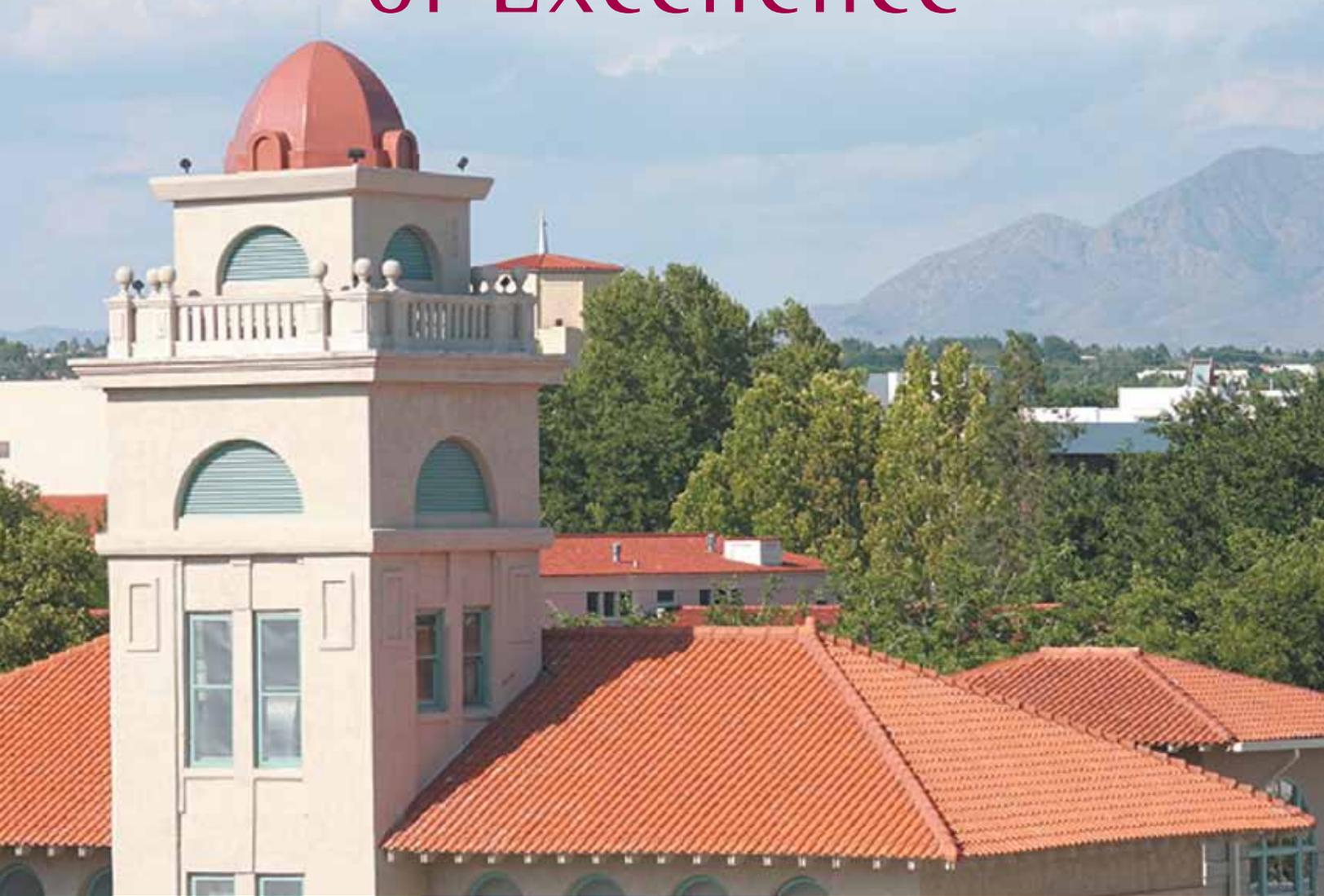


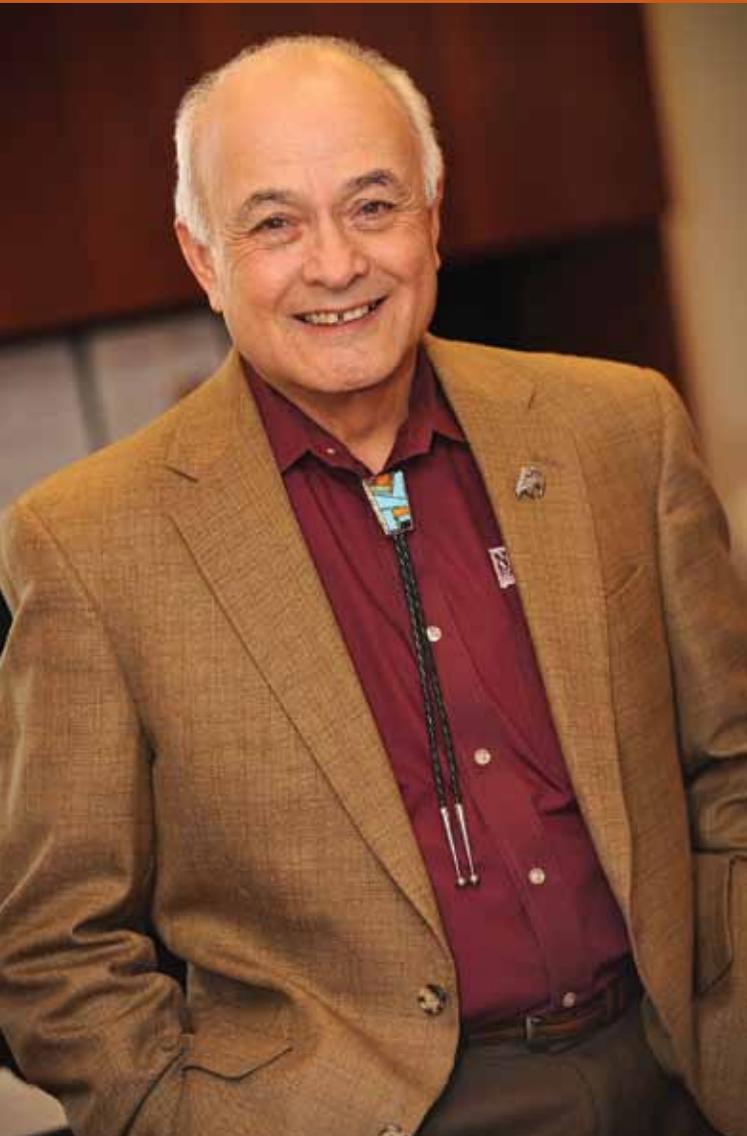
College of Engineering

Celebrating 125 YEARS of Excellence



New Mexico State University
All About Discovery!

2012-2013:
Highlights of the Year



A Message *from the* Dean

"Transforming lives through discovery" is the message newly appointed NMSU President Garrey Carruthers articulated as his vision for the university – an idea that reflects a continued tradition at New Mexico State as we commemorate our 125th anniversary.

The rich history of NMSU extends well beyond the classroom, as a land-grant institution serving the needs of our state and its citizens. The College of Engineering has been an active participant in this noble cause.

Throughout the decades, our leaders ardently accepted the service mission by creating a caring community we foster today – through some traditional avenues and, more recently, in some novel ways.

The Engineering New Mexico Resource Network – our newly formalized outreach arm – is making strides toward that end by providing services to an ever-increasing clientele. From prospective students to business owners to innovators, many have benefited from expanding opportunities for discovery outside the classroom setting. While our administrators, faculty and staff members are actively engaged in outreach activities, our engineering students are taking knowledge out of the classrooms

and laboratories and into the local community and beyond. The winning combination of community service and project-based learning connects classroom learning with real-world opportunities.

As 2013 chemical engineering graduate and then E-Council President Amanda Sandoval said, "The engineering experience gained at NMSU is not just about the grades." The engineering field is dedicated to improving the world and enhancing people's lives. I trust you will find many examples of this dedication represented in the programs and research highlighted in this publication.

Sincerely,

A handwritten signature in black ink that reads "Ricardo B. Jacquez". The signature is stylized and cursive.

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

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)

College of Engineering Leadership

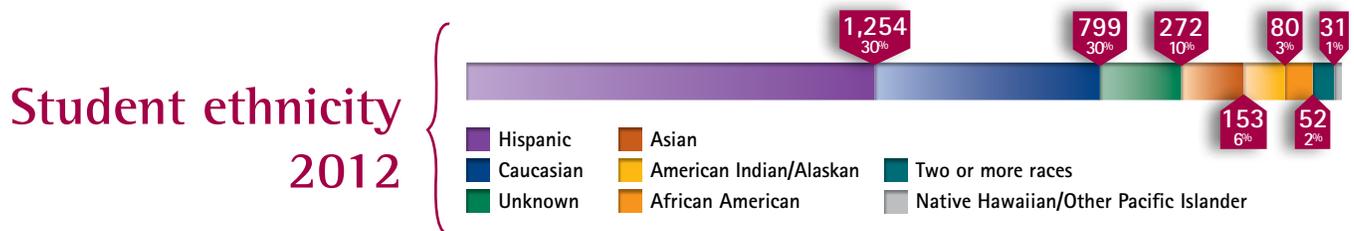
Ricardo B. Jacquez, Dean
Sonya L. Cooper, Associate Dean of Academics
Martha C. Mitchell, Associate Dean of Research
Patricia A. Sullivan, Assistant Dean of External Relations and
Director of Engineering New Mexico Resource Network
Jeffrey S. Beasley, Engineering Technology and
Surveying Engineering Department Head
Ian Leslie, Mechanical and Aerospace Engineering Department Head
Peter T. Martin, Civil Engineering Department Head
Edward Pines, Industrial Engineering Department Head
Satish Ranade, Electrical and Computer Engineering Department Head
David A. Rockstraw, Chemical 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. Baccalaureate programs in civil, electronics and computer, and mechanical engineering technology are accredited by the Engineering Technology Accreditation Commission of ABET.

Commission of the Accreditation Board for Engineering and Technology www.abet.org

College Statistics



*Note: This incorporates all financial aid processed through the College of Engineering.

Engineering New Mexico Resource Network

Designed to leverage the college's extensive resources to advance the state's economy, our Engineering New Mexico Resource Network delivers a range of outreach programs to businesses, government agencies, teachers and K-12 students.

Over the past year, 126 businesses received technical assistance designed to enhance their economic and technical competitiveness. More than 969 individuals were trained through professional development, certificate programs and short courses. In addition, some 5,822 students participated in College of Engineering K-12 STEM programs.

Delivery of hands-on programs for K-12 students that support critical thinking, entrepreneurship and innovation are a major focus of the network. Professional development programs have been structured to ensure a highly skilled workforce exists to meet current and future needs.

Assistance for New Mexico-based businesses is available through specialized training, innovative solutions to engineering and design problems, manufacturing and prototype development. The goal is to help boost the competitive nature of small- and medium-sized businesses in the state.

For more information about the Engineering New Mexico Resource Network, visit enr.nmsu.edu/outreach.shtml.

Teachers build robots to inspire future engineers and scientists

In May 2012, 24 middle- and high-school teachers participated in a project with far-reaching benefits for America's future generations. As participants of the NMSU Engineering New Mexico Resource Network and Scientifically Connected Communities, the teachers learned how to start and mentor school-based robotics teams. The ultimate goal was to have better-trained teachers in terms of encouraging students to pursue the disciplines of science, technology, engineering and math.

"We've partnered with the College of Education to support teachers and help them build a common curriculum to expose their students to engineering concepts through robotics, whether they do it in the classroom or through co-curricular activities, like NM BEST Robotics," said Patricia Sullivan, assistant dean of the College of Engineering.

The VEX Robotics Design System is the platform students will use to learn about designing and building programmable robots. Through this work, students gain an understanding of science and engineering principles, teamwork, leadership and problem solving. The platform is also used in the NM BEST (Boosting Engineering Science and Technology) Robotics Competition and in Project Lead the Way (PLTW), a national program providing core engineering and sciences curricula designed by teachers, engineering and science professionals and school administrators. The College of Engineering is the NM University Affiliate for PLTW; more than 20 schools statewide participate. More than 8,000 students have participated in the PLTW program.

In the fall of 2012, the college hosted the NM BEST Robotics Competition. More than 400 students from throughout the state participated, joining the thousands who have taken part in this national robotics program. NMSU has been the New Mexico hub directorate for this initiative since 2001. In addition to NM BEST robotics, there are currently seven VEX Robotics Teams in the state: one in White Sands Missile Range and the others in the Albuquerque area.

"We [hosted] several highly successful robotics summer camps for middle- and high-school students—one each in Albuquerque, Hobbs and Las Vegas, and two in Las Cruces," Sullivan said. "We are hoping to host a state VEX Robotics Competition on campus next year and start an NMSU collegiate team which could serve as a senior capstone project as well."



2012-2013 Engineering Outreach



ENGINEERING BUSINESS ASSISTANCE

PROFESSIONAL DEVELOPMENT

K-16 STEM OUTREACH

Patricia Sullivan, assistant dean of the College of Engineering, touches on his robot.

Engineering faculty members offer expertise to entrepreneurs

College of Engineering faculty acting as enterprise advisers are helping aspiring entrepreneurs start new businesses and commercialize technology. Part of multi-disciplinary teams established by the Arrowhead Innovation Network, the advisers—experienced executives, serial entrepreneurs and subject-matter experts—offer advice on-site or remotely.

In early 2013, NMSU's Arrowhead Center received a \$1 million grant from the U.S. Department of Commerce's Economic Development Administration, an amount matched by the university and its partners. The funds created Launch, an initiative expanding the proof-of-concept program and funding the Arrowhead Innovation Network.

"[These advisers add] great value to commercialization and innovation initiatives at Arrowhead Center, filling in gaps in the expertise network required to move NMSU innovation to market," said Kathryn Renner Hansen, director and chief executive officer of the Arrowhead Center.

Enterprise adviser Anthony Hyde is a professor of mechanical engineering technology and director of the Manufacturing Technology and Engineering Center (M-TEC). Hyde offers expertise in manufacturing processes, manufacturing management and product development and design. M-TEC, operating under the Engineering New Mexico Resource Network, provides technical assistance to individuals, entrepreneurs and businesses to assist with engineering, manufacturing, product development and prototyping.



Professor Luke Nogales (mechanical engineering technology), an enterprise adviser, is shown working with a student (left) in the machine shop.

Enterprise adviser Luke Nogales' passion lies in helping innovators reach their potential. An assistant professor of engineering technology, Nogales teaches mechanical engineering technology courses and is developing an innovation and product development curriculum. Before coming to NMSU, Nogales worked as an innovator at Procter & Gamble.

Paul M. Furth, enterprise adviser and associate professor of electrical and computer engineering, conducts research in analog and mixed-signal VLSI design, power management circuits and CMOS image sensors. Furth received his master's and doctoral degrees from Johns Hopkins University and has worked with Sandia National Laboratories, Micron Technology and Motorola. His background and experience bridge engineering with opportunities for innovation and entrepreneurship.

Enterprise adviser Edward Pines, head of the Industrial Engineering Department, specializes in quality and continuous improvement, large-scale systems and engineering and public policy. Pines gained engineering experience at AIL Systems Inc. and Unisys Corp. He manages the Verge Fund Lecture Series in Innovation, Ventures and Entrepreneurship and directs the college distance education programs. Awarded the Daniels Fund Ethics Fellowship in 2011 and 2012, he is working with the College of Business on a multi-disciplinary minor in entrepreneurship.

Engineering New Mexico Resource Network Outreach Programs

Engineering Business Assistance

Engineering Technology and Surveying Engineering Outreach Projects
Institute for Energy and the Environment P2/E2 Assessments
Southwest Technology Development Institute Engineering Assistance
Partners in Energy Efficiency Program Workshops
Manufacturing-Technology Engineering Center Business Assistance Projects

Professional Development

Electric Utility Professional Engineer Refresher Course
Bridge Inspection Training
Quality Concrete School
Project Lead the Way Teacher Development
Southwest Technology Development Institute Photovoltaic/National Electric Codes Training
GIS/NM EDGE Training
Manufacturing-Technology Engineering Center Training
Institute for Energy and the Environment Pollution Prevention Training
Wells, Pumps, Etc.
Smart Device App Development
Re-Energize the Americas Conference
El Paso Community College Alternative Energy Teacher Training
VEX Robotics Teacher Training
TI-Nspire Teacher Training

K-12 STEM Outreach

Project Lead the Way
NM Pre-freshman
Engineering Program
NM BEST Robotics
NM Alliance for Minority Participation
Reaching the Pinnacle
WERC Environmental Design Contest
RASSI Camp
Integrated Learning Communities
City of Las Cruces Water Festival
Career Awareness
Robotics Camp



Students prepare their robot for final competition in one of the five robotics summer camps presented by the Engineering New Mexico Resource Network.

Research

From Fulbright fellows to undergraduate students, members of the College of Engineering engage in research that addresses the most pressing challenges of today, thereby fulfilling a fundamental tenet of NMSU's land-grant mission: improving the quality of life for people throughout New Mexico and beyond.

The Carnegie Foundation ranks NMSU as a RU/H (Research University with high research activity) institution. The National Science Foundation ranked NMSU 25th in Federal R&D Expenditures in Engineering (2011).

Our faculty-driven research, advanced scholarship and collaboration across departmental, school and university boundaries are key contributors toward NMSU's research goals.

College of Engineering *core research areas*

Aerospace: Offering the only degree-granting aerospace program in the state and with newly added graduate-level degree programs, NMSU leads the future of aerospace engineering. Projects include systems monitoring materials behavior, biomimetrics to understand the mechanisms that allow birds and fish to generate thrust, computer simulation of structural vibrations, nanosatellites, unmanned aerial vehicles and the development of robotics to control aerospace vehicle maneuvers.

Energy: To help address the growing nationwide demand for power, we are building on our expertise in microgrids, fuel-cell technology, renewable resources and electric power systems engineering. Other areas of focus include examining ways to develop alternative sources of energy and utilize traditional fossil resources to provide cost-effective, distributed electricity to our communities. Our Institute for Energy and the Environment provides innovative research in alternative energy and water. Since 1968, our Electric Utility Management Program has been developing students with the engineering skills and business acumen to serve as leaders in this complex industry.

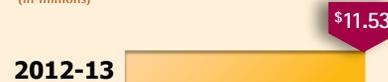
Information Sciences: NMSU is at the forefront of this important area, with funded research in wireless networking, remote sensing, sensor networks, target recognition, speech processing, space communications and antenna design. Our strengths in information sciences draw from expertise in computer networking, communications, digital signal processing, integrated circuit design, microwave engineering and optics. In 1987, the International Foundation for Telemetering designated NMSU as the first Telemetering Center of Excellence for the study of telemetry systems, advanced communications, advanced modulation, coding, data transport and equalization techniques.

Transportation: The college has a long history of research and collaboration with industry through our Bridge Research Center, launched in 1972, which works to improve the safety and performance of bridges. The program offers the only Bridge Safety Inspection training program in the nation. This program fosters research in new technologies for improving highway safety, evaluation methods and performance.

Water: Our expertise in ensuring water quality and quantity crosses a number of disciplines and not only addresses local issues for our arid region but also has worldwide applications. As a partner in the

New Research Awards and Renewals

(in millions)



Research Expenditures

(in millions)



National Science Foundation's Urban Water Engineering Research Center, we are pursuing the goal to reinvent America's aging and inadequate water infrastructure. Projects across campus include the use of algae for wastewater treatment and energy production, riparian zone management, management of urban drainage systems and development of the use of brine in landscaping.

Biomedical: Our engineers are making inroads in biomedical research across disciplines. Engineering research that earned a U.S. patent on a reduced-gravity technology used to train astronauts also has promising applications in helping people with physical disabilities or injuries offload weight for training and rehabilitation purposes. Another project introducing new technology in the standard instrumentation used in flow cytometry may open up a host of biological research applications. Yet another researcher is developing novel methods for characterization and modeling of bone structure that has important implications for the development of improved materials for surgical bone implants. Industrial engineering researchers are working toward finding efficiencies for medical delivery systems.

Manufacturing: The Manufacturing Technology and Engineering Center was established in 2000 to provide manufacturing, engineering, proof of concept and prototype refinement for businesses along with improving the technical workforce through new program development, training and outreach activities. The center leverages research facilities, expertise and statewide resources including the NMSU Engineering New Mexico Resource Network, NMSU Arrowhead Center and the New Mexico Manufacturing Extension Program.

Staff

Tenured Faculty: 43
Tenure-track Faculty: 26
Research Faculty and Staff: 35

National Faculty Awardees

Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring: **Ricardo B. Jacquez**
Department of Energy PECASE Award: **Jeanine Cook**
National Science Foundation CAREER Award: **Charles Creusere, Gabe Garcia, Jessica Houston**

Endowed Chairs

Ed and Harold Foreman Endowed Chair in Civil Engineering: **Nagamany Nirmalakhandan**
Frank Carden Endowed Chair for Telemetry 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: **Peter T. Martin**
Paul W. and Valerie Klipsch Distinguished Professorships in Electrical and Computer Engineering: **Vojin Oklobdzija, Kwong Ng, David Voelz, Jaime Ramirez-Angulo**
Robert Davis Distinguished Professorship in Chemical Engineering: **Shuguang Deng**
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 H. Leslie**
International Foundation for Telemetry Professorship in Electrical and Computer Engineering: **Deva Borah**
Mechanical and Aerospace Engineering Academy Professorship: **Igor Sevostianov**
John Kaichiro Nakayama and Tome Miyaguchi Nakayama Professorship for Teaching Excellence: **Phillip De Leon**
John Kaichiro Nakayama and Tome Miyaguchi Nakayama Professorship for Research Excellence: **Ou Ma**

Intellectual *property activity*

U.S. Patents Awarded

- **Ou Ma, Carlos E. Ortega, Ken Ruble, Qi Lu**
"Multi-Degree-of-Freedom Test Stand for Unmanned Air Vehicles"
- **Shuguang Deng, Geoffrey Smith, Nagamany Nirmalakhandan**
"Method and Apparatus for Membrane-Based, Two-Stage Gas Production from Solid Biomaterials"
(Continuation patent)

U.S. Patents Pending: 7

U.S. Provisional Patents Filed: 3

Invention Disclosures Filed: 6



Ou Ma, professor of mechanical and aerospace engineering, received a U.S. patent for his project, "Apparatus and Method for Reduced-Gravity Simulation." This research investigates an innovative reduced- or zero-gravity simulator based on passive gravity compensation.

Sandia National Laboratories, NMSU engineering extend partnership

The College of Engineering and Sandia National Laboratories recently agreed to continue to expand inter-institutional opportunities for the next five years with the signing of a memorandum of understanding this past April. The MOU will provide for expanded research interaction and collaboration, leveraging technical expertise and laboratory facilities and strengthening employment opportunities for NMSU students at Sandia upon graduation.

Specific areas of common research interest include:

- Infrastructure safety, security and reliability
- Information security
- Microelectronics and microelectromechanical systems
- Remote sensing
- Aerospace technologies
- Robotics

Sandia and the College of Engineering have a long-standing relationship, and signed a similar MOU in 2006. Sandia currently funds two engineering graduate student research projects and has supported collaborative research contracts totaling more than \$3.3 million since 2010. There are 568 NMSU alumni employed at Sandia, 17 of whom currently serve in official advisory roles to NMSU.

"NMSU has an extensive pool of talent that includes both students and faculty," said Anthony Medina, Sandia Director of Energetic Components, NMSU electrical engineering alumnus and current chair of the Dean's Advisory Council. "This agreement will strengthen our relationship and provide expanded research interactions between Sandia and NMSU researchers in areas that will benefit the nation."

Key engineering *research collaborations*

Our research extends through collaborations with leading institutes and consortia throughout the nation.

Army High-Performance Computing Research Center
Stanford University (Lead)

Department of Homeland Security Center of Excellence in
Border Security and Immigration
University of Arizona (Lead)

NASA, Investigation of Composition of Cosmic Rays
New Mexico State University (Lead)

National Alliance for Advanced Biofuels and Bioproducts
Donald Danforth Plant Science Center (Lead)

National Science Foundation Engineering Research Center,
Re-inventing America's Urban Water Infrastructure
Stanford University (Lead)

National Science Foundation Louis Stokes Alliance for
Minority Participation
New Mexico State University (Lead)

National Consortium for Graduate Degrees for Minorities in
Engineering and Science

Office of Naval Research and Bureau of Reclamation,
NMSU Water Security Program
New Mexico State University (Lead)

The Wind Alliance
Texas Tech University (Lead)



Minority college students in the state receive STEM degrees through the AMP program, which began in 1983.

Chemical Engineering



Chemical Engineering Professor Julio Martinez examines a thermoelectric testing device in his lab. Martinez developed the device as part of his nanotechnology research.

Professor focuses *on nanotechnology*

Sending probes to Mars and harvesting energy are just two of many applications of thermoelectric and nanotechnology research conducted by Professor Julio Martinez.

"One nanometer is about a ten thousand times thinner than a hair," said Martinez, chemical engineering assistant professor. "Those are the dimensions of the materials that my group works with. Our research involves the use of advanced fabrication and characterization tools to understand the novel properties of nanostructured materials."

Martinez said the group uses nanomanipulation to essentially pick up individual nanowires and place them into devices.

"One example of nanotechnology application is converting heat into electricity by high-efficient thermoelectric materials," Martinez said.

When heat is applied to thermoelectric materials, electric power is produced, he explained. The amount of electricity generated depends on how much heat is applied and the efficiency of the material to convert heat into electricity. That amount increases at the nano-level.

"Ten years ago, physicists developed a new theoretical framework for thermoelectrics," Martinez said. "They found that nanostructured materials would drastically increase the thermoelectric efficiency."

Thermoelectrics can, for example, convert the heat waste from a car engine's tailpipe into electricity, improving gas mileage. The engine would be powered by gas and the thermoelectric component would charge the battery.

"Nanowires are perhaps the best example of how to get high-efficiency thermoelectric materials," Martinez said. In addition to energy harvesting, thermoelectric nanostructured materials can assist in cooling high-power transistors.

Although he first began working with silicon nanowires at Lawrence Livermore National Laboratory, Martinez has since moved on to experimenting with gallium nitride, which has better characteristics for computer chip applications, and silicon-germanium alloy nanowires. Silicon, he explained, works well for electronics but is limited by its thermoelectric efficiency.

Martinez also helped in the construction of the nanomanipulator as a thermoelectric testing tool. Already in development at Sandia National Laboratories, Martinez helped fine-tune it to suit his needs.

"It's a superb research tool," he said. "You can do research that can be translated and applied. Applicable research is what I'm really excited about. The results you get can lead to larger-scale applications."

"Nanomanipulation is not an issue at all," he added. "When you're measuring thermoelectric properties, you need to understand how to improve the contacts between nanowires and the electrical devices."

Nanowires are perhaps the best example of how to get high-efficiency thermoelectric materials.

Martinez said because of the size of the material the group is working with, contact is challenging, but that they are making significant progress.

"If you're working in large-scale applications, for example, the contact limitations that you have for one nanowire, you're now going to have for a million nanowires," he said. A native of Buenos Aires, Martinez earned his bachelor's degree from the National Technological University in Argentina and his master's from Mississippi State University. He obtained his doctorate from the University of California-Davis/Lawrence Livermore National Laboratory (LLNL).

Martinez is the recipient of the 2003 Honda-Barrier Fellowship and the Lawrence Scholar from LLNL in 2005.

Before joining the NMSU faculty in 2013, he worked at the Center for Integrated Nanotechnologies at Sandia National Laboratories.

His goal, said Martinez, is "to improve the outlook of some of the emerging issues we are facing as a society."

Civil Engineering



Civil Engineering Professor Craig Newton and his colleagues are developing ultra-high performance concrete with local materials that is comparable to steel in strength and twice as strong as concrete used to construct New Mexico's bridges.

Researchers develop ultra-strong concrete *using local materials*

Only five years after beginning research to create a locally produced and cost-effective ultra-high performance concrete (UHPC), students and professors have succeeded in their efforts.

New Mexico builders may soon be able to purchase high-strength concrete made from local materials at half the cost they would pay for imported UHPC. The team is now in the process of obtaining a patent for their product.

The project originated with a former NMSU student, Srinivas Allena, who was working on his Ph.D. in 2007.

"It was a very basic idea," Allena said. "My main determination was not to use any expensive, imported materials because that drives up the cost of the final product."

We found that for the material to pay for itself, it would have to outlast traditional concrete.

Allena, who is now an assistant professor at Washington State University Tri-Cities, experimented with materials available in New Mexico and produced UHPC after rigorous optimization of mixture proportions. He tested the concrete's strengths at various time intervals and found his mixture comparable to commercially available pre-packaged UHPC.

Craig Newton, civil engineering professor, said Allena worked on mixture proportions to produce concrete that yields strengths of 20,000 pounds per square inch (psi).

"That kind of strength is ridiculously high and can be beneficial for things like blast resistance (more immune to cracks and repairs)," Newton said.

Because of those qualities, research soon began to move in the direction of bridge applications.

"UHPC is more expensive than traditional concrete," Newton said. "So we found that for the material to pay for itself, it would have to outlast traditional concrete."

After Allena's graduation, Newton, along with fellow Civil Engineering Professors Brad Weldon and David Jáuregui, received funding from the New Mexico Department of Transportation to continue the research.

"The proposal was for a feasibility study to test whether the material could be used in bridge girder applications – specifically, pre-stressed concrete, which refers to a specific construction method," Newton said.

He said the team hoped to examine both bridge designs and economic analyses. While Newton developed the materials, Jáuregui and Weldon worked on analyzing structural behavior and bridge designs.

"We focused more on structural components and laboratory and field testing," said Jáuregui, director of the NMSU Bridge Inspection Program. "Ultimately, we hope to see UHPC used in the field."

The team is preparing to start phase three of the research, which is a full-scale lab evaluation of UHPC beams. Jáuregui said the current strength of concrete being used throughout the state is approximately 10,000 psi – half the strength of UHPC.

Ductal concrete, he added, is commercial UHPC developed in France and is shipped from Canada at 10 times the cost for normal concrete. Jáuregui estimated locally developed UHPC would sell at only five times the cost for normal concrete.

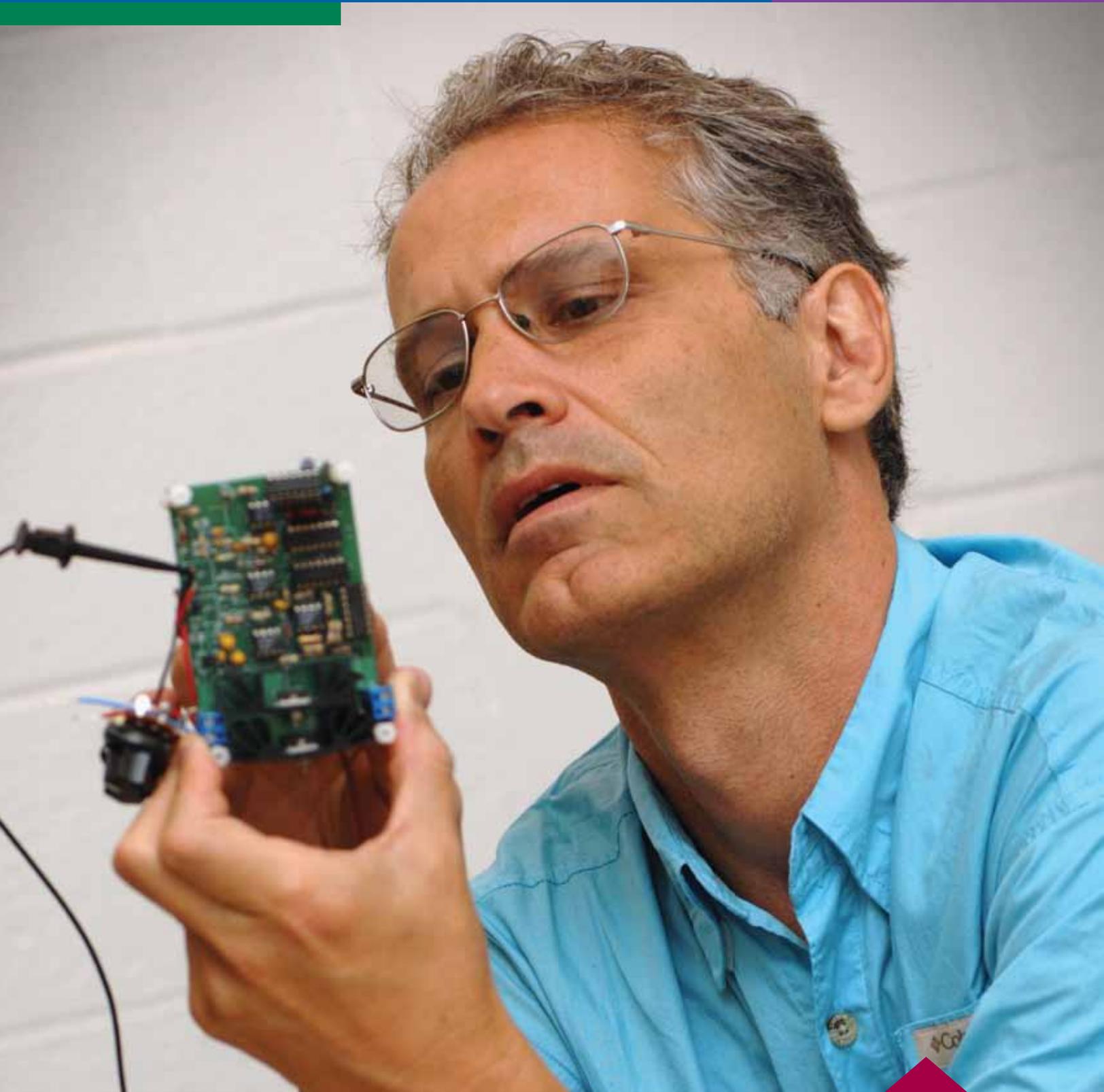
"Concrete needs two things: strength and durability," Allena said. "We succeeded in achieving strength comparable to commercially available UHPC products – now we need to improve the durability."

"My goal is to make this material available in two years," Allena said, adding that aside from bridge girders, there are numerous applications for this concrete.

Allena said the fact that they are using local materials to produce UHPC is very exciting.

"We've produced the UHPC in our own local facilities with local materials in the cheapest way," he said. "That is actually a big leap toward sustainability."

Electrical & Computer Engineering



Paul Furth, associate professor of electrical and computer engineering, is using his analog research to benefit local industry.

Analog research helps advance *regional economic competitiveness*

In an increasingly digital world, the word “analog” often connotes the idea of being outdated. In reality analog technology is helping make the digital world and digital technology of today more efficient.

Researchers recently completed a project for a local business using analog technology to save rechargeable batteries from being damaged when voltage becomes too low.

Paul Furth, associate professor of electrical and computer engineering, and his graduate students spent four months working on a design for battery packs as primary power sources for things like portable lighting systems.

“These battery systems need to be periodically recharged,” Furth said. “If a battery voltage gets below a certain value, it starts damaging the battery to continue to use it.”

Furth and his graduate students designed a device called a low-voltage battery disconnect. The device senses when the input voltage on a battery is low and disconnects the battery from the load (the system the battery is powering) via an electronic switch.

When the battery voltage is normal, this electronic switch stays on and the load functions properly.

The customer for whom this device was designed needed it to be programmable, as the battery systems used sometimes reach 96 volts. The user can program the voltage to where he or she wants the system to shut down by using a knob on the side of the device.

The customer also requested a light-emitting diode to indicate that the low-voltage battery disconnect device is functioning. The students handled the main roles in the project, with Furth advising and helping as necessary along the way.

“One of the things that excites me about this relatively small project is that we’re interacting with local industry,” Furth said.

He said in the Las Cruces and El Paso area markets, no companies are currently designing their own integrated circuits, also known as computer chips.

“They’re very costly to design and, normally, you only design your own integrated circuit if you want to make a million of them,” Furth said.

That raised the question as to what to do if only one, or ten or even one hundred are needed.

“In that case, you are better off creating a printed circuit board and populating it with integrated circuits designed by other companies, such as Texas Instruments,” Furth said. “That’s what we did on the programmable low-voltage battery disconnect device.”

Furth hopes to work with other local firms requiring analog circuits in their products. He said helping these companies become more successful could economically benefit the region.

Ultimately we're hoping that we can contribute to a moneymaking product.

“That is one reason we are excited about this project. In fact, I have contacted other companies and told them, ‘we are here and we’re ready to serve you,’ and ultimately we are hoping that we can contribute to a moneymaking product,” he said.

Patricia Sullivan, assistant dean of the College of Engineering, said funding for the low-voltage battery disconnect project was provided by the Engineering New Mexico Resource Network as a means of advancing the economic competitiveness of New Mexico-based businesses.

“Dr. Furth is one of several faculty members in the Klipsch School of Electrical and Computer Engineering leading an effort to meet a growing demand for expertise in analog circuit design,” Sullivan said.

Engineering Technology & Surveying Engineering



Engineering Technology Professor Craig Ricketts has been working on the development and testing of high-strength HEPA filters for critical U.S. nuclear applications for several decades. He and physics graduate student Crystal Elam are developing new standards for these filters that will be published in the American Society of Mechanical Engineers' Code on Nuclear Air and Gas Treatment in 2014.

Our HEPA filter test site *helps improve nuclear facility safety codes*

Associate Professor Craig Ricketts is dedicated to improving the safety of U.S. nuclear facilities.

For nearly 20 years, he has engaged in applied research to integrate performance qualification specifications for high-strength HEPA (high-efficiency particulate air) filters into the American Society of Mechanical Engineers' AG-1 Code on Nuclear Air and Gas Treatment. He expects such filters will soon be implemented in U.S. nuclear facility air-cleaning systems, where they will help increase the safety of nuclear facilities.

In 2006, mechanical engineering technology students men-

A past proposal submitted by Ricketts and colleagues identified the fragility of conventional glass-fiber filter media as a primary weakness.

"HEPA filters are unique in the sense that they constitute crucial barriers between contaminated zones of nuclear facilities and the environment or plant personnel," Ricketts said. "Their high filtration performance is based upon a fragile filter medium of sub-micron diameter glass fibers that is only one-half of a millimeter thick."

Aerospace/engineering physics major Rachel Sage contributed to the project. Her efforts were focused on building two new filter test rigs. Over several weeks, she and a team of other students designed and built a rough-handling machine, an oven and a soundproofing building capable of helping to establish the higher performance limits of the filters.

"One of our goals is to fatigue the filters without destroying them," Sage said. "We built test equipment to enhance the practicality of the proposed code section so that it's more cost-efficient for filter testing.

"We were also able to complete numerous filtration efficiency tests, which helped determine the pass or failure of the filter after going through fatigue and pressure impulse testing," Sage said. "The data gathered from the FETs will be extremely valuable in the development of future filter designs and test methods."

Ricketts said he became involved in this area of research in the mid-1970s as an NMSU graduate student and research assistant in the mechanical engineering department. Los Alamos National Laboratory researchers were studying the effects of tornado pressure pulses on HEPA filters.

"At that time, testing was conducted to establish the limits of filter mechanical robustness," Ricketts said. "After spending 10 years at a German national laboratory where the first high-strength HEPA filters were developed, I returned to NMSU in the early 1990s and became involved in efforts toward adoption of the filters for critical U.S. nuclear applications."

The Engineering New Mexico Resource Network, the U.S. Department of Energy, the International Society of Nuclear Air Treatment Technologies and the American Society of Mechanical Engineers have all provided project funding.

"Indispensable guidance has been rendered by the American Society of Mechanical Engineers' Committee on Nuclear Air and Gas Treatment," Ricketts added.

HEPA filters are unique in the sense that they constitute crucial barriers.

tored by Ricketts began conceptual work toward a full-scale prototype test rig on campus. Efforts by subsequent student teams led to the current full-scale prototype rig for pressure impulse testing of filters in a wet condition. Since November 2012, 21 prototypical high-strength filters have been evaluated at the site using a total of four independent test rigs.

Ricketts said after taking all costs into account, the life-cycle costs of high-strength filters can be less than or equal to conventional ones, depending upon the application.

"This represents an unexpected secondary benefit, given that the initial cost of high-strength units is currently two to three times greater than that of conventional ones," he said.

High-strength HEPA filters could cost between \$1,000 and \$1,500 once they become commercially available on the market, and would "better help confine radioactive and toxic airborne particles within controlled areas of U.S. nuclear facilities."

Ricketts notes that recent applications have also been proposed for laboratories containing harmful microbes.

Industrial Engineering



Left to right: Agricultural Economics Professor Ram Acharya, Industrial Engineering Professor Delia Valles-Rosales, Ed and Harold Foreman Endowed Chair Nirmala Khandanm and civil engineering graduate student Yalini Arudcheluum examine a prototype of a photobioreactor inside Khandan's laboratory. The professors and their students are collaborating on an interdisciplinary project aimed at improving efficiency of algae fuel production.

Collaborative project to promote sustainable energy for USDA

NMSU's Colleges of Engineering and Agricultural, Consumer and Environmental Sciences are collaborating with three other institutions to promote sustainable energy for the U.S. Department of Agriculture, thanks to a \$3.2 million grant.

The BGREEN (Building Regional Energy and Educational Alliances) project will create a collaborative network of sustainable energy researchers, educators, USDA agencies and non-profits to coordinate efforts and increase educational and career opportunities for Hispanic students pursuing sustainable energy and agriculture research.

NMSU's contribution focuses on logistics, bio-energy and bio-materials and economics in the areas of engineering and agriculture. Professors collaborating on the research include principal investigator Delia J. Valles-Rosales and Hansuk Sohn (industrial engineering), Nirmala Khandan (civil engineering) and Ram Acharya (agricultural economics).

A primary aim of BGREEN is to increase the number of under-represented minorities who are pursuing degrees in science and engineering fields linked to the USDA mission. Curriculum design and development, instruction delivery systems, student experiential learning, recruitment and retention are goals of the program.

"The main area is sustainable energy, and our role is to train students to conduct research in that area and be able to work priority areas for the USDA and its agencies," Acharya said.

The grant supports undergraduate and graduate students in advancing their education in the fields of renewable energy and energy efficiency. This includes recruitment within both the engineering and agriculture colleges. Students accepted into the program will be co-advised by professors from both colleges and take program-specific classes incorporating the engineering and agriculture aspects of sustainable energy.

The project will support six undergraduate students a year; they will take required courses and work on a research project. Funding will also support four undergraduate students who will participate on a research project at a USDA agency. Two master's students and four doctoral students will be supported each year to conduct research; they will have the opportunity to continue research at USDA-Agricultural Research Service facilities.

The NMSU team will create a formal curriculum incorporating agriculture and engineering, and a system to recruit students. Students will conduct research focused on biofuels and biohydrogen, biodiesel, microbial fuel cells, biomaterials and distribution and pre-processing.

Khandan will develop curriculum materials and provide field experience in several on-going algal biodiesel research projects. He is using a photobioreactor to study different species of algae at an outdoor test bed facility. His research efforts also include collaborations with industry leaders; students will have opportunities to make visits to these industrial settings.

Acharya will provide students with knowledge in the area of agricultural economics, develop teaching materials related to economic aspects of sustainable energy and incorporate them in a number of existing undergraduate-level courses. He will also work to place students in summer internships at USDA facilities.

Sohn will contribute to curriculum development and educate students on biofuels, energy distribution, planning and related transportation issues. He'll prepare new materials and re-design an existing undergraduate- and graduate-level course. He will also coordinate efforts for evaluation and assessment of the program.

Our role is to train students to conduct research in sustainable energy.

Valles-Rosales will manage all NMSU activities and coordinate with partner institutions. She will redesign existing graduate- and undergraduate-level courses on manufacturing processes to include: biofuels process modeling and simulation; algae and other biomass resources plating, harvesting and processing; life product cycle assessment; bioproduct design and manufacturing; and product degradation and reliability analysis.

The University of Texas at El Paso is the lead institution for BGREEN; Texas A&M University-Kingsville and Texas State University-San Marcos are also included in the grant.

Mechanical & Aerospace Engineering



Krishna Kota, mechanical engineering, is developing new surfaces on materials that will improve thermal-fluid performance. His research may enable longer space missions than are currently possible, along with a whole host of applications that will improve energy efficiency.

Engineering research aims to extend space missions

Krishna Kota, assistant professor of mechanical engineering, is conducting research to extend the duration of space missions—a high priority of NASA.

Kota directs the Surface-Fluid Interaction Research Laboratory, funded by NASA through the New Mexico Space Grant Consortium.

"Most space missions are limited to a few weeks," Kota said. "The goal is to enable prolonged space missions up to a few months."

The project focuses on a critical issue in realizing long duration space missions: the gradual loss of cryogenic propellants due to boil-off from radiation exposure. Cryogenic propellants (including liquid oxygen and hydrogen) require extremely low temperatures to remain liquid. Stored on-board in insulated tanks, the liquid propellants vaporize, increasing the pressure of the storage tanks. Relief valves attached to the tanks release the gaseous propellant and maintain the designated pressure, resulting in a gradual loss of the propellant.

The goal is to enable prolonged space missions up to a few months.

"It's very advantageous for the propellants to be in a liquid form to prevent their boil-off," he explained. Cryocoolers are employed to keep temperatures low in liquid form.

"One of the primary components of the cryocoolers is the heat exchanger, which plays a very crucial role in determining how well the cryocooler can perform," Kota said, adding that the size of the heat exchanger is the biggest problem.

Current state-of-the-art heat exchangers are either compact and ineffective or highly effective and bulky. Development of compact and portable cryocoolers is crucial to enable extended storage of cryogenic propellants for orbital missions.

Based on preliminary analysis, Kota's research found under

certain operating conditions cryogenic heat exchangers could be at least one-third of the current size, with more than a 10- to 15-percent improvement in thermal performance.

"We're doing really exciting research to increase the heat exchanger performance without increasing the size," Kota said.

To achieve this, he is examining the thermal interaction of the liquid propellants with the surface of the tubing as they flow in to the heat exchanger. To improve performance, Kota and his team are tailoring engineered surfaces to optimize the flow, including dimpled and innovatively textured wavy surfaces.

"This is the first time that anyone has looked at such wavy channels for this purpose," Kota said. "We have multiple ways to modify the surface topology. One way is through conventional machining, like milling or drilling."

Anthony Hyde of the Manufacturing Technology and Engineering Center is working with Kota to develop cost-efficient manufacturing methods to produce these textured surfaces. Another method for modifying surface topology is by chemical modification.

"On the microscale we can modify the surfaces using chemicals or micro-fabrication techniques performed in a clean room, and can fundamentally alter the way these surfaces interact with different fluids," Kota said.

For example, chemical treatments can produce thousands of nanostructures on the surface of copper, making it hydrophobic: water slides on the surface. The lotus leaf inspired this surface structure, since it has a naturally occurring hydrophobic surface.

"This reduces the drag of the fluid or the friction of the fluid as it flows through the pipes," Kota said. "When the drag goes down it saves a lot in the pumping power, which means less electricity consumption."

Kota and Hyde are working to optimize flow and heat transfer of cryogenic fluids through the proposed textured channels and are identifying a cost-effective manufacturing solution. Along with Brian Motil, chief of Fluid Physics and Transport Branch of NASA GRC, Kota and Hyde plan to integrate the findings into actual cryocooler systems.

"The driving force is energy," Kota said. "We're trying to improve energy efficiency by lowering the electrical costs of pumping and improving thermal transfer using engineered surfaces and bio-inspired designs."

If the research improves energy efficiency from the thermal-fluid perspective, its effects would be twofold: a reduction of the carbon footprint and more economical renewable power generation.



Igor Sevostianov, NMSU mechanical engineering professor, visited Vienna, Austria as a Fulbright Fellow. His research has important implications for the development of improved materials for surgical bone implants, as well as new materials for the aerospace and automotive industries and other fields.

NMSU mechanical engineer receives Fulbright Fellowship for biomechanics research

An acquaintance made more than a decade ago led to Igor Sevostianov, associate professor of mechanical engineering, to be named a Fulbright Fellow.

Sevostianov met Helmut Böhm, professor at the Vienna University of Technology Institute, at a conference more than 10 years ago. Both were pursuing similar research in biomechanics. The two met again in person in 2011 and decided to pursue a Fulbright Fellowship, which was awarded in spring 2012.

This past January, Sevostianov, who holds the Mechanical and Aerospace Engineering Academy Professorship, traveled to Vienna, Austria, to teach and conduct research on the structure of bone.

His research has focused on the two types of tissue that comprise bone: cortical bone, the hard outer layer of bones that is solid and dense, and cancellous bone, which is spongy and porous.

Sevostianov and his colleagues in Vienna examined the different properties of

bone on scales ranging from several millimeters to centimeters, where the two types of bone can be distinguished, to several tens of nanometers, where the elementary components of bone can be distinguished. They are developing new analytical models and a tool for predicting mechanical

“Bone structure changes under microgravity conditions experienced during long stays in space.”

behavior of bone based on the micro-scale information.

“Before we can make improvements in

predicting behavior, we have to understand the qualitative characteristics of bone from an engineering standpoint,” Sevostianov said.

His research also has implications for space.

“Bone structure changes under the microgravity conditions experienced during long stays in space and this will likely become more of a concern as researchers and mission specialists spend extended time in the space station,” he said. NASA, through the New Mexico Space Grant Consortium, has funded some of Sevostianov's work.

The research has medical applications as well. “Conditions like osteoporosis result in the loss of bone mineral,” Sevostianov said. “For example, a 10 percent bone loss will lead to a two-fold decrease in bone strength, which is quite a lot.”

He said current tests, such as bone density scans, are too general. Though these tests can detect mineral density in bone, they cannot detect changes in shapes of the

Faculty Accomplishments

bone material, such as microcracks, which will change its behavior.

The methods Sevostianov is developing for characterization and modeling are relevant to a wide class of materials having complex micro- and nanostructure. His research has important implications for the development of improved materials for surgical bone implants, as well as new materials for the aerospace and automotive industries and other fields.

Sevostianov is working on the development of materials that are chemically similar to bone for use in surgical implants. He is also working on developing composite materials with special properties - automotive materials that are lightweight but capable of absorbing impact energy in a collision, for instance, and materials that can provide a heat barrier for the blades in turbine engines. Sevostianov is part of a multi-disciplinary research team that is collaborating with other New Mexico universities and colleges to study new pathways for energy generation.

Thus far, Sevostianov has been using cow bone samples, provided by the meat laboratory in the College of Agricultural, Consumer and Environmental Sciences, for his observations. Through a National Science Foundation grant seven years ago, he acquired an Instron machine, which is used to evaluate the mechanical properties of materials.

"Eventually, it will be necessary to collaborate with a medical school," Sevostianov said. He has been seeking necessary funding and has initiated discussions with the Henry Ford Hospital in Detroit and Tufts Medical Center in Boston.

While in Vienna, Sevostianov gave lectures and taught a graduate course in micromechanics of materials, a class he has taught for three semesters at NMSU. He also had seven invitations to lecture at various universities throughout Europe during his four-and-a-half month visit.

Ed Conley, Gabe Garcia (mechanical and aerospace engineering) and Steve Stochaj (electrical and computer engineering) were each awarded \$25,000 by the NM Space Grant Consortium for capstone classes.

Assistant Dean Patricia Sullivan was reappointed by NM Gov. Susana Martinez to serve a third term on the Western Interstate Commission for Higher Education.

The NM Space Grant Consortium Research Enhancement Program provided seed funding for various projects to Assistant Dean Patricia Sullivan, Hongmei Luo and David Rockstraw (chemical engineering), Steve Stochaj (electrical and computer engineering), Thomas Jenkins (engineering technology) and Chunpei Cai and Igor Sevostianov (mechanical/aerospace engineering).

Arrowhead Center 2013 Launch competition awards went to: Shuguang Deng and Jessica Houston (chemical engineering), Zohrab Samani (civil engineering) and Phillip De Leon (electrical and computer engineering). This support allows campus inventors to work on technology development while exploring commercial markets for the end product.

Professors Steve Stochaj (electrical and computer engineering) and Anthony Hyde (engineering technology) were named NMSU Distinguished Achievement Professors.

Edgar Conley (mechanical/aerospace engineering) received the NMSU Donald C. Roush Award for 2012.

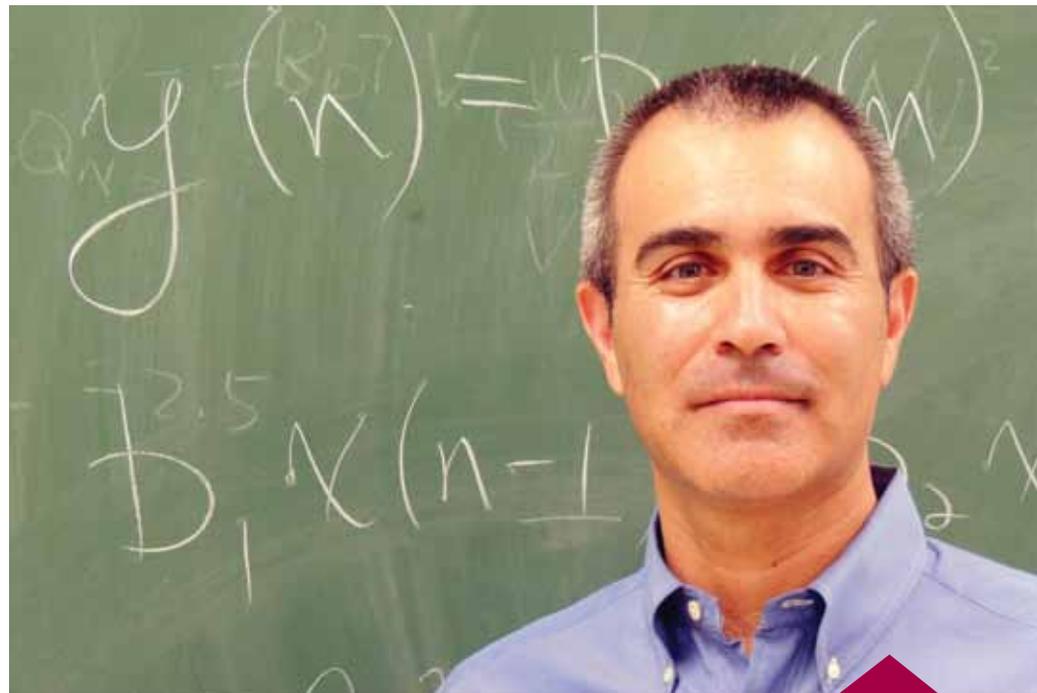
Shuguang Deng (chemical engineering) won the NMSU 2012 Westhafer Award for Excellence in Teaching and Research.

Hongmei Luo (chemical engineering) received the University Research Council Early Career Awards for Exceptional Achievements in Creative Scholarly Activity.

Department of Civil Engineering Head Peter T. Martin received the John Clark Professorship in Civil Engineering.

Ou Ma (mechanical/aerospace engineering) was awarded the John Kaichiro Nakayama and Tome Miyaguchi Nakayama Professorship for Research Excellence.

Associate Dean of Academics Sonya Cooper was among nine recipients of the NM Technology Council's Women in Technology Awards for 2012.



Electrical Engineering Professor Phillip De Leon was the first recipient of the John Kaichiro Nakayama and Tome Miyaguchi Nakayama Professorship for Teaching Excellence.

Donor Spotlight

El Paso Electric establishes endowed scholarships at NMSU and UTEP in memory of former board chairman

El Paso Electric established endowed scholarship programs in the colleges of engineering at NMSU and the University of Texas at El Paso. Each university received \$250,000. The Kenneth R. Heitz/El Paso Electric Endowed Scholarships were established in the name of El Paso Electric Board Chairman Kenneth R. Heitz, who passed away in July 2012.

At NMSU, the endowment will be used to provide scholarships to engineering students who foster technology innovation and sustainability within the electric industry. Examples include: renewable energy integration, energy efficiency and support for transmission and distribution systems.

"These endowments signify El Paso Electric's commitment to supporting regional educational efforts and to assist those students who are focused on curriculums that benefit our industry and our customers," said Tom Shockley, CEO of El Paso Electric. "In addition, those students selected to receive the scholarships will have the opportunity



El Paso Electric Chairman of the Board Michael Parks; Linda Heitz, widow of Kenneth Heitz; and El Paso Electric CEO Tom Shockley gather following the announcement of the endowment.

to take part in internship and mentoring programs at El Paso Electric."

Heitz, for whom the scholarships are named, served as a board member from 1996 until 2008 when he was elected chairman. He served in that capacity until his death.

"Ken was a dedicated board member who cared about the future of El Paso Electric," said Chairman of

the EPE Board of Directors Michael Parks. "His experience, knowledge and leadership helped establish the company as a financially stable utility after its emergence from bankruptcy in 1996.

"I know Ken would have been proud to have his name associated with scholarships that will assist students continue their education and hopefully become leaders in the region," Parks said.

Wolslager Foundation is long-time supporter of STEM education

Every summer since 1997, approximately 200 middle- and high-school students attend the College of Engineering Pre-freshmen Engineering Program, or PREP, designed to encourage them to pursue degrees and careers in the fields of science, technology, engineering and math.

PREP is an academically intensive, six-week summer program that includes hands-on laboratory experiments and projects such as building robots and rockets.

PREP is sponsored by numerous benefactors, including its largest supporter, the Wolslager Foundation, which has sponsored the PREP program for the past nine years.

Addressing students at this year's graduation ceremony, Wolslager Foundation President Stephen Wolslager said, "This is a great program to prepare you for careers for which there are jobs and for which there is a great need. I hope that all of you will be students at this campus someday."



Engineering alum hosts Haulin' Aggies

When NMSU chemical engineering alumnus Richard Huff learned that a group of students from his alma mater would be in his town, he and his wife Renee generously opened their home to them, for a second time since 2010.

Huff, class of '73, lives in Bellingham, site of the May 2013 Baja SAE competition hosted by Western Washington University. The Haulin' Aggies racecar placed 27th out of 87 entries. This is the best finish for the NMSU students participating in the SAE competition for the past 13 years (records only available to the year 2000).

"A lot of this success can be attributed to the Huffs," said the team's adviser Ken Ruble. "He opened up his shop to the students."

"During the first day of competition the upper front shock mount broke off the car. The course was brutal and took many cars out of competition," said Ruble. "We took the car back to the Huff's shop and [were able to make] the necessary repairs."

During the team's stay, the Huffs made sure they didn't go hungry, spending \$600 on groceries to feed 10 students over the course of four days.

"My wife and I enjoyed the students," said Huff. "I think the student competitions are great. Overall, the Baja competition is like any real-life project that an engineer may be involved in."



NMSU Haulin' Aggies racecar placed 27th out of 87 entries at the Baja SAE competition hosted by Western Washington University in May. Their entry was made possible with support from Cummins Inc.

Significant gifts

Forrest J. Mooney, '49 mechanical engineering, left an estate gift of \$250,000 to establish a new professorship in aerospace engineering.

The Boeing Co. made gifts totaling \$45,000 to provide scholarships, funding for student design projects focused on electrical and computer, industrial and mechanical engineering and support for the NM BEST Robotics contest.

Ralph G. Tamm, mechanical engineering alum '50, and his wife Beatrice established a planned gift in 1998. Ralph, who survived Beatrice, passed away in January 2012, and left a gift of \$49,000. The funds will be used to establish a College Endowed Fund that will be added to by other alumni and friends to address changing needs well into the future.

Western Refining Co. made a gift of \$50,000 to provide scholarships, equipment for the civil engineering department and other support to the chemical engineering department.

The Wolslager Foundation gave \$40,000 to support the Pre-Freshman Engineering Program (a summer outreach program for middle- and high-school students). Wolslager has sponsored the program for the past nine years and is its largest supporter.

The Intel Foundation made a \$30,000 gift in support of the NM Pre-Freshman Engineering Program.

TRAX International, formerly known as the New Mexico Technology Group LLC (NewTec), presented the college with a \$25,000 check to support the continuation of an agreement to educate and employ engineering talent in the region; the funds will support engineering scholarships and capstone projects.

More than \$22,000 was raised for engineering scholarships at the Second Annual Volt Information Sciences Slide Rule Golf Tournament. The title sponsor was Volt Information Sciences company founder and NMSU alum Jerry Shaw.

The Robert E. and Evelyn McKee Foundation of El Paso awarded the College of Engineering a \$10,000 gift (for scholarships for undergraduate engineering students) and the NMSU Library an \$11,500 gift. The library will use the funds to purchase engineering reference materials.

Halliburton made a gift of \$15,000 to expand career development workshops and seminars under the Halliburton Global Scholars 21st Century Engineers program, designed to ensure engineering students are exposed to career development skills beyond their academic experiences.

Calculux Inc. made a \$10,500 gift to support the New Mexico BEST Robotics competition. Calculux CEO/CTO and President Martin Small, NMSU engineering alumnus, has supported the competition yearly since its inception in 2001.

Cummins Inc. provided support for the Haulin' Aggies mini Baja team, which competed in the May 2013 Society of Automotive Engineers competition in Washington state.

Student Spotlight



Andrew Giesler, NMSU civil engineering senior, was awarded \$20,000 from the Daniel P. Jenny Research Fellowship program to further his research testing precast, pre-stressed concrete.

Engineering student receives \$20,000 fellowship for bridge research

Andrew Giesler, NMSU civil engineering senior, was recently awarded a \$20,000 Daniel P. Jenny Research Fellowship to further his research testing precast, pre-stressed concrete. The fellowship was awarded through the Precast/Prestressed Concrete Institute.

"We'll be making beams with Coreslab Structures Inc. out of Albuquerque," Giesler said. "We're designing the reaction frames to test the beams in the laboratory. These beams are geared towards bridge design. Hopefully, the beams will be able to be implemented into state design codes."

Giesler and Brad Weldon, civil engineering instructor, will conduct large-scale testing on beams made from ultra-high performance concrete, a mixture produced at NMSU and made from local materials.

"We'll be the first in the state to do large-scale testing," Giesler added. "There has been a lot of testing on small samples

– cylinders, cubes, rectangular beams – but those tests are not as representative as large-scale testing."

Giesler said testing will create a more accurate picture of how the beams actually behave when making bridges.

He was originally an aerospace engineering major, but switched to civil after taking a class with Weldon. With civil engineering, Giesler found something he really enjoys, he said, describing the department as "extremely helpful."

"I've loved it," he added. "Being able to be hands-on with these types of structures is something I am really passionate about."

Giesler hopes to contribute to expanding the use of UHPC in the state. He thinks the use of UHPC would provide the public with a lot more assurance when they're driving over bridges.

"There aren't a lot of people doing this kind of work in New Mexico," he explained. "I'd like to be a part of implementing widespread use of UHPC."

Student Achievements

Former NMSU electrical engineering student Steven Sandoval is completing his doctoral studies at Arizona State University through a grant from the Minority Doctoral Assistance Loan for Service Program. Per the agreement, he will secure a faculty position at NMSU following graduation.

Civil engineering student Juan Solis has obtained a three-year, \$40,000 Graduate Research Fellowship from the National Science Foundation to support his research in the measurement of ET depletion of inland saltgrass and salt cedar.

NMSU's student chapter of American Society of Civil Engineers finished second at the ASCE Rocky Mountain Student Conference at Utah State University, where its concrete canoe competed against canoes of 11 other universities.

Chemical engineering graduate student Joshua Hill was selected by a scientific review panel to participate in the 63rd Lindau Nobel Laureate Meeting in Lindau, Germany. Hill also received a \$40,000 graduate research fellowship from Sandia National Laboratories.

Two NMSU engineering students and their teammates from Michigan, Mexico and India

earned second place in the Partners for the Advancement of Collaborative Engineering Education (PACE) Sustainable Urban Transportation competition at the 2012 PACE Global Annual Forum, held in Shanghai.

Mechanical engineering students Steven Stroup, Erin McMath, Fazzel Gurrola, Jacob Lovas, Reid Sharpe, David Williams and industrial engineering student Stephanie Ziegler developed a passive-gravity balancing exoskeleton for the human arm that might help in rehabilitation for injured people that took first place in the first-ever College of Engineering Senior Capstone Project Showcase.

Rocketry team selected for NASA competition

For the second year in a row, the Atomic Aggies won the right to participate in the NASA University Student Launch Initiative competition. The project engages students in scientific research and real-world engineering processes with NASA engineers.

This year's Atomic Aggies, 14 electronics and computer engineering technology seniors, presented their proposal and preliminary designs to NASA a year in advance. Colleges and universities face a competitive proposal process to win the right to launch. The Atomic Aggies' rocket counts among those of only 36 university teams selected to participate.

Leading their effort is Engineering Technology Professor Lynn Kelly. The project will serve as the students' senior capstone design course – the culmination of the engineering curriculum at NMSU, requiring students to utilize knowledge and skills acquired throughout their coursework.

"This gives them the opportunity to really develop their skills as engineers," said Kelly, who deems this as one of the biggest benefits to students.

Even more beneficial, she said, is the opportunity for students to interact with NASA engineers.

The students make three presentations to a panel of scientists and engineers from NASA, NASA contactors and external partners: Preliminary Design Review, Critical Design Review and Flight Readiness Review. They also complete a Post-Launch Assessment Review to include conclusions from

their science or engineering experiment and the overall flight performance.

"The students conduct the presentations via video conference," said Kelly. "After presenting their Preliminary Design Review, the NASA reviewers commented on how professional they were. It's wonderful that people of that caliber were so impressed with our students."



Members of the Atomic Aggies student rocket team work to repair a rocket they designed and built for the NASA University Student Launch Initiative competition.



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