



## The College of Engineering

# Mission Statement

The mission of the College of Engineering is to provide programs that are effectively responsive to regional aspirations and that address the needs and changing characteristics of the leading-edge engineers of the future.

The College aims to educate students prepared to apply technology for the betterment of society and to serve as change agents for the future. Rowan University also recognizes that the College of Engineering will aid in the economic and cultural development of southern New Jersey, while generating opportunities for its diverse graduates in local and national industries.

**On the Cover:** Rowan students have been selected several times to participate in NASA's reduced gravity flights.



Art and technology meet in the sculptures of mankind's inventions outside Rowan Hall, which houses the University's College of Engineering.

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## Message from the Dean

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The last few years provided a wealth of opportunities and recognition for our students and faculty, as you will read throughout this report. The College of Engineering continued to build on a strong education component and to offer significant research opportunities for undergraduate and graduate students. College members completed noteworthy work on campus, in the community and around the world.

The last few years also provided us with a great deal of insight into how others perceive our programs.

Recently, I attended a National Academy of Engineering education summit during which industry and academe focused on important traits necessary for the engineers of today and tomorrow. Many times during our discussions I was pleased – but not surprised – to hear colleagues say “Rowan has done that” or “Rowan has integrated that concept in teaching.”

The exceptional nature of our program also became clearer to me when I served as president of the American Institute of Chemical Engineers in 2003 and had the opportunity to work closely with engineering leaders in every discipline. Frequently, conversations touched on the need for collaboration between the disciplines, and I was pleased to be able to discuss Rowan’s inroads in that area.



Closer to home, our industrial affiliates are an important barometer for us. They consistently rank our students very high, with comments such as “We would like to have more Rowan engineering students in future years” and “We intend to hire him when he graduates.”

There is more. Faculty members have generated major research and educational funding (more than \$8 million in external proposals, with \$4 million funded for FY '04). Our students and faculty have received many honors for their achievements, among them a Fulbright Award and a National Science Foundation Early Career Award, two internationally recognized marks of excellence. And, reflecting the recognition of our peers from across the country, *U.S. News & World Report* for 2005 ranked Rowan’s College of Engineering 21st among 142 institutions.

The Rowan University College of Engineering continues to build on an exceptional foundation. We look forward to reporting on more achievements in the future.

**Dr. Dianne Dorland**  
Dean

## Message from the **Chairperson**, Dean's Advisory Council



When we envision a world that we want for ourselves, our children and all future generations, we expect technology to play an important role in ensuring that everyone can attain the dream of a healthy and happy life. Rowan Engineering is preparing engineers to meet the challenges that will help us all realize such dreams.

From the start, Rowan recognized that to prepare engineers for future technological demands, fundamental changes in engineering education were needed. The College brought in dynamic professors and developed a curriculum that emphasized teamwork and problem solving. The success of this approach has been obvious.


Recent engineering graduates are contributing to businesses and government, attending outstanding graduate schools and taking an entrepreneurial approach to bringing their ideas to fruition. The quality of students being accepted into Rowan Engineering compares well with the best engineering schools in our country. The quality of students graduating from Rowan Engineering demonstrates the success of the College's approach to education.

The Dean's Advisory Council is one part of the overall engineering program at Rowan, and I and all the other council members are proud to assist the administration and faculty in preparing students for the future. The Dean's Advisory Council includes industrial and business leaders in the Delaware Valley and beyond who volunteer their time to help Rowan Engineering stay grounded in the needs of the regional business community while at the same time prepare for a challenging and exciting future.

To help students better understand the demands of new technologies, the Dean's Advisory Council last year brought in keynote speakers for the Henry M. Rowan Speaker Series to address biopharmaceuticals, biotechnology and hydrogen fuel cells. We co-hosted Navy Day on campus, during which students and faculty were introduced to the U.S. Navy's programs and technological demands. This coming year, our Henry M. Rowan Speaker Series will look further at the future of hydrogen technology and showcase nanotechnology, which our federal government predicts will become the fastest growth area of our economy.

Our members are pleased to continue to invest our time and effort in supporting the College of Engineering, and we are proud to see all the College has achieved.

**Chet Dawson**  
**Chairperson**  
**Dean's Advisory Council**



Students and professors use virtual reality to help safeguard U.S. pipelines.

# Unique Project May Impact National Security

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Wearing dark glasses, Rowan engineering students focus on a large video screen as they use hand controls to swerve and dip through rounded curves and tight spaces above and beneath the earth's surface.

This is no game. The students are exploring three-dimensional views of natural gas pipelines as part of their work to design a virtual reality system that could revolutionize pipeline inspection and eventually help protect 180,000 miles of U.S. pipeline.

Rowan engineering students and faculty from electrical and computer engineering, mechanical engineering, and civil and environmental engineering are part of the pipeline team. That team is employing artificial intelligence, data fusion, environmental models, geographic information systems and other technologies to create a virtual map of natural gas transmission pipelines and a detection system that will pinpoint defects in the pipelines.

To date, no other U.S. student group is doing this type of work, which is part of Rowan's signature hands-on engi-

neering clinic sequence. The U.S. Department of Energy, the National Science Foundation and ExxonMobil have contributed \$500,000 for the effort.

The team is collaborating on campus and at the firm with Physical Acoustics Corp., Princeton, Junction, N.J., a manufacturer of nondestructive testing equipment. Students are learning, among other things, where their work fits into engineering practices in industry.

The project coordinators expect students will be able to help pipeline industry professionals design new systems or remediate existing systems, said Dr. Shreekanth Mandayam, an electrical and computer engineering associate professor and the project's principal investigator.

For Rowan graduate student Justin Bram (ECE '04), this project has been a great opportunity. "As an undergraduate," he said, "working closely with professors, graduate students and other undergraduates in order to accomplish the goals of a real world project with real deadlines and objectives is invaluable."

# College Hallmark Provides Hands-On, Minds-On Experiences



Clinic teams work on projects such as improving the layout of state police cars (top) and developing a natural additive to turn white salmon pink (bottom).



Through Rowan's unique engineering clinics, students tackle hands-on, minds-on projects from the first semester they enter the College until they graduate. These multidisciplinary clinics are a hallmark of Rowan Engineering, providing students with a two-year head start over most other engineering programs. And clinic projects present students with opportunities to learn while they *do*, sometimes making a contribution that can impact their neighborhood . . . or the world.

Consider the New Jersey State Police car project: under the leadership of Dr. John Schmalzel, Electrical and Computer Engineering Department chair and professor, students streamlined the layout of a trooper's mandatory equipment, such as computer and communication devices. The State Police, New Jersey Department of Transportation and Federal Highway Administration provided \$350,000 in funding to Rowan, which introduced its prototype at the 4th Annual New Jersey Department of Transportation Annual Research Showcase in November 2002.

Another project has an international flavor: Dr. Zenaida Otero Gephardt, a chemical engineering associate professor, and her students are collaborating with a professor from Chile to develop a natural, inexpensive source of the pigment astaxanthin to turn white, farm-raised salmon pink. The team is using a supercritical fluid extraction process that would substitute a natural food product for the algae and shrimp that turn wild salmon pink, thereby helping to improve the farmed-salmon industry in Chile and elsewhere.

And, with the support of the National Science Foundation Division of Undergraduate Education, Dr. Stephanie Farrell, a chemical engineering associate professor, and her clinic students are teaming with students and professors from the Health & Exercise Science Department in the College of Education to analyze engineering systems in the human body, investigating concepts of mass and energy balances, fluid flow, electrical signal processing and more. Their work is teaching students basic concepts about reverse engineering using a tool with which they all are familiar: the human body.

Clinics include work for major corporations, small businesses and government and cover many topics. While students select from dozens of clinic options each semester and test themselves with all types of engineering challenges, they share one key component: they learn by doing.

Rowan students tested experiments on NASA's "Vomit Comet."

# 7 Future Engineers "Shoot for the Moon"

Rowan Engineering students have been enjoying out-of-this-world research experiences.

During the past few summers, two teams - Rowan's third and fourth groups in six years - landed spots in NASA's highly competitive Reduced Gravity Student Flight Opportunities Program at the Johnson Space Center in Houston, which provides an aerial laboratory for college students to conduct a wide range of experiments.

This summer, five students working under Drs. Jennifer Kadlowec and Stephanie Farrell, a mechanical engineering associate professor and chemical engineering associate professor, respectively, tested a resistive exercise device as a countermeasure for muscle atrophy in low gravity. The team of mechanical and electrical and computer engineering students worked to determine the role of lower leg muscles in reduced gravity and their effect on human mechanical efficiency, and they anticipate the exercise project will lead to an improved exercise protocol for use in microgravity.

Under the guidance of Dr. Anthony Marchese, a mechanical engineering associate professor, another Rowan team in 2002 exam-

ined "Enhanced Boiling Heat Transfer Under Reduced Gravity Conditions." That team's goal was to develop more effective heat transfer modes, which are critical to space exploration and can impact technology such as computers.

Both teams conducted their experiments on NASA's KC-135A aircraft - dubbed "The Vomit Comet" - which is used to train astronauts, test hardware and experiments scheduled for space flight and evaluate potential medical protocols. Working in the plane's 60-foot, foam-padded test area during a two- to three-hour flight over the Gulf of Mexico, the students experienced about 30 parabolas, roller coaster-like steep climbs and descents during which they and their experiments shared 25 to 30 seconds of zero gravity.

Rowan students appreciated their opportunity. "This kind of project is one that draws young people to engineering," said Colleen Boland (ME '05), a 2004 team member. "Getting on the project is a competition, and working on this project has been an unforgettable experience. Our findings will be available as reference for future experiments like ours."





**Gino Banco is  
Rowan's latest  
Fulbright winner.**

# Rowan Students Garner Local, Regional, National Accolades

A Rowan engineering education motivates students to turn ideas into reality and enables them to achieve in their field. Students, faculty, parents and business leaders see these achievements in small and large ways every day. Recently, those achievements included such prestigious recognition as a U.S. Patent, a Fulbright scholarship and a Sol Seid Award.

U.S. Patent #6,703,547, "Tuning Peg Construction," illustrates the innovation encouraged by a Rowan education. Fred Hovermann (ME '01, MS '03) and Pete Ferrara (ME '01) began the project that led to the patent in a junior/senior engineering clinic, working on Hovermann's idea of a knob to maintain the same tension on guitar strings, and thus the same tuning, even if the instrument is jarred. Funding from the College and the National Collegiate Inventors and Innovators Alliance supported the work, which the inventors introduced at the National Association of Music Merchants Winter 2002 Trade Show.

That same enterprising spirit characterizes mechanical engineering graduate Gino Banco (ME '04), who received a Fulbright scholarship from this competitive international exchange program of the U.S. government. Through the Fulbright program, Banco, founder and former chair of the Rowan Society of Automotive Engineers (SAE) chapter, is studying automotive engineering and diesel technology at Germany's RWTH Aachen University. Banco also studied diesel technology advancements as a participant in the highly regarded Washington Internships in Science and Engineering program sponsored by the National Science Foundation and the SAE.

And, in recognition of her academic record and extracurricular activities, Jamie Gooch (CE '05), received a \$10,000 Sol Seid Scholarship from New Jersey Professional Engineers in Construction. Gooch is president of the American Society of Civil Engineers Student Chapter at Rowan and has worked for a steel fabricator and erector, Cornell and Co., in Westville, N.J.

These noteworthy examples are just a few illustrations of the caliber and dedication of Rowan's engineering students, who win awards for their achievements, who publish technical papers in authoritative journals and who receive funding for entrepreneurial engineering projects.

# Robi Polikar Wins Major NSF Award, NIH Grant

Two significant awards to one professor highlight the dedication and accomplishments of Rowan's College of Engineering faculty. Dr. Robi Polikar, an assistant professor of electrical and computer engineering, can positively impact students, the university and possibly the world through a National Science Foundation (NSF) Faculty Early Career (CAREER) Development Award, which includes a \$400,000 grant, and a National Institutes of Health's National Institute on Aging \$1.1 million grant.

The prestigious NSF award supports Polikar's project "CAREER: An Ensemble of Classifiers Based Approach for Incremental Learning" through which Polikar intends to develop techniques for computers to mimic the intelligent decision-making capability of the brain. His goal is to create methods for computers to continually learn new information without forgetting previously acquired knowledge.


Polikar said, "A CAREER grant, due to its national recognition as a prestigious award, certainly is meaningful for any young faculty member who receives it. However, it is particularly meaningful to me since this is the first time Rowan University ever received a CAREER grant. Also, since CAREER awards are typically made to major research institutions, I consider this as a mandate from NSF to show that quality research can be done at any educational institution when there is a good idea and a clear plan for conducting the research for implementing the proposed idea, as well as for integrating the research with innovative educational activities."

Through the grant, Polikar will establish a signal processing and pattern recognition laboratory at Rowan to expose undergraduate and graduate students to cutting-edge research that has applications to virtually any field that calls for automated data analysis.

Under the NIH grant, Polikar and his Rowan student team are collaborating with colleagues at the University of Pennsylvania School of Medicine and Drexel University to determine whether Alzheimer's disease can be diagnosed earlier through analysis of electroencephalogram (EEG) signals. If the work is successful, the team hopes to make available even for community clinics a non-invasive and cost-effective diagnostic tool for Alzheimer's disease. This tool would make an immediate diagnosis - and consequently earlier treatment - more easily available.



Dr. Robi Polikar



Dr. Joe Orlins works with students to evaluate nearby waterways and dams.

## Faculty Accomplishments

# Professors Garner Recognition for Teaching and Research

Rowan Engineering faculty get noticed.

Whether on campus, locally, nationally or internationally, professors undertake engineering projects that make a difference to the world around them, and they receive recognition for those projects.

On campus, Dr. Kauser Jahan, a civil and environmental engineering associate professor, continues to administer a summer Research Experience for Undergraduates (REU) program through a competitive grant from the National Science Foundation. The REU brings a small group of college students from across the country to Rowan for almost two months. Most recently, the participants teamed with Rowan faculty mentors from the College of Engineering and the College of Liberal Arts & Sciences for “Research Opportunities in Pollution Prevention at Rowan University.”

Locally, Dr. Joseph Orlins, an associate professor of civil and environmental engineering, has been appointed to the Board of Supervisors of the Gloucester County Soil Conservation District, which oversees operations, management and finances of the district and provides resource conservation advice and agricultural technical assistance in five southern New Jersey counties.

Nationally, Dr. Stephanie Farrell, a chemical engineering associate professor, received the 2004 American Society of Engineering

Education (ASEE) National Teaching Medal; the medal represented the fifth straight year ASEE recognized Farrell for her abilities. Dr. Kevin Dahm, an assistant professor of chemical engineering, received the 2003 Joseph J. Martin Award for the best paper presented at the annual conference of ASEE (Chemical Engineering Division), which also awarded Dr. Jennifer Kadowec, an assistant professor of mechanical engineering, the 2003 Ferdinand Beer and Russell Johnston Outstanding New Mechanics Educator Award. In addition, Dr. Clay Gabler, an associate professor of mechanical engineering, won the 2003 Ralph R. Teetor Educational Award from the Society of Automotive Engineers and the Region III Outstanding Faculty Advisor Award from the American Society of Mechanical Engineers.

Internationally, Jahan has traveled to Bangladesh through a grant to work with faculty at Dhaka University and Bangladesh University of Engineering and Technology to investigate the microbial processes in the country’s arsenic-contaminated groundwater, and Dr. Yusuf Mehta, an assistant professor of civil and environmental engineering, has received a grant from the Indian government to develop a new asphalt concrete mixture design for pavements there.

The College of Engineering boasts numerous other award-winning faculty members. They, like their colleagues mentioned here, enrich the education and training of all Rowan engineering students.

## Team's Work Bridges the Region

High above the Delaware River between Pennsauken, N.J., and Philadelphia, a Rowan engineering team attached miniaturized cube-shaped devices to the massive structural beams of the Betsy Ross Bridge. Dr. Ralph Dusseau, Civil and Environmental Engineering Department chair and professor, and his team mounted accelerometers to record the bridge's motion in order to study the forces the structure can withstand, particularly in an earthquake.

11 The summer sun has seen Dusseau and five student engineering teams work on the Betsy Ross, Benjamin Franklin and Walt Whitman bridges as part of a \$1-million, four-year contract awarded to Rowan's College of Engineering by the Delaware River Port Authority (DRPA).

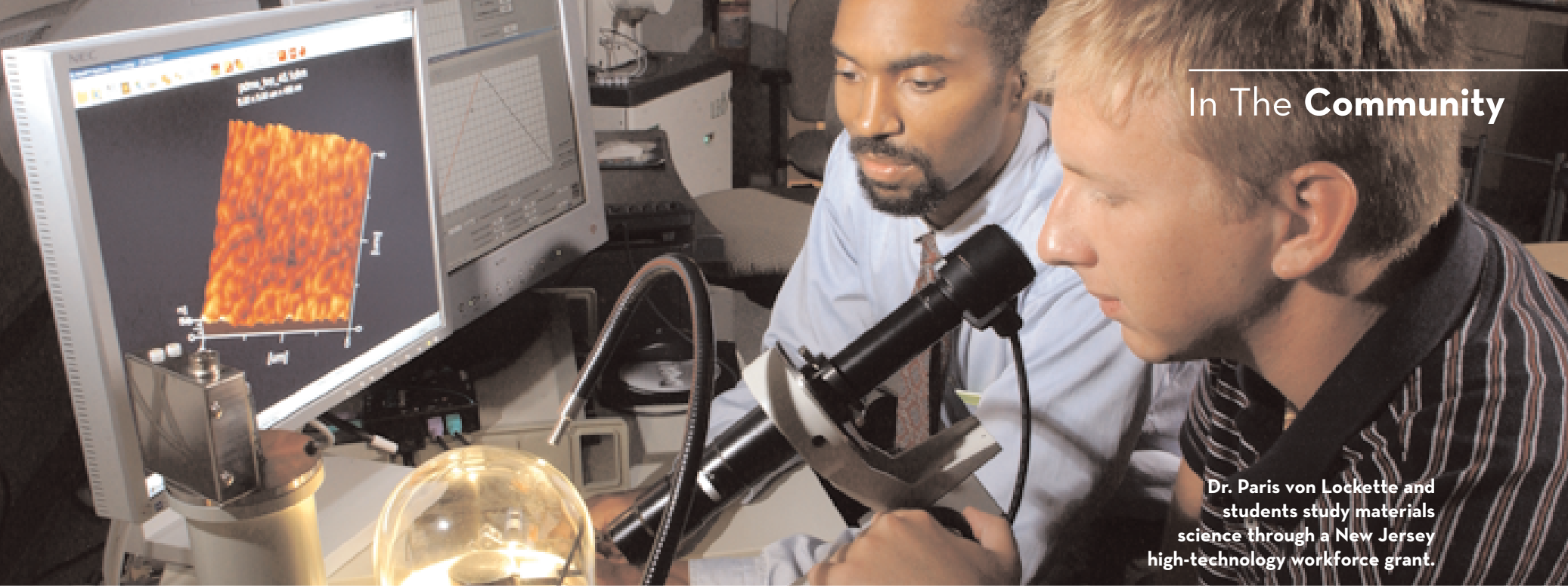
The bridges' field measurements also have been the starting point for collaborative work by two of Dusseau's civil and environmental engineering colleagues. With additional student teams, Dr. Beena Sukumaran, an associate professor, is performing related soil and earthquake analysis, and Dr. Douglas Cleary, an associate professor, is developing computer models to predict what would happen to the bridges in various scenarios and is determining the strength in each part of the Betsy Ross Bridge's superstructures.

"Although we experience only a few minor earthquakes each decade, there is the potential for a moderate earthquake at any time," Dusseau said. "These bridges are vital links in the region. Our research will help the DRPA prepare for the worst-case scenario."

"The contract is more than just a business transaction for the two organizations," said Dr. Philip Tumminia, executive director of the Rowan University Foundation. "Students are given the unique opportunity to solve real problems while the DRPA gets the expertise of nationally recognized engineering faculty."



**Dr. Ralph Dusseau**



Dr. Paris von Lockette and students study materials science through a New Jersey high-technology workforce grant.

## Professors, Students Reach Out to New Jersey, Beyond

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**R**owan engineering faculty members lead the way in finding practical solutions to real problems.

Dr. Beena Sukumaran, an associate professor of civil and environmental engineering, is the principal investigator for a project for the Federal Aviation Administration in which she and students are modeling runways that will help improve pavement design for today's heavier aircraft. She also is collaborating with Dr. Shreekanth Mandayam, an associate professor of electrical and computer engineering, on a National Science Foundation investigation, which looks at how sands behave during an earthquake, a critical component to building structures on such soils.

This type of collaboration among faculty, which always involves multidisciplinary engineering student teams, continues with the bus and truck emissions testing work of Dr. Robert Hesketh, a chemical engineering professor, and Dr. Anthony Marchese, a mechanical engineering associate professor. They have been focusing on reducing

bus emissions and examining low-exhaust gas temperature catalytic converter technologies.

As part of the work that Dr. Clay Gabler, a mechanical engineering associate professor, is doing under the sponsorship of Lockheed Martin, junior/senior clinic engineering student teams are investigating how to enhance the cooling systems for high-power electronic radar so that the equipment will function more accurately and reliably.

At times, as with the three-year, \$1.45-million high-technology state workforce grant from the New Jersey Commission on Higher Education, the project crosses college boundaries. Under the grant for materials research, the College of Engineering's Dr. Robert Krchnavek, an electrical and computer engineering associate professor; Dr. Paris von Lockette, a mechanical engineering associate professor; and Dr. James Newell, a chemical engineering professor, are working with personnel from the College of Liberal Arts & Sciences.

# Students Build on Education Through Activities, Internships

Rowan Engineering's hands-on, minds-on approach to education doesn't stop in the classroom or lab. Students have many opportunities to further their education through campus professional groups and internship opportunities at Fortune 500 and regional companies and U.S. government agencies.

Participation in campus chapters of the American Society of Mechanical Engineers (ASME), American Institute of Chemical Engineers (AIChE), American Society of Civil Engineers (ASCE), Institute of Electrical and Electronics Engineers (IEEE), Society of Automotive Engineers (SAE) and Society of Women Engineers (SWE) increases knowledge of the professional world of engineering through field trips, engineering competitions, service projects and interaction with students from other universities.

Rowan teams compete in SAE's international Mini Baja® competition, building a fully operational vehicle for a three-day endurance race. Teamwork, design, promotion, fund-raising and accounting all are part of the process, and the experience reflects the collaboration, budgeting, marketing, problem-solving and technical challenges of the business world.

The AIChE-sponsored Chem-E car competition calls for students to design and race small cars powered by chemical reactions. Through the ASCE National Concrete Canoe contest, students compete with crafts they build using nontraditional lightweight aggregate concrete and reinforcing materials.

In addition, students can be part of the IEEE and its micromouse robotics competition, in which student-built autonomous robots attempt to navigate to the center of a square maze and back again, or assist SWE with Girl Scout Design and Discovery Day, which introduces girls to the fundamentals of engineering.

Internships provide another way to prepare for a career in engineering. "Internships are a win-win situation for both company and student," noted Melanie Basantis, director, engineering outreach. "Companies have a need for engineering-based assistance, and the students fill this void. In turn, students can apply their technical knowledge coupled with their analytical theory while developing social and professional skills to deal with people in the workplace."

Whatever their engineering discipline, Rowan students have many opportunities to become involved in extracurricular and internship activities that will influence their future careers.

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Concrete floats in the annual concrete canoe contest, hosted regionally in 2004 by Rowan Engineering.



All's peaceful on the ski lift, thanks to SnoRhino.

## After Rowan University, Graduates Conquer the Mountain

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After graduation, Rowan engineering alumni take positive steps along their professional paths. Some engineers choose graduate programs, some move into companies where they already have completed internships, others choose different companies, and some, as in the case of the SnoRhino inventors, form their own companies.

The SnoRhino began in a Rowan engineering clinic as Peter Boyle (ME '03), Matthew Eberhardt (ME '03), and Jeffrey Gladnick (ECE '03) developed a retrofit device that would allow skiers and snowboarders to share seats while riding a ski lift up a mountain. Funding from Rowan Engineering's Venture Capital Fund and the National Collegiate Inventors and Innovators Alliance contributed additional resources for the team to create a device that provides two snowboard rests perpendicular to those used for skis.

The team formed Uphill Enterprises, Inc. to start manufacturing the SnoRhino, applied for a patent, assembled

a sales team and introduced the device at ski resorts. Already, SnoRhino has made its debut at the Winter 2003 X Games, and the company has orders from several resorts across the country as well as a second order from its first client. According to Gladnick, "Rowan University's overwhelming support was fundamental to our success. In fact, the University continued to let us use engineering facilities after we graduated, and staff members were happy to help us well after normal business hours. For that, we are eternally grateful."

The SnoRhino team has plenty of company in the success area. Whether forming a new company, joining a regional or Fortune 500 corporation or attending graduate school, Rowan engineering graduates do well: more than 95 percent currently are employed or in graduate school. That statistic alone speaks to the quality of both the engineering students and the engineering program at Rowan University.

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# ROWAN UNIVERSITY

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