building on the many fine qualities of our engineering program.

For more than 115 years, our college has educated students so they may go beyond being experts in their fields and become leaders in industry, government and academia.

The college takes NMSU's land-grant mission of teaching, research and outreach and service very seriously. Providing an engineering program that is accessible to students from all backgrounds is an important component.

NMSU is a federally designated Hispanic-serving institution and some 42 percent of our student population is of Hispanic descent. This results in a dynamic environment, giving our students unique insights and valuable collaborative experience. Our success is demonstrated by the high demand for our graduates and by a robust research program that has brought millions of dollars in funding to the college.

In terms of outreach and service, we create opportunities for students and our community. We help entrepreneurs turn ideas into reality. We generate income from new patents, licenses and spin-off businesses, further boosting our economy. Such contributions are essential in meeting the challenges of a high-tech future and in driving New Mexico's economy forward.

The high quality of our faculty and students, the strength of our scholarly programs, and the generosity of our supporters are keys to our success.

We are indebted to the friends, alumni and corporate partners who recognize the value in providing an excellent education to the next generation of engineers and technological leaders.

Sincerely,

Ricardo B. Jacquez, Ph.D., P.E.
Dean and Regents Professor

On the cover: Dorothy Lanphere is earning her master's degree through the Electric Utilities Management Program in the Klipsch School of Electrical and Computer Engineering.

College Profile

Degrees Offered

Aerospace Engineering (BS, MS and Ph.D.)
Chemical Engineering (BS, MS and Ph.D.)
Civil Engineering (BS, MS and Ph.D.)
Electrical and Computer Engineering (BS, MS and Ph.D.)
Engineering Physics (BS)
Engineering Technology (BS, majors in Civil, Electronics and Computer, Information, or Mechanical)
Industrial Engineering (BS, MS and Ph.D.)
Information and Communication Technology (BICT)
Mechanical Engineering (BS, MS and Ph.D.)
Surveying Engineering (BS)

Staff

Tenured Faculty 56
Tenure-Track Faculty 22
Research Faculty and Staff 63
National Science Foundation Career Awardees. 5

Endowed Chairs

Ed and Harold Foreman Endowed Chair in Civil Engineering . . . . . **Nirmala Khandan**
Frank Carden Endowed Chair for Telemetering and Telecommunications . . . . . **Charles Creusere**
PNM Endowed Chair for Utility Management. . . . . **Satish Ranade**
William Kersting Endowed Chair in Power Systems Engineering . . . . . **TBD**

Endowed Professorships

Harold Foreman Distinguished Professorship in Civil Engineering . . . . . **Rola Idriss**
Ed Foreman Distinguished Professorship in Civil Engineering . . . . . **Zohrab Samani**
John Clark Distinguished Professorship in Civil . . . . . Engineering . . . . . **TBD**
Paul W. and Valerie Klipsch Distinguished Professorships in Electrical and Computer Engineering . . . . . **Vojin Oklobdzija**
. . . . . **Kwong Ng**
. . . . . **Jaime Ramirez-Angulo**
. . . . . **David Voelz**
Robert Davis Distinguished Professorships in Chemical Engineering . . . . . **Shuguang Deng**
. . . . . **Martha Mitchell**
Dwight and Audrey Chapman Distinguished Professorship in Mechanical Engineering . . . . . **Eric Butcher**
Wells-Hatch Endowed Professorship in Civil Engineering . . . . . **David Jáuregui**
Robert G. Myers Endowed Professorship in Mechanical Engineering . . . . . **Ian Leslie**
International Foundation for Telemetering Professorship in Electrical and Computer Engineering . . . . . **Deva Borah**
Mechanical and Aerospace Engineering Academy Professorship . . . . . **TBD**

College of Engineering Leadership

Ricardo B. Jacquez, Dean
Sonya Cooper, Associate Dean of Academics
Rudi Schoenmackers, Associate Dean of Research
Patricia A. Sullivan, Assistant Dean of Development and External Relations
Ian Leslie, Interim Mechanical and Aerospace Engineering Department Head
Jeffrey S. Beasley, Engineering Technology and Surveying Engineering Department Head
Vojin Oklobdzija, Electrical and Computer Engineering Department Head
Adrian T. Hanson, Interim Civil Engineering Department Head
Martha C. Mitchell, Chemical Engineering Department Head
Edward Pines, Industrial Engineering Department Head

Accreditation

Baccalaureate programs in civil, chemical, electrical and computer, engineering physics, industrial, mechanical, and surveying engineering are accredited by the Engineering Accreditation Commission of ABET, Inc. Baccalaureate programs in civil, electronics and computer, and mechanical engineering technology are accredited by the Technology Accreditation Commission of ABET, Inc.

Commission of the Accreditation Board for Engineering and Technology
III Market Place, Suite 1050
Baltimore, MD 21202-4012
Telephone 410-347-7700

Statistics

Numbers for 2004-2005 in the following charts are the baseline for goals outlined in the College of Engineering strategic plan. Numbers for 2015 are targeted goals.

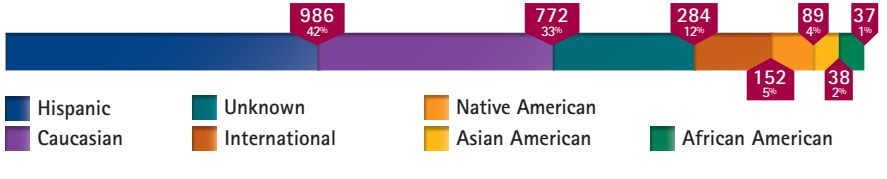
New freshman enrollment

Freshman to sophomore retention

Total enrollment

Graduate

Fall 2010 student ethnicity



Fall 2010 student gender

College endowment
(in millions)

Total gifts received
(in millions)

Number of scholarships awarded

Total value of scholarships awarded
(in thousands)

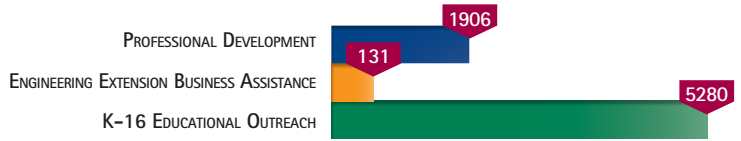
Engineering Extension and Educational Outreach

In keeping with the land-grant mission of NMSU, the College of Engineering advances the economy of the state of New Mexico through the delivery of hands-on, customized training, technical assistance and services. Our extension and outreach programs combine faculty strengths with partnerships that include state and local government agencies, industry, other academic institutions and national laboratories.

Educational outreach efforts support K-16 science, technology, engineering and math education along with professional development and continuing education geared toward a competitive workforce. Engineering extension programs focus on alternative energy technology development and deployment, energy efficiency and power delivery; initiatives to improve water quality/quantity and to encourage pollution prevention; and manufacturing and agricultural engineering assistance to improve processes and mechanization, incorporate new technologies and develop products that benefit New Mexico and far beyond.

During the past fiscal year, we reached 5,270 K-16 students through our STEM programs. More than 1,900 individuals have been trained through professional development, certificate programs and short courses. Plus, nearly 150 businesses have received technical assistance.

2010-2011 Engineering Extension and Educational Outreach



The Southwest Technology Development Institute trained more than 1,500 electricians on photovoltaic electric codes last year.

Professional Development

- Electric Utility Management Professional Engineer Refresher Course
- Bureau of Indian Affairs Water Resources Technician Training
- Bridge Inspection Training
- Quality Concrete School
- PLTW Teacher Training
- SWTDI Photovoltaic/National Electric Codes Training
- MTEC Training
- WERC Pollution Prevention Training

Engineering Extension Business Assistance

- Engineering Technology and Surveying Engineering Outreach Projects
- IEE P2/E2 Assessments
- SWTDI Engineering Assistance
- MTEC Business Assistance Projects

K-16 STEM Outreach

- Project Lead the Way
- Pre-freshman Engineering Program
- Boosting Engineering, Science and Technology
- New Mexico Alliance for Minority Participation Programs
- Reaching the Pinnacle
- WERC Pollution Prevention, Energy Efficiency and Water Programs
- WERC Environmental Design Contest

NMSU training tribal wastewater treatment professionals

Since the arrival of casinos, New Mexico's Native American tribal wastewater treatment professionals have faced issues associated with on-site systems. For the past three years, we have partnered with the College of Agricultural, Consumer and Environmental Sciences to provide on-site training to the tribal communities to address some of the challenges of processing wastewater from the newly developed casinos, hotels and restaurants, as well as other small-scale systems not connected to the communities' centralized sewer systems.

"The trained professionals, who have been working with large-scale wastewater treatment for their communities, are facing different issues with the on-site wastewater systems," said Adrian Hanson, NMSU professor and interim head of the department of civil engineering.

The New Mexico Tribal Management for On-Site Wastewater Program is supported by Environmental Protection Agency funds. The concept for the program began five years ago when EPA became aware that tribes needed educational support.

The program offers training to provide each tribal community with the means to protect the public health and help their wastewater operators and installers operate their systems at peak capability.

More than 110 individual tribal members (representing 19 of the 22 tribes in New Mexico), Indian Health Service engineers, and New Mexico Environmental Department specialists have received the training.

"This is a great program," said Michael Alvidrez, director of the Pueblo of Santa Ana's utilities department and past president of the New Mexico Water and Wastewater Association. "They have provided some training that you can't get anywhere else. The training is geared for the operators. They are getting down to the level that we can actually take something home with us."

Students in the civil engineering department's ongoing Bureau of Indian Affairs Water Technicians Training Program tour the Las Cruces Wastewater Treatment Plant.

Program helps minority students succeed in science, engineering and math

In 1999, when Ricardo Jacquez, now dean of the College of Engineering, became the lead for a National Science Foundation grant, little did he know that it would impact the lives of nearly 8,000 students over the next 18 years.

The college submitted a proposal to NSF for the Alliance for Minority Participation (AMP), a new program aimed at increasing the enrollment and graduation rates of underrepresented, ethnic minority students in the STEM fields. The group received funding for what was to be a 10-year program—based on its success, they later received an extension for another 10 years (through 2013) with the expanded goal of helping students pursue graduate education. NMSU is the administrative arm of what is now the Louis Stokes Alliance for Minority Participation, a network of 20 community colleges and seven degree-granting universities.

The goal in 1993 was to double the number of STEM degrees awarded by New Mexico institutions to underrepresented minority students in 10 years. In '93 there were 253 graduates and in 2003 there were 516. The number peaked in 2004 with 580 and in 2010 there were 542. Over the lifetime of the program, 7,815 STEM degrees have been awarded to underrepresented minority students.

"Even more significant, the percentage of STEM degrees awarded to minority students increased from 24 percent in 1993 to 41 percent in 2010, indicating that we are closing the achievement gap in New Mexico," Jacquez said.

Although the program was getting results, there was still a need to increase the number of high school students pursuing STEM programs in higher education

NMSU began working with a high school enrichment program designed to serve as a feeder to STEM degree-granting programs.

Still, many students were found to be unprepared for the rigorous curriculum associated with STEM fields.

The college developed Integrated Learning Communities, also funded by NSF, to address retention of these at-risk students. Freshmen move through basic courses together, receiving supplemental instruction, assistance and support, and are engaged in hands-on projects.

Some 74 percent of ILC participants have continued at NMSU past their freshman year, 57 percent of them in engineering. Among those students, 59 percent are underrepresented minorities and 56 percent are females.

Equally important, these students, many of whom are economically disadvantaged, achieve and maintain the minimum 2.5 GPA necessary to qualify for the New Mexico Lottery Scholarship.

While numbers indicate the success of the program, it is the individual stories of student participants that show the true impact of AMP.

Mechanical engineering student Gerardo Martinez talks with fellow students about his research at a New Mexico AMP Student Research Conference.

One AMP student who has turned his experience into a great future is mechanical engineering student Gerardo Martinez, who just graduated with his bachelor's degree. Martinez has been developing a suborbital flight experiment using robotics. He recently received a three-year, $40,000 per year NSF Graduate Research Fellowship.

"I am a first-generation college student, the first in my family to graduate from high school, and I am a member of an underrepresented minority coming from a low-income home," said Martinez. "This, however, does not define me. I define myself as a curious, motivated, hardworking, disciplined, and proficient engineering student."

Research

One of the college's greatest strengths lies in extensive research programs. Our groundbreaking work in several areas has brought us widespread recognition and millions of dollars in funding. Such unique research opportunities provide our students with invaluable practical experience and the chance to work closely with mentoring professors.

We are actively pursuing projects that contribute toward the National Academy of Engineering's Grand Challenges: engineering solutions that will help people and the planet thrive. Our faculty members are working on a number of the challenges identified by the academy, including making solar energy more economical, providing access to clean water, and restoring and improving the urban infrastructure.

We have significant programs aimed at developing both renewable resources and electric power systems engineering to address the growing nationwide demand for power. We are examining ways to develop alternative sources of energy and utilize traditional fossil resources to provide cost-effective, distributed electricity. Our Electric Utility Management Program has been graduating students with the engineering skills and business acumen to serve as leaders in this complex industry for nearly 40 years. We are conducting innovative research in alternative energy through the Southwest Technology Development Institute. SWTDI, established in 1977, is currently the lead in a Department of Energy initiative for setting national codes and standards for implementation of solar energy.

Our Bridge Research Center improves the safety and performance of the nation's bridges. Launched in 1972, the program offers the only Bridge Safety Inspection training program in the U.S. through which bridge inspectors from across the nation receive certification. This program fostered our world-renowned research in "smart bridge" technology that uses fiber optics to monitor bridge performance. Research also extends to new technologies for improving highway safety, evaluation methods and performance.

Our interdisciplinary expertise in ensuring water quality and quantity in arid regions not only addresses local issues but has worldwide application. Research includes novel methods of desalination, cost-effective ways to remove arsenic from drinking water and the use of satellite data to measure agricultural crop evapotranspiration. We are partnering with the Office of Naval Research and General Electric Water and Process Technologies at the Tularosa Basin National Desalination Research Facility to investigate ways to make the vast reservoir of brackish water lying underneath most of New Mexico usable to its citizens, thereby combining innovation and technology to provide clean, affordable water today and in the future.

New Research Awards and Renewals
(in millions)

Research expenditures
(in millions)

Intellectual Property Activity

Licenses/Options Signed

- Nirmala Khandan, Civil Engineering, inter-institutional agreement with University of Arizona.
- Sukumar Brahma, Electrical and Computer Engineering, inter-institutional agreement with North Dakota State University Research Foundation.

U.S. Patents Awarded

- Sukumar Brahma, et al, Electrical and Computer Engineering, "Eliminating the Use of Anti-Aliasing Filters in Digital Relays by Oversampling."
- Zohrab Samani, Civil Engineering, "Liquid Fertilizer from Waste Using Successive Extraction and Bioleaching."
- Deva Borah, Electrical and Computer Engineering, "Speaker Identification in the Presence of Packet Losses."
- Zohrab Samani, Civil Engineering, "Methane Generation from Waste Materials."

U.S. Patents Pending: 2

U.S. Provisional Patents Filed: 6

Invention Disclosures Filed: 11

Civil and geological engineering professor Nirmala Khandan and students examine an algae sample taken from an algal raceway reactor at the NMSU Fabian Garcia Science Center.

Key University Research Collaborations

National Science Foundation Louis Stokes Alliance for Minority Participation

New Mexico State University (Lead)
New Mexico Highlands University
Eastern New Mexico University
New Mexico Tech
University of New Mexico
Western New Mexico University
Central New Mexico Community College
Diné College
Luna Community College
New Mexico Junior College
New Mexico Military Institute
New Mexico State University, Alamogordo
New Mexico State University, Carlsbad
New Mexico State University, Doña Ana
New Mexico State University, Grants
Northern New Mexico College
San Juan College
Santa Fe Community College
Southwestern Indian Polytechnic Institute
University of New Mexico, Gallup
University of New Mexico, Los Alamos
University of New Mexico, Valencia

National Alliance for Advanced Biofuels and Bioproducts

Donald Danforth Plant Science Center (Lead)
Los Alamos National Laboratory
New Mexico State University
University of Arizona
Texas A&M University
Pacific Northwest National Laboratory
Others

The Wind Alliance

Texas Tech University (Lead)
New Mexico State University
University of Houston
Texas A&M University
Rice University
University of Texas
University of Iowa
University of California, Davis
Florida State University
BP Wind Energy
Shell Wind Energy
TECO Westinghouse
Vestas Technology
Others

Office of Naval Research and Bureau of Reclamation, NMSU Water Security Program

New Mexico State University (Lead)
General Electric

NASA, Investigation of Composition of Cosmic Rays

New Mexico State University (Lead)
University of New Hampshire
Stanford University
Goddard Space Flight Center

National Science Foundation Engineering Research Center, Re-inventing America's Urban Water Infrastructure

Stanford University (Lead)
New Mexico State University
University of California, Berkeley
Colorado School of Mines

Army High Performance Computing Research Center

Stanford University (Lead)
New Mexico State University
University of Texas, El Paso
Morgan State University
High Performance Technologies, Inc.

Department of Homeland Security Center of Excellence in Border Security and Immigration

University of Arizona (Lead)
New Mexico State University
Arizona State University
San Diego State University
University of Minnesota
University of Washington
West Virginia University
Others

Novel method to analyze cells benefits biological research

A standard instrument used to analyze cells one by one, coupled with a new technology, could have many biological research applications, including advancements in the treatment of HIV/AIDS, methods for detecting and treating cancer, genetic engineering of single cells, identification of new marine species, or improving production of algal biofuel, to name a few.

Jessica Houston, a chemical engineering assistant professor, is developing enhancements to the use of flow cytometry. A flow cytometer passes thousands of cells per second, one at a time, through a laser beam and measures both the fluorescence light emitted from each cell as well as the light scattered off the cell from the laser beam. The data is gathered and converted to digital information, which conveys statistics about the physical or molecular state of the cell that is analyzed.

All cells emit fluorescence when excited with light of a specific color. Researchers commonly add fluorescent agents, or dyes, designed to bind to cells and act as beacons to reveal particular information about the cell, depending on where or how the dye is bound.

Problems occur when the fluorescent dyes emit light identical to the naturally occurring fluorescence of the cells or other dyes introduced to the cells. Houston is developing a method to distinguish among the sources of fluorescence.

As cells treated with a fluorescent agent pass through cytometer, the fluorescent species in the cells absorb energy from the laser and emit fluorescent light. The emission is part of the process whereby the excited dye releases energy in order to return to a non-excited state. There is a short window of time that passes before cells return to their natural state—their fluorescent lifetime—is unique for each dye. Houston is working with both commercial cytometry instruments as well as laboratory-built cytometers to enable the measurement of that time so that the properties targeted with different dyes can be resolved.

"This is very challenging to do," said Houston. "The end goal is to translate a new cytometry technique to the biomedical community. We also hope to simply discover new fluorescence phenomena within single cells. There is a plethora of information that can be gained whether it be relating cell growth cycle to the lifetime of native proteins in the cell or identifying unknown fluorescent species in the cell nucleus, membrane, or cytoplasm."

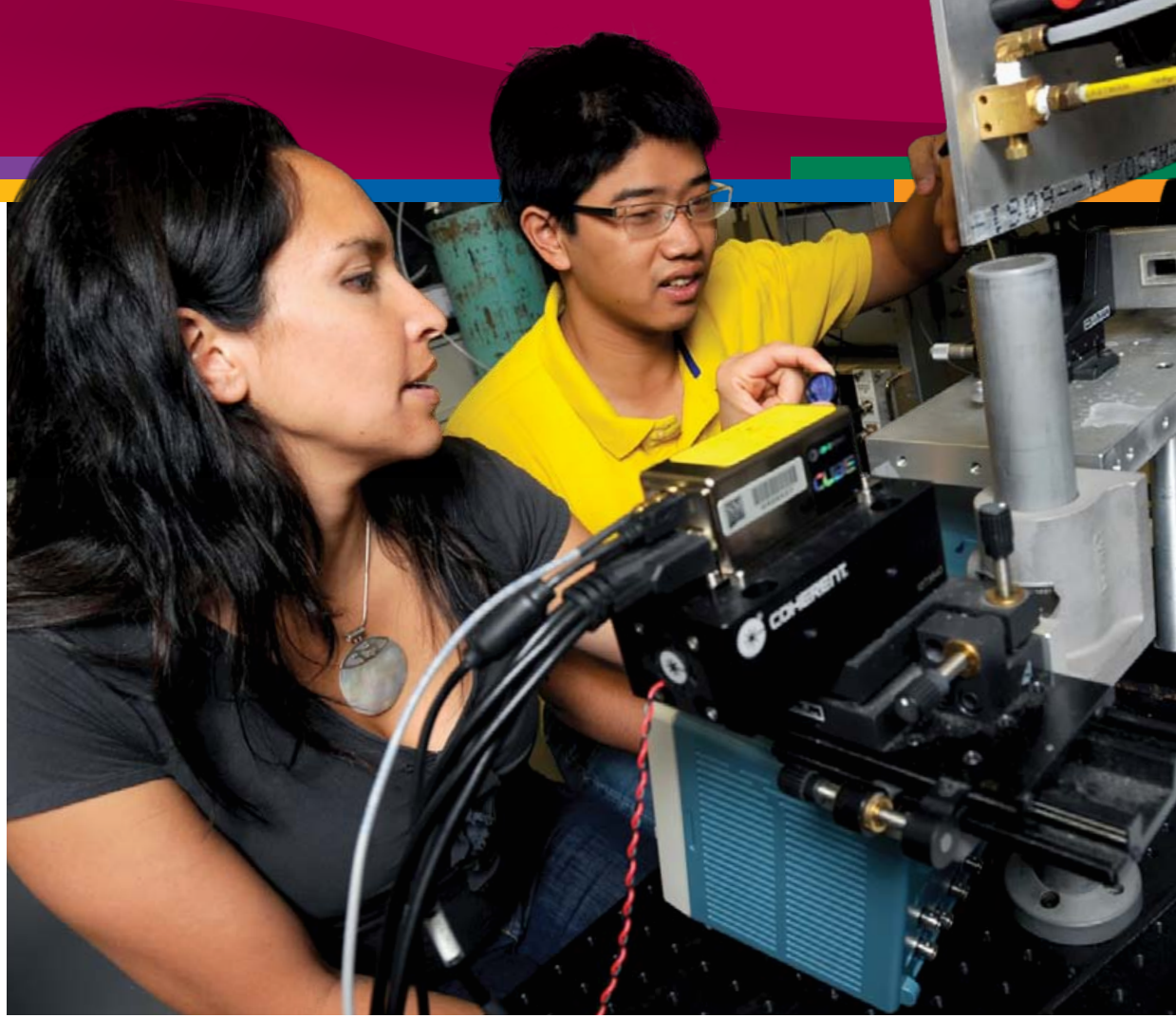
There is much interest in this method of analyzing cells. Houston already has three grants totaling more than $650,000 from NIH and NSF supporting her research. Two of the grants support development of the technology; one supports its application.

An NIH partnership between the Fred Hutchinson Cancer Research Center and NMSU's College of Agricultural, Consumer and Environmental Sciences funds a cooperative effort in the application of the technology. Houston is working with FHCRC scientist Roger Brent, who uses fluorescent lifetime measurements to study signaling pathways in yeast cells. The information resulting from this study may eventually lead to a better understanding of the alterations in signaling pathways in cancer cells and result in more-effective treatments.

Houston's line of biomedical research has opened new funding and collaboration opportunities to NMSU's chemical engineering department and fellow faculty members. Professor Shuguang Deng is using this technology to identify and separate specific bacteria species to make fuel from algae. Professor Hongmei Luo is looking at ways to use flow cytometry in her research with nanoparticles.

Recognizing there may be opportunity for commercialization, Houston is considering if patenting the technology is necessary; however, her real interest is in developing the technology and building a device that would be available for use more broadly.

"From benchtop-to-bedside is the phrase that is used," said Houston. "There are many benefits that could result if a technology developed in the laboratory is quickly translated for routine use in the biomedical community."



Chemical engineering professor Jessica Houston, and chemical engineering student Ruofan Cao examine a lab-built flow cytometer in Houston's lab. Houston, Cao, and other members of Houston's research team, use this and similar instruments to measure phase shift of fluorescent light.

Researchers use remote sensing to improve irrigation management

Agriculture is big business in Doña Ana County, home to New Mexico State. The majority of the state's 36,000 acres of pecan trees are located here. In 2009, the state ranked first in value of production of pecans in the United States, resulting in 70 million pounds valued at approximately $133 million in net sales going directly to the growers, reports the New Mexico Department of Agriculture.

Key to such success is the efficient use of water, one of the most precious of commodities in the region. An interdisciplinary team of researchers is investigating the use of new technologies to improve irrigation management with the goal to help farmers increase the yield of their crops. Local farmers may soon be able to observe real-time data about their crops via the Internet.

The project team includes Zohrab Samani, civil engineering professor; Salim Bawazir, civil engineering associate professor; Max Bleiweiss, science specialist and adjunct professor in the department of entomology, plant, pathology and weed science; and Rhonda Skaggs, agricultural economics and agricultural business professor.

By using data available from satellites, the group has developed techniques to estimate water loss by evaporation from the soil and transpiration from plants into the atmosphere, making it possible to calculate water consumption.

The team uses real-time Landsat satellite data collected by the Center for Applied Remote Sensing in Agriculture, Meteorology and Environment. The information is augmented with images from video cameras mounted in a College of Agricultural, Consumer and Environmental Sciences plane.

The researchers utilize NMSU's super-computing capabilities to create mathematical models showing evapotranspiration rates in the region based upon the satellite data.

Evapotranspiration rates are indicated by variations in color on the satellite imagery. This is validated with data from climate stations that are placed in the fields throughout the region. They measure relative humidity, temperature, solar radiation, rainfall, wind speed and direction from which estimates of evapotranspiration can be derived.

"Prior to this, we had to look at individual crops. Now we can look at the entire valley and get a more accurate understanding of water consumption and how we can help farmers increase the yield of their crops," said Bawazir.

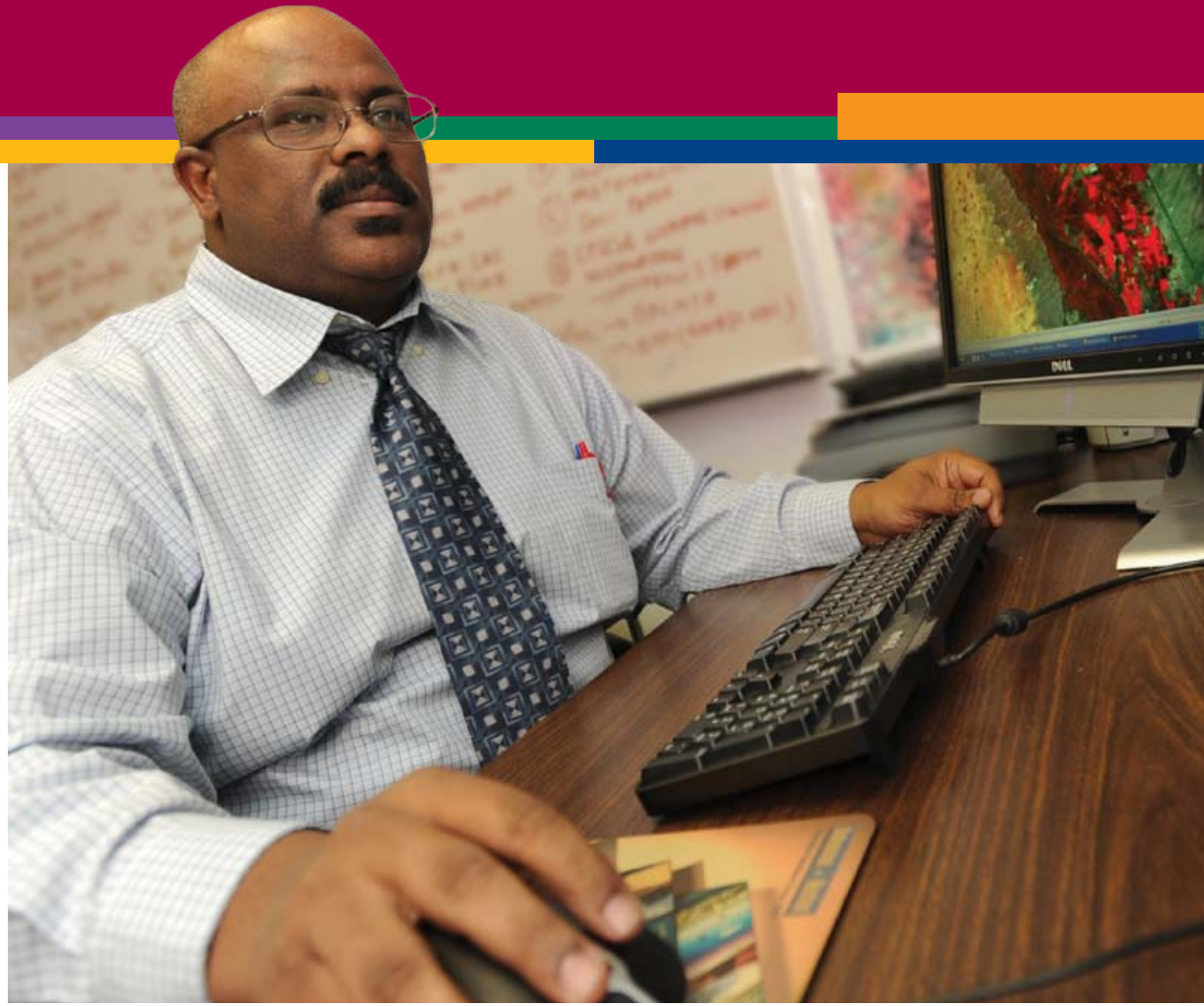
Skaggs is using the data to look at the socio-economic issues related to crop water usage and has found a strong relationship between water consumptive use and yield, or value of crop, which ultimately influences the economic output of the region.

Local farmers and agricultural enterprises, including Stahmann Farms, the largest pecan-producing farm in the U.S., are cooperating with the research team. They allow climate stations to be placed on their property and the data are shared with them.

Team members are also working to make the data available via the Internet and on making the interface more user-friendly. They anticipate making the system available to local farmers within two years.

"I envision that, someday, a farmer in his truck out in the field can access this information on his cell phone in real time," said Bawazir.

"Our goal is to better understand the budget of water of the entire valley and better manage this scarce resource," said Bawazir. "In a region that receives less than eight inches of rainfall a year, this is an opportunity to help our farmers and advance our economy."



Civil engineering associate professor Salim Bawazir examines time series evapotranspiration flux data for remote sensing. The data is used to estimate crop water use.

NMSU researchers pioneer new power system paradigm

Nearly everyone living in New Mexico and west Texas felt the impact of rolling power outages caused by the record-breaking low temperatures in early February 2011. A group of our engineers interpreted the unprecedented event as a call to further their research on emerging paradigms for power system delivery and supply.

Small power systems, known as microgrids, could enable homeowners, businesses, neighborhoods, or even large government installations or school systems to generate their own power—preferably through renewable sources of energy such as solar or wind. Such systems could add reliability to power delivery and reduce costs.

"The existence of microgrids [in February 2011] might have helped to reduce the severity and geographic magnitude of the situation," said Satish Ranade, professor of electrical engineering and head of the Electric Utility Management Program.

Ranade, along with Sukumar Brahma and Wenxin Liu, associate professors of electrical engineering, lead a multi-faceted effort to investigate the development and modeling of microgrids. Currently, NMSU faculty are actively engaged in research that focuses on public policy issues, development of microgrid designs and advanced control systems, and prototype implementation under grants from the Department of Energy, Sandia National Laboratories, the California Energy Commission, Raytheon, and NMSU's Office of the Vice President of Research.

During February's rolling blackouts, the Las Cruces campus was able to continue providing power for essential services, such as fire, police and communications networks, through the use of its own co-generation plant. Experienced power professionals worked in conjunction with El Paso Electric to use campus-generated power when needed, but the implementation was done manually.

Adding multiple sources of energy generated by different methods complicates the ability to detect issues and control the system.

Liu is conducting research focused on advanced computer control and optimization models that can improve the efficiency and reliability of microgrids during normal and abnormal operating conditions. Liu is achieving advanced design and improved performance by introducing recent developments in computational intelligence to power system research.

Brahma is investigating aspects of protection and fault location in microgrids. Due to the unique topology and varied generation resources in a microgrid, the established methods of protection and fault location for distribution systems do not apply.

"We need methods to protect the network—the ability to sense problems with the system and automatically turn parts of it on and off in a safe manner so that critical services are not jeopardized," said Ranade. "Advanced communications and controls could detect problems and help coordinate customer generation for safety."

While the benefits of co-generation are evident, the rules of engagement are not in place yet; policy and economic issues related to implementation remain up in the air.

From left, electrical engineering professors Satish Ranade, Wenxin Liu and Sukumar Brahma look over a student project in the NMSU Power System Protection and Utility Management Lab.

Assistant Dean Patricia Sullivan, also an industrial engineering doctorate candidate, is developing methods to analyze the associated public policy on customers making investments in microgrid systems, utility companies integrating the generation and the economic effects on the general public.

"Done right, microgrids that incorporate renewable generation should increase access so that anyone can benefit from the system, regardless of socio-economic levels," Sullivan said.

A goal of the New Mexico Green Grid Initiative, a cooperative effort of the national laboratories, utilities, energy businesses and research universities including NMSU, was to set up fully integrated microgrids for testing and evaluation in one rural area and one urban zone starting in 2010. While several possible sites have been identified, financial backing is slow to come.

NMSU is, however, working toward the demonstration of an autonomous microgrid sometime within the coming year, as well as a microgrid teaching lab equipped with wireless communication and automatic controls. They will work in conjunction with several prototype houses on campus outfitted with solar panels and operated by the College of Engineering's Southwest Region Experiment Station, established in 1977 by the U.S. Department of Energy.

Engineering and Cooperative Extension Service pair to demonstrate agricultural use of solar power

On more than 25,000 farms spread across the rural landscape in New Mexico, electrical power isn't always readily available. In remote areas, windmills have long been the traditional source of pulling water from wells; however, solar panels soon may be doing the lion's share of their work.

Our engineers are working with NMSU's Cooperative Extension Service to show farmers and ranchers how they can use alternative energy, with extension agents providing live demonstrations using a portable solar-powered water pump.

Tom Jenkins, professor of engineering technology and head of the department's renewable energy program, has been working with extension officers to produce training presentations explaining the use of renewable energy sources in agricultural applications. Taking the idea further, they knew it would be valuable to demonstrate to the agricultural community in the state how solar power could be used to pump well water.

Jenkins presented a group of mechanical engineering technology students with the problem. Three of them took on the problem as their senior capstone project in the spring 2011 semester. Senior capstone design courses are the culmination of the engineering curriculum at NMSU, requiring students to utilize knowledge and skills acquired throughout their coursework.

Under the tutelage of Craig Ricketts, associate engineering technology professor, students designed and built a portable demonstration unit that could be taken into the field.

The unit consists of a rolling cart outfitted with a small solar panel that collects heat energy from sunlight and converts it to electricity. The electricity powers a high-pressure submersible pump in a 50-gallon storage vessel. The pump is equipped with a sophisticated control box that optimizes the power needed to control the speed of the pump. Meters show the current and voltage produced by the solar panel and used by the pump.

"A major engineering challenge of this project was for the students to come up with a method to simulate different depths of water in a portable unit," said Jeff Beasley, engineering technology and surveying engineering department head.

The students incorporated a valve to control water pressure and simulate pumping from depths up to 400 feet, using mathematical equations to determine the correlation between water pressure and depth.

"The depth of water in the state is all over the scale, anywhere from 10 to 1,000 feet," said Craig Runyan, extension plant sciences associate. "Four hundred feet is pushing the limit for solar, but technology is catching up fast. There are a lot of wells 600-700 feet deep on the eastern side of the state. It's not unreasonable for a conventional windmill to lift water from 700 feet, but it takes quite a while. It really depends on how much flow you need."

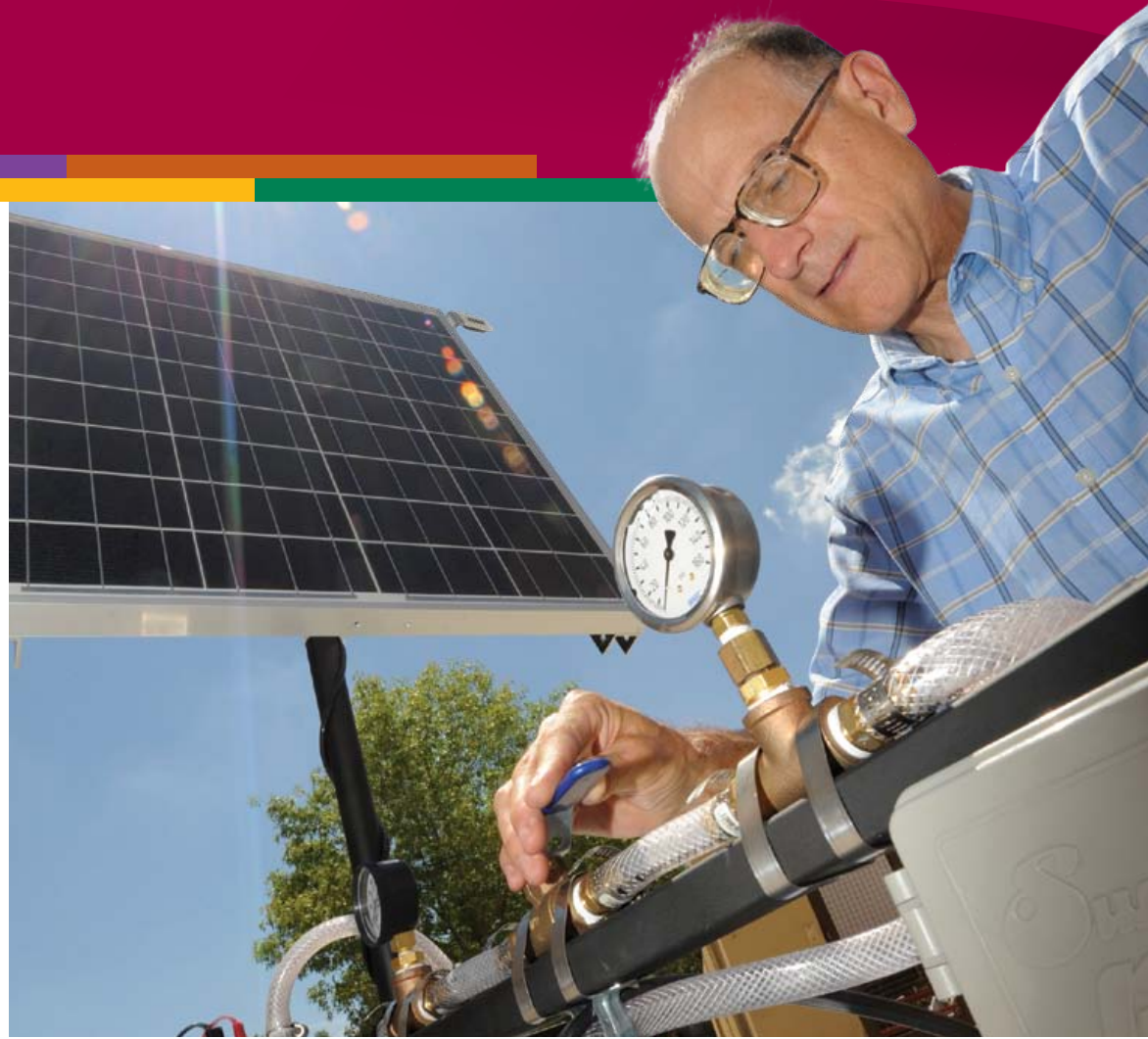
At the same time, other engineering technology students were developing a spreadsheet tool that could be used by potential clientele of solar water pump systems.

"Clientele can enter information about the depth of their well, if it will be used for livestock and what type of livestock. The system will recommend a hardware layout for their given application," said Ricketts. "The spreadsheet will recommend the volume of water needed, how much storage will be needed as reserve for cloudy days, how many panels will be needed, pump and pipe size."

The spreadsheet also has an economic component that will help estimate how much a system might cost.

While the market is pretty evenly split between wind and solar used to draw water from wells in New Mexico, said Runyan, producers are all looking for alternatives to the high cost of fuel.

"It's a great avenue for us to help fulfill an increasing need of our clientele," said Jon Boren, associate dean and director of the Cooperative Extension Service. "Using expertise from the College of Engineering for alternative energy technologies, the Cooperative Extension Service has the network to deliver new choices to our clientele."



Associate professor Craig Ricketts supervised the work of three mechanical engineering technology seniors who designed and built a solar-powered water pump for Cooperative Extension Service agents to use for field demonstrations.

Engineers seek to expand wood-plastic composites - with chile plant

NMSU's Chile Pepper Institute is famous for its work in crossbreeding and manipulating chile varieties to provide for delectable culinary experiences. Now our department of industrial engineering is getting in on the act, with researchers looking at ways to combine the chile plant itself with plastic. Not a tasty venture, to be sure, but, if successful, it could be a significant income generator for New Mexicans.

Wood-plastic composites, also known as natural fiber plastic composites or natural fiber reinforced plastics, are materials comprised mainly of a mixture of wood fibers and plastics, as well as small amounts of additives to enhance the compatibility and mechanical properties of the composite material. The wood particles act as reinforcement fibers while the plastic serves as a matrix to hold the fibers. The material originally was developed in the 1960s, and improved applications coupled with increased market demand have allowed the industry to grow rapidly over the last two decades.

Industry experts project that revenues could top $5 billion by 2013, as the composite material grows in popularity, particularly in decking and railing products. It is environmentally friendly, resistant to decay and insects, and weathers better than wood, rarely splintering, cracking or warping.

Companies use both recycled and virgin plastic to combine with wood products like pallets, furniture waste, recycled oak wood flour, oak and pine from millwork and reclaimed cedar wood chips, among other sources. Over time, researchers have investigated high levels of wood and plastic combinations with functional additives, such as coupling agents, UV stabilizers, antimicrobials and antioxidants.

Delia Valles-Rosales, associate professor of industrial engineering, believes manufacturers in New Mexico could cash in on this growth by using chile plants for the composite material. She directs interdisciplinary research on the viability of such a combination. The effort includes NMSU's departments of extension plant science, plant and environmental sciences, and engineering technology; the department of chemistry at the University of Texas, El Paso, and Biad Chili Ltd. Co.

Approximately 60 percent of a mature chile plant's weight resides in its stems, leaves and roots which typically are discarded or used as cattle feed post-harvest. If that material could be utilized for WPCs, manufacturing facilities could be built to produce the product. Since New Mexico is the nation's leader in chile production, the industry is a natural fit.

The research team is exploring a wide range of composite ratios - how much wood versus how much plastic, and also varying grain sizes - 120, 150 and 600 microns, which basically ranges from product that resembles sawdust all the way down to a floury, sandy type of grain. The plastics used in the process also are composed of recycled material.

The research is far-reaching. To test the various WPC ratios and grain combinations, the team must create product models that measure up to standards set forth by ASTM International, a globally recognized leader in the development and delivery of international voluntary consensus standards (specifically ASTM D638-9 - Standard practice for tests to evaluate the

tension test of plastics and plastics composites). To meet these standards, very particular, exact models of each WPC combination had to be manufactured. Students from mechanical and industrial engineering, and the Manufacturing, Technology and Engineering Center designed plastic molds to create the models, and also were involved in using injection-molding machinery to actually fill the molds with the WPC sample.

Degradation testing is another part of the research and development process. The team will subject the samples to UV light testing and as many other weather and environmental conditions as possible in a very intense fashion, to replicate years of wear in a matter of months. It is crucial to measure and record how well the samples created at NMSU with the chile plant holds up in comparison to other WPC products, as well as regular plastic and wood products of similar type.

Part of the work Valles-Rosales and her team are doing includes examining the costs of collecting the chile plants, included logistics and transportation analysis and a feasibility analysis on the ability to temporarily store the plant waste. Also, since red chile is seasonal, the team is investigating other potential local resources for use in WPCs, such as byproducts from cotton plants, branches from pecan trees and even the pecan shells themselves.

Delia Valles-Rosales shows samples of wood-plastic composites developed by her research team, using plastic molds developed by industrial and mechanical engineering students, as well as students from NMSU's Manufacturing, Technology and Engineering Center.

3D motion capture could help prevent falls

When a young person falls, he may suffer from embarrassment; when an older person falls, the consequences can be more serious than a bruised ego. Statistics show that falls are the number one cause of injurious death in older adults and one out of every three older adults will fall each year.

To help identify those at risk for potentially serious falls, researchers are using a 3D motion-capture system to analyze the gait of older adults.

Professor of mechanical engineering Ou Ma is working with Robert Wood, professor and academic head of NMSU's department of human performance, dance and recreation, to analyze and compare movement patterns of older adults who have and have not fallen in order to more accurately assess factors that put people at risk for falls.

The gait analysis, funded through the Interdisciplinary Research Grant program, is taking place at NMSU's recently constructed Reduced Gravity and Biomechanics Lab. Subjects have photo-reflective technical markers placed on various parts of the body (i.e., arms, chest, back, legs and feet) to help the 10-camera system track the person's movements in three dimensions.

The subjects walk on an instrumented treadmill with a belt for each foot that measures kinematic information including velocity, joint angles and the magnitude of force used by the person walking.

Specialized software generates data Wood and Ma analyze to determine what distinguishes a normal gait from an abnormal gait. Once these factors are isolated, researchers can more accurately determine not only who is at risk for falls, but their degree of risk. Moreover, the development of a sensitive assessment can be used to assess the efficacy of future interventions.

"A benefit to this type of analysis is that we will have information generated by the software as well as the 3D data points from the markers and the regular video file. This way, we can go between the different types of information to more accurately understand what is happening and why," Ma said.

Wood and Ma have recruited undergraduate students Samantha Johnson and Krystyna Gonzalez and graduate students Lin Zhang and Wenwu Xiu to go to conferences, present data, translate documents, work in the community, collect testing data and develop mathematical models.

The partnership with Ma and the RGB lab is helping Wood take his prior research a step further by providing another tool to help delineate the factors that put people at risk for falls. The resulting data may also prove beneficial to places that provide preventative and aftercare to individuals who are at risk for falls.

As baby boomers age and life expectancy increases, there has been growing research that focuses on preventative care that aims to improve the quality of life of adults as they age. The professors point out that funding this type of research is often less expensive than funding research relating to pharmaceuticals and

is also an important step toward controlling health care costs.

Wood has been conducting research associated with falls since 2000 and has helped develop a written screening instrument and collected risk data on approximately 800 older adults.

"Our mission ultimately is to enhance quality of life and falls represent a significant threat to that quality," Wood said. He plans to continue working with places like cooperative living communities and healthcare facilities in order to track individuals over an extended period of time.

Engineering professor Ou Ma, left, and human performance, dance and recreation department head Robert Wood use reflective markers and other imaging equipment to record and analyze the movements of a test subject walking on a treadmill.

Engineering professor receives Fulbright to teach and conduct research in Vietnam

Nadipuram "Ram" Prasad, associate professor of electrical and computer engineering, will journey to Vietnam in January 2012 as a Fulbright Scholar to teach and conduct research at the Ho Chi Minh City University of Technology.

His close ties to the nation promise to make his time spent there unique. Prasad's wife is from Vietnam and he has visited the nation many times.

Prasad plans to share his ideas on scalable and environmentally benign approaches to harvesting hydroelectric energy—Vietnam is a country rich in hydroelectric potential.

"Building dams for the sole purpose of energy production is environmentally damaging. However, dams built for purposes of flood control are essential to provide safety to all those who could be in harm's way by the forces of nature," Prasad said.

"The Mekong River delta has tremendous hydroelectric potential and there is a great need for energy in the region, but there are a lot of forces against building dams and any potential impact on biological life and fishing. The people there have a fabulous environmental backdrop, and yet there is a shortage of energy," Prasad said.

The 3,000-mile Mekong River flows through Laos, Cambodia and Thailand drains into the South China Sea via a delta. The river delta is teeming with freshwater fish and the majority of the people who live in the lower delta are involved in the fishing industry.

"Most of the people there live in abject poverty. They work in the fishing industry and they live on boats," Prasad said. "However, they are environmentally aware and I believe they can incorporate methods to scavenge energy from ambient resources with no environmental impact," he added.

Prasad has been teaching a course on energy harvesting at NMSU for the past several semesters and also has been working with the Elephant Butte Irrigation District to harvest energy from the canal system.

"The same scenario is a good fit for the canal system used in farming along the Mekong delta," Prasad said.

Prasad will be interacting with engineers who may be involved in the construction of the dams and he plans to take students to visit one of the proposed dam sites for a week.

"Each of us must arrive at our own directly experienced understanding of the environment we live in. It cannot be transmitted to us by the words of others. Their experience and awareness will bring out their talents. It's one's imagination that leads to mindful ways of doing things," Prasad said.

"All said and done, it is really a cultural exchange. I've always had the desire to spend more extensive time in the region to learn about their traditions and sharpen my language skills. My six-year-old daughter is already my translator. She wants to learn some of the ancient dance that is practiced there," Prasad said.

Inspiration for pursuing the Fulbright came from a colleague at Howard University who worked with Prasad on a project funded by NASA. Prasad says the application process involved intense self-reflection.

"I spent several months examining and refining my thoughts about what I wanted to learn and share with others," he said. "It was a humbling experience."

Fullbright Fellow Nadipuram Prasad will share his knowledge about scalable and environmentally benign approaches to harvesting hydroelectric energy in Vietnam.

Electrical engineering graduate student receives fellowship just in time

Just days after coming to believe that he would not be able to achieve his lifelong goal of receiving his Ph.D, one NMSU engineering student was given a fellowship that changed his destiny.

Jayson Briscoe is now pursuing his doctorate in electrical engineering in photonics with $40,000 in support from the Sandia National Laboratories Excellence in Engineering Graduate Research Fellowship.

"Even with continued support from NMSU's electrical engineering department, my personal savings were gone and the financial strain of continuing school while raising a family was becoming too much," Briscoe said of the plight he'd found himself in before receiving the Sandia award.

"I believed I was going to fail at a lifetime goal. It was definitely a low point. With this fellowship, Sandia National Labs has completely changed my life," Briscoe said.

"I think he was chosen because of his dedication to the research. As a first-year Ph.D. student, Jayson has published a peer-reviewed journal paper and is showing good progress toward the degree," said Sang Yeon Cho, an assistant professor in the Klipsch School of Electrical and Computer Engineering.

"Jayson is a great fit for the SNL fellowship, especially in light of our research collaboration with Sandia," Cho said.

Cho recognizes that an opportunity like this not only provides financial assistance to students throughout the research process, but it is an incredible advantage for students to work with scientists making great advances in the same field. This couldn't be more true for someone in Briscoe's position.

"The financial support from this fellowship allows me the freedom to fully concentrate and explore yet undiscovered physics," Briscoe said.

"Additionally, combining the collective experiences of collaborators at NMSU and Sandia will enhance an already exceptional support group throughout my dissertation. Working with Sandia will also provide me with an opportunity to access unique resources such as the extraordinary cleanroom at SNL's Center for Integrated Nanotechnologies," Briscoe said.

Briscoe will conduct research in the area of nanophotonics to design, fabricate, and demonstrate a nanolaser.

"We are currently developing a new nanometer scale laser. This tiny laser can be used in many applications, such as chip-scale communications and biomedical sensing," Cho explained.

Briscoe received his bachelor's degree in traditional physics from St. Bonaventure University in New York. After graduating, he taught for two years in the public schools. Next, Briscoe worked for the New Mexico Public Education Department before deciding to earn his master's degree in electrical engineering. He will defend his master's thesis on a plasmonic sensor this year and expects to graduate in 2013 with a doctorate in electrical engineering and a dissertation in nanophotonics.

Jayson Briscoe left his job as a high school physics teacher to pursue an electrical engineering degree. He is now working on his doctorate in nanophotonics and has been awarded fellowship support from Sandia National Laboratories.

Foreman brothers continue to share their success

Brothers Ed Foreman, class of 1955, and Harold "Chub," Foreman, class of 1961, have been strong supporters of the civil engineering department for many years. Both are members of the Civil Engineering Academy and were listed among the Top 100 Distinguished Alumni from the College of Engineering during the centennial celebration in 1988. In late 2005, they made a major gift to the college, establishing two professorships and an endowed chair in civil engineering.

Today, they are enjoying the rewards of their hard work, but haven't forgotten their humble background and the guidance that made their success possible. The brothers grew up on a peanut and sweet potato farm in Portales, NM.

"Chub and I are most fortunate," Ed said. "We had loving, hard-working parents who instilled in us the importance of a strong belief and responsibility to and for ourselves, our family, friends, and Christian principles."

While working as an oil field hand, Ed launched a highly successful petroleum-related business that made him a millionaire by age 26. He is the only person in the past 100 years to be elected to the U.S. Congress from two states: New Mexico and Texas. Today, Ed is one of the country's top motivational speakers. Ed has developed numerous programs and products to teach the success formula that guides his life.

Harold's career began in heavy construction and led to real estate brokerage and management. He is currently president and co-owner of Valley Leasing and Development, Inc. in Las Cruces. He served for eight years in the New Mexico State Senate.

A year after their names were placed on Engineering Complex III, Ed and Chub said, "Walking across the magnificent, expanding and attractive NMSU campus and seeing our names on that building gives us a thankful feeling of grateful pride for an educational institution that's had such a positive impact on the lives of two rambunctious farm boys from Portales. No doubt professors like Dad Jett, Frank Bromilow, John Clark, et al, are looking down from heaven and saying, 'Who woulda' ever believed it?' Yes, miracles are still possible."

The naming of the Ed and Harold Foreman Engineering Complex was celebrated by the College of Engineering at Homecoming 2006.

Marty Small keeps NM BEST going

When Sheila Horan, then-professor of electrical and computer engineering, established NMSU as the hub for NM BEST (Boosting Engineering, Science and Technology) in 2001, she launched an ongoing tradition in the state and west Texas.

Horan has since retired, but the robotic competition is still going strong, largely due to the generosity and dedication of alumnus Martin "Marty" Small, class of 1985, who has made BEST his own tradition.

BEST offers some 400 middle- and high-school students an opportunity to design, build and compete in an annual robot competition. The BEST mission is to inspire participating students to pursue careers in engineering, science, technology, and math.

As CEO/CTO and president of CALCULEX, Inc., which he founded in 1986, Small is living proof of the value of a technical education. He earned three degrees from NMSU: a bachelor of science in computer science, a bachelor of science in mathematics, and a bachelor of science in electrical and computer engineering.

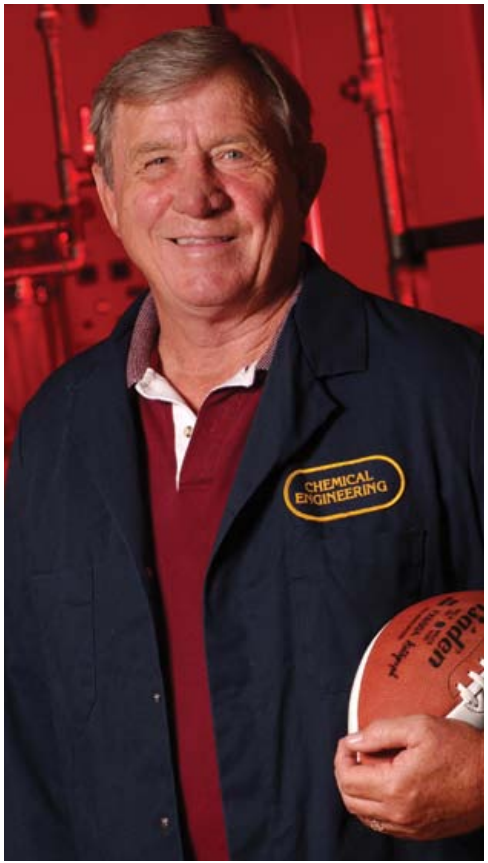
CALCULEX, based in Las Cruces, specializes in the development and production of state-of-the-art electronics and software systems that satisfy a diversity of engineering applications. This past August, CALCULEX celebrated its 23rd year of operation with total revenue exceeding $100 million.

Engineering alumnus Marty Small has supported the NM BEST program since its inception.

While Small has built a successful business, he has never forgotten the engineering education he received at NMSU. In 2002, he was inducted into the Electrical and Computer Engineering Academy and has served in an advisory capacity to the department ever since.

"Without Marty Small and the help of his company, NM BEST would not have happened," said Horan.

"When asked for monetary support, Marty and CALCULEX willingly gave it; when we needed judges, Marty was there, calling in employees to come and help; when we needed someone to fill in and serve as master of ceremonies at the competition, Marty gave it his all, and then volunteered to do it each subsequent year," said Horan.



Charley Johnson, recently named to the Texas Sports Hall of Fame, earned a doctorate in chemical engineering while playing pro football.

Faculty and Staff Honors

- Steven Frank, professor of surveying engineering, was appointed to the Accreditation Board for Engineering and Technology Applied Science Accreditation Commission.
- Nirmala Khandan, professor of civil engineering, has been named the first holder of the Ed and Harold Foreman Endowed Chair in Civil Engineering.
- NMSU surveying engineering professor emeritus Earl F. Burkholder was presented the 2010 Surveying and Mapping Award by the American Society of Civil Engineers.
- David A. Rockstraw, professor of chemical engineering, was elected chair of the Professional Engineers in Higher Education interest group within the National Society of Professional Engineers.
- The New Mexico Association of Energy Engineers has named Assistant Dean of Engineering Patricia Sullivan its 2010 Executive of the Year. Sullivan was recognized for her revitalization of NMSU's energy programs and her work with NMSU electrical engineering power program.
- The Texas Sports Hall of Fame inducted chemical engineering Professor Charley Johnson, a Big Spring, Tex. native and 15-year National Football League quarterback with the Chicago Cardinals, Houston Oilers and Denver Broncos.
- Deva Borah, associate professor in electrical and computer engineering, was awarded the International Foundation for Telemetering and Telecommunications Professorship.
- NMSU's College of Engineering top researchers whose projects generated funding of $500,000 or more during FY 2010 include: Abbas Ghassemi, Institute for Energy and the Environment; Jessica Houston, Chemical Engineering; Ricardo Jacquez, Alliance for Minority Participation; David Jáuregui, Civil Engineering; Ou Ma, Mechanical Engineering; Robert Paz, Electrical and Computer Engineering; Satishkumar Ranade, Electrical and Computer Engineering; Andrew Rosenthal, Southwest Technology Development Institute; Rudi Schoenmackers, Engineering Research Center; and David Voelz, Electrical and Computer Engineering.

Student Achievements

- Samantha Chacon, Alyssa Day and Michael A. Chavez, electrical and computer engineering students, attended the Army High Performance Computing Research Center's 2011 Summer Institute at Stanford University.
- Mechanical engineering master's student Francisco Pereda has been awarded an MIT Lincoln Laboratory Graduate Fellowship--a $15,000 merit-based, nationally competitive award.
- Gerardo Martinez, mechanical engineering master's student, has received a National Science Foundation Graduate Research Fellowship--a merit-based, three-year, $40,000-per-year award.
- Electrical engineering Ph.D. candidates Patricia Grubel and Jayson Briscoe (see profile page 24) each received $40,000 Sandia National Laboratories Excellence in Engineering Graduate Research Fellowships.
- Civil engineering Ph.D. candidates Ambica Koushik Pegallapati, Balachandran Ketheesan, and Yalini Arudchelvam, along with civil engineering Professor Nirmala Khandan, were selected to compete in the Environmental Protection Agency's P3 Program in Washington, D.C.

Bill Curtis, left, prepares to launch a rocket while PREP students look on. The PREP program is totally funded through outside support.

They were earlier awarded $10,000 for their Phase I proposal to build a reactor that will produce alternative fuel.

- Members of NMSU Engineers Without Borders traveled to Hondura Azul, Condega, Nicaragua, this past spring where they built a pedestrian bridge that will serve the community and three nearby villages.
- Electrical engineering students Richard Gutierrez, Robert Pham and Gregorio Hinojos each received $10,000 grants from the National Consortium for Measures and Signatures Intelligence Research.
- New Mexico State University's American Institute of Chemical Engineers student chapter was selected by the national organization as an outstanding chapter for the 2009-2010 academic year—the third year the group has received this distinction.

Significant Gifts to the College

- ConocoPhillips donated $20,000 to support the engineering Integrated Learning Community for incoming engineering freshmen. The grant will support ConocoPhillips Faculty Fellows to implement an engineering-based curriculum with the ILC.
- The First Annual Volt Information Sciences Slide Rule Golf Classic raised more than $20,000 to provide engineering scholarships. The premier sponsor was Volt Information Sciences, whose president and CEO is Jerry Shaw, class of 1949, an electrical engineering alum. Shaw and his wife, Joyce, gave an additional $50,000 for their endowed scholarship fund to support minority students.
- The New Mexico Technology Group, LLC (NewTec), presented the college with $25,000 to support engineering design courses.
- Halliburton made a gift of $10,000 to provide merit-based scholarships through the Halliburton Global Scholars 21st Century Engineers program, established in 2009.
- The Boeing Company made gifts totaling $42,000 to provide scholarship support as well as to fund student design projects focused on electrical and computer, industrial, and mechanical engineering.
- Civil engineering alumnus Adelmo "Del" Archuleta, class of 1973 and 1975, made a gift of $20,000 to support College of Engineering activities. Archuleta is a strong supporter of the college both personally and through his company, Molzen-Corbin and Associates, for which he serves as CEO.
- Ed Foreman, class of 1955, civil engineering alumnus, made a $20,000 gift to support scholarships and provide staff recognition. Foreman and his brother Harold, class of 1961, made a major gift to the college in 2005 establishing two professorships and an endowed chair in civil engineering. (profile on page 26.)
- Intel Corp. made a gift totaling $55,000 to support the WERC International Environmental Design Contest and the Pre-freshman Engineering Program, a summer enrichment course for middle- and high-school aged students.
- Mechanical engineering alumnus Jerry King made a gift of $150,000 to complete an endowed professorship that was initiated a number of years ago by the department's academy. King established an endowed scholarship in 2008.
- Western Refining Co. made a gift of $50,000 to provide scholarships and other support to the chemical engineering department. The company has provided support to the college for a number of years.

NM STATE

College of Engineering

New Mexico State University
College of Engineering
PO Box 30001, MSC 3449
Las Cruces, NM 88003-8001

575.646.2913
engr.nmsu.edu

College of Engineering Advisory Council

AL/9-11/14716