Optimization in Engineering Design
April 2-4 - University Park
Participants will learn the theory behind engineering design optimization, then apply that theory in hands-on sessions. The course will cover optimization algorithms, how they work, and how they can be applied to engineering design problems, including finite-element-based design optimization for stress, vibration, and noise response.

Annual Manufacturing Technology Showcase
Date and topic to be announced.
This program, for manufacturing professionals, features in-depth presentations on advanced topics in manufacturing innovation, focusing on one or two areas of current interest. The program format provides opportunities for discussion and networking. For detailed information, see the IME Department web page at: www.ie.psu.edu

HEC-RAS River Analysis Program - Introductory Course
May 7-11 - University Park
This introductory course focuses on use of the HEC-RAS river flow analysis computer program to compute one-dimensional water surface profiles and to model bridges, culverts, and other structures in river systems. Participants will learn the theory and application of the HEC-RAS program through lectures supplemented with hands-on exercises in the computer laboratory. Engineers, planners, and land developers who deal with floodway management and measure floodway encroachments will find this course useful.

Powder Analysis and Characterization: An Intensive Tutorial
June 18-19 - University Park
This unique course serves a recognized need for basic training and introductory information on the technology and practice of powder analysis and characterization.

Summer Graduate Program in Acoustics
June 10-23 - University Park
This is an intense program of selected acoustics graduate courses offered in concentrated two-week sessions. Topics include: general and applied acoustics, underwater acoustics and sonar, acoustic signal processing, and noise and vibration control.

ITMNR-4 - Fourth International Topical Meeting On Neutron Radiography: Advances in Neutron Imaging for the 21st Century
June 3-6 - State College, PA
This international gathering will focus on an assessment of where neutron imaging is headed in the 21st century, with regard to technology, they can be taken virtually through technology, they can be taken anywhere. For information, contact the Continuing Education office. The course is available through Penn State's College of Engineering Continuing and Distance Education. For more information, visit the course website: www.cde.psu.edu/courses/ENM_0558

Modern Bearing Technology: Overview of Bearing Technology
June 17-18 - University Park
Designed for managers and staff who want to develop a better understanding of bearings and bearing technology, this is an ideal course for individuals in sales, marketing, finance, human resources, and other positions at bearing companies. It is also a valuable course for individuals who work for suppliers to the bearing industry or for bearing distributors.

Computational Methods in Stormwater Management
June 21-23 - University Park
This short course helps engineers and planners upgrade their skills in microcomputer methods for hydrologic analysis and hydraulic design of stormwater facilities. Topics covered represent a comprehensive array of tools for stormwater management planning, detention facility design, and subdivision planning.

Corrosion Short Course
June 24-29 - University Park
Co-sponsored by the College of Earth and Mineral Sciences, the Penn State Corrosion Center, and Gannry Instruments, this course features lectures and laboratories to illustrate how electrochemical techniques are applied, when they should be used, and how the various techniques can be integrated to solve complex problems. The course will be useful for people entering the corrosion field and for professionals looking for a refresh course. For more information, visit the course website: www.esm.psu.edu/contents/corrosion

HEC-HMS Short Course
June 25-29 - University Park
Participants in this short course will learn about the HEC-HMS computer program for rainfall-runoff analysis. HEC-HMS uses a graphical user interface (GUI) to specify watershed components. It also provides precipitation-runoff simulation and flow forecasting techniques that can use grid-based, spatially distributed rainfall data. Lectures on the theory of the program will be supplemented with hands-on exercises in the computer lab.

Independent Study Courses
Want to upgrade your skills, but can’t come back to campus? The following Engineering courses are now available through Penn State’s World Campus. Since they are instructed through technology, they can be taken virtually anytime and anywhere. For information, contact the Engineering Continuing Education office.

Future programs
July
- Nuclear Science and Technology in the 21st Century – A Curriculum and Issues Workshop for Teachers
- Modern Protective Structures
- VEC-Tour in Engineering (Venture in Engineering Camp)

August
- Water Works Operators Association of Pennsylvania – 74th Annual Conference
- HEC-RAS River Analysis Program-Advanced Course
- Advanced School in Power Engineering
- Rotary Wing Technology

September
- Modern Bearing Technology: Introductory Course for Engineers
- Smoke School/Visible Emissions: Fall offerings
- ERAPPA 2001 Conference—Facilities Management, Foundation for Academic Excellence
- Modern Bearing Technology: Advanced Topics

For more information
Additional information about these and other engineering conferences can be found on the World Wide Web at the College’s Continuing Education Web site: www.cde.psu.edu/Engineering.html

You may also contact Engineering Continuing Education directly at:
Phone: (814) 865-7643
Fax: (814) 865-3969
E-mail: tjr10@psu.edu/cde/

Engineering Continuing & Distance Education
410 Rider Building II
227 W. Beaver Avenue
University Park, PA 16801-4819

Customized Programs — Do you have a special need for an educational program, at your company or in your area, but don’t know where to start? The College’s Continuing and Distance Education office can probably help. Please contact us at the address or numbers above. We will be happy to work with you to design a program that meets your lifelong learning needs and goals.
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Sniffing for clues ... 14
New portal may stop terrorists in their tracks

On the cover: Work by Gary Settles, professor of mechanical engineering, has created a portal capable of “sniffing” for bombs. The technology relies on the constantly generated “thermal plume,” which rises from every person. Using special equipment and taking advantage of the physics of cool and warm air, Settles has photographed the human thermal plume, shown on the cover. For more on his work, see p. 14.
Getting an early start
Program gives women students early start into research

Danielle Zurovcik's work focuses on the effectiveness of carbon filaments as a longitudinal reinforcement in concrete. In many ways her research is not dissimilar from other projects around the University. She's done her testing, analyzed her data, and written up her results. But what makes her different is that she's not a graduate student, but a sophomore.

Zurovcik is one of more than 40 female students actively working with faculty on research as part of the Women in Science and Engineering Research (WISER) Program.

Lisa Brown, acting director for the Pennsylvania Space Grant Consortium, which administers the WISER Program, says the program's goal is retaining women in engineering and science.

“We want to engage women early and at a deeper level so they become more interested in the field and feel they're actively participating,” Brown says.

Brown says women are sent program brochures during their first semester at Penn State. They can then log onto the Web and browse the areas of faculty research available and fill out a Web-based application.

“They're encouraged to look outside of their own departments to see what's out there,” Brown says, adding the applications allow women to choose three research topics from the list of faculty participants.

Each faculty member then reviews the application to see whether the student’s interests and goals match up with their own. Finally the student and faculty member meet each other for a face-to-face interview.

“When we make a match, it’s because both faculty and student have an interest,” Brown says.

The selected students begin working with faculty on their research during the second semester of their first year. The research lasts for two semesters.

Brown says that a National Science Foundation-funded evaluation of the program’s first four years showed that students who participated in WISER were more than twice as likely to stay enrolled in science and engineering majors than academically similar female and male control groups who did not participate in the research internship program.

Zurovcik says the program has been a boon for her academic career.

“You’re a freshman and you don’t think you can get involved in that. You think it’s something for your junior or senior year,” the mechanical engineering major explains. “I went into this knowing nothing, but this semester I have Engineering Mechanics 13 and I understand everything because of the work I did in the lab.”

Renata Engel, director of the Schreyer Institute for Innovation in Learning and an associate professor in the College of Engineering, says the first-year students she’s worked with—including Zurovcik—have been a valuable addition to her research effort. “I’m very satisfied with the students’ interest,” she says. “They’re not graduate students, but they bring a strong willingness to be involved in the research. It’s not just about getting work done, but giving them the opportunity to learn.”

Student Nicole Shepard, who is currently in the program, says, “You’re learning on a higher level. It gives you hands-on experience and you’re with people who are either teaching the classes you’re in or have taken them already.” Shepard hopes WISER will help her decide between pursuing chemical engineering or physics.

“Some people believe at a big research university like Penn State that research and teaching are exclusive activities,” Engel says. “But they’re not. There are many places where the two come together, and this is just one them.”

More information on the WISER Program can be found on the Web at www.psu.edu/spacegrant/wiser.
Seeing is believing

Engineers develop image processing methods for computer vision-based fuel gauge

Taking a “look” at how much fuel is left in the tank could become literally possible now that Penn State computer engineers have developed image processing methods necessary for a computer vision-based fuel gauge.

The image processing methods were created by Srivatsan Chakravarthy, who earned his master’s degree in August 1999 at Penn State, Rangachar Kasturi, professor of computer science and engineering, and Rajeev Sharma, associate professor of computer science and engineering. The work was part of Chakravarthy’s master’s thesis.

The developers say a computer vision-based gauge would be safer than current gauges that rely on a sensor with low voltage electrical leads that come in contact with the fuel. Electrical contact fuel measuring systems are often suspected of triggering explosions in aircraft disasters.

“It’s not a good idea to have any electrical wires in a fuel tank because there’s always the potential for a spark,” Kasturi says, adding that even fumes in an empty tank pose a threat.

In the new method, nothing need be in the tank except the fuel, Kasturi says.

Two transparent glass portholes in the fuel tank’s top allow all the access needed to determine the liquid’s depth inside. One port enables a light source to flash the image of two crossed lines on the liquid’s surface while the other port allows an off-the-shelf video camera attached to a computer to record the lines’ position.

The computer’s image processing software, developed by the team, is trained in a calibration process in which the tank is filled gradually and the crossed lines’ position, as recorded by the camera, is noted at the various depths. The correspondence between the depths in the actual 3-D scene and the 2-D image recorded by the camera is established in a process called digital mapping. The computer can then calculate the liquid’s depth as a function of the position of the crossed lines in the camera’s image.

The researchers note the mathematical problems involved in determining depth in a three-dimensional space from a two-dimensional camera image forms a part of many computer vision applications.

The researchers used the well-known principle of triangulation to estimate the depth at low computational cost. Although their computations were performed with a stationary system, they believe their approach can be adapted to systems undergoing vibration, turbulence, or other displacement.

In addition to fuel depth in aircraft, Sharma says the system can be adapted to safely measure depth of volatile chemicals in large tanks.

—Barbara Hale
Dr. Kasturi is at (814) 863-4254 or at rsk12@psu.edu by email; Dr. Sharma is at (814) 863-0147 or at rxs51@psu.edu by email.

Rangachar Kasturi, professor of computer science and engineering, left, and Rajeev Sharma, associate professor of computer science and engineering, have developed a fuel gauge that eliminates the need for sensors equipped with low voltage electrical leads. The team constructed a prototype using a fuel tank from an automobile.
One of a kind
Generating metal prototypes directly from CAD files speeds product development

Most people think the use of sintered metallic components is only cost-effective in large-scale production. “The perception is that powder metal processing technologies only work when you want to make a million of something,” says Randall M. German, director of the Center for Innovative Sintered Products (CISP) and Brush Chair Professor in Materials. “You pay for the tool set and then replicate, replicate, replicate to amortize the cost of the tooling.”

The initial cost of a tool set, and the time it takes to make it, can be a tremendous barrier to the creation of new or improved products. “How do you try out ideas? How do you make a tool set cheap?” Germans asks.

These are some of the questions research associates at CISP are helping to answer in a cooperative venture with DTM Corporation of Austin, TX. The company manufactures the Sinterstation®, a rapid prototyping machine that uses a process known as Selective Laser Sintering (SLS) to generate one-of-a-kind articles directly from computer-aided design (CAD) files.

In SLS, three-dimensional objects are “built” from a powder-polymer mixture in a layer-by-layer fashion. The process begins with a thin layer of the powder-polymer mixture spread on the build platform in a Sinterstation. Next, a laser guided by data in a CAD file “draws” the first cross-section of the object. Powder that the laser contacts is fused as the polymer melts, whereas powder that is not contacted remains loose. When the laser finishes scanning the first cross-section, a new layer of the powder-polymer mixture is spread across the build platform and the process is repeated for the next cross-section.

These alternating steps—laser fusing followed by powder spreading—continue until the three-dimensional object is formed. This “green” object is subsequently sintered by heating in a furnace.

Led by Donald F. Heaney, CISP’s director of process development, researchers are exploring the use of new materials in the Sinterstation—specifically aluminum and controlled porosity stainless steel—in an effort to lower the cost and shorten the time it takes to go “from art to part.”

“We’re looking at ways to make metal prototypes directly from CAD files,” says Heaney. “You save time and money because you don’t have to make a dye first and then machine the part.” For example, CISP researchers have fabricated test vehicle parts in quantities of 10 to 20 directly from CAD files. The process is also opening the door for the production of complex geometries that were never before attainable through sintering.

The ability to produce one-of-a-kind sintered objects will help manufacturers bring new products to the marketplace faster, but Sundar Atre, CISP’s director of polymer chemistry, sees possibilities in other arenas as well.

Consider, he says, the current method for capping a tooth. The dentist takes an impression, which is sent away for processing. The resulting porcelain crown often does not fit the patient properly and must be adjusted by grinding. “But suppose you could take an image and end up with a crown that is the exact shape, the exact fit?” asks Atre.

Now that’s one of a kind.

More information on the Center for Innovative Sintered Products can be found on the Web at www.cisp.psu.edu. Dr. German can be reached at (814) 863-8025 or rmg4@psu.edu. Dr. Heaney can be reached at (814) 865-2121 or dfh100@psu.edu. Dr. Atre can be reached at (814) 865-2121 or sva101@psu.edu.
Sign of the times

Engineers examine effectiveness of signs

Alumni returning to State College in the past few months may have noticed signs for the Happy Food Market or Hannah’s Sandwich Shop, but if they wanted some groceries or a quick snack from either store, they’d be out of luck.

That’s because neither exists. The street signs are part of a research project by Martin Pietrucha, associate professor of civil engineering, and Philip Garvey, senior research assistant, investigating how effectively drivers read signs along a road.

The project is sponsored by the U.S. Sign Council trade group and conducted through the University’s Pennsylvania Transportation Institute.

“The U.S. Sign Council came to us with a concern that signing ordinances from zoning and architectural review boards were being based only on aesthetics and not on driver utility,” explains Pietrucha. He stresses the research isn’t about advertising, but about safety.

“Many of the signs out there are traffic hazards. Drivers need to be able to identify a business from far enough back in order to slow down or change lanes,” he says. “Looking for signs causes congestion and accidents. The more visible the signs are, the smoother traffic flows. The question is, ‘Can you see the sign from far enough away to give you time to do what you need to do?’”

To answer that, Pietrucha and his team devised a methodology to test sign effectiveness. The team created a real-world driving course utilizing street and highway conditions around the State College area. More than 140 young and old subjects drove through the course in day and night conditions.

The researchers manipulated sign factors including position relative to the road (parallel or perpendicular), size, and amount of text appearing on the signs.

With graduate student Abdul Zineddin in the passenger seat, subjects began their trek around town. As they drove through State College, Zineddin asked drivers to locate specific businesses along their route—the fake signs. “On the left,” Zineddin said, “locate a place where I can make copies.” As soon as the driver identified the fictional Quick Copy Center, Zineddin punched the response into a laptop computer specially wired into the car to record response time and distance from the sign. Undergraduate student R.J. Porter also assisted in data collection.

With the test phase complete, Garvey says the preliminary results are interesting. Drivers could identify signs quicker in the out-of-town situation (134 feet away) as opposed to in-town situations (70 feet away). “We think that’s the case because of all the visual clutter—more pedestrians, more traffic, and more things to look at,” says Garvey. He also said placing signs perpendicular to the road helps out-of-town visibility more than it does in-town visibility.

Although the data analysis is not yet complete, the team is hoping to continue the research and look into factors such as eye movement, sign height, and the impact of age in day and night driving.

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Lake effects
Mountain-front reservoirs control cycles of Great Salt Lake

More than 50,000 years ago, a deep freshwater lake covered much of present-day western Utah, as well as parts of Nevada and Idaho. This body of water—Lake Bonneville—eventually shrunk to become what is known today as the Great Salt Lake.

For prehistoric people, the lake's surrounding freshwater marshes and streams offered a place to hunt and fish. European settlers became aware of the lake as early as the 1700s, and the Great Salt Lake was instrumental in the Mormons' efforts to settle the area.

Major cycles in the size and depth of Utah's Great Salt Lake are known from as far back as the 19th century, but now a Penn State researcher suggests an explanation for the seemingly odd behavior of the lake.

"In the 1980s, the Great Salt Lake was very high," says Christopher J. Duffy, associate professor of civil and environmental engineering. "Twenty years earlier, in the 1960s, the lake was so low that there was talk of it drying up."

It appears the long-term fluctuations of the Great Salt Lake do not directly match the fluctuations of the rainfall and snowfall, since rain and snowfall in the Wasatch Mountains move rapidly downhill to the lake each season.

However, the Great Salt Lake rises and falls over time scales of decades. According to Duffy, to explain how the mountain front stores the water is to understand these cycles may be the key to understanding how long-term climate change impacts human development.

From the mountain
"At the highest part of the Wasatch Mountains, runoff from rain and snow forms perennial streams with little storage under ground and rapid downhill movement," Duffy says.

The middle and lower parts of the mountain slope occupy what hydrologists call the "losing stream zone."

The huge underground reservoirs have a long residence time. When streams cross the losing stream zone, the fractured bedrock and alluvial deposits can store significant amounts of water, carrying deep groundwater into deep alluvial deposits.

Mountain-front reservoirs control cycles of Great Salt Lake

Lessons learned and to learn
Not understanding the lake's cycles has sometimes been an expensive mistake for those living around the lake.

In the 1980s, the melting snowpack in the Wasatch Mountains rocketed the lake's waters to unusually high levels, threatening Interstate 80, the city's airport, and municipal wastewater treatment facilities.

About the lake

- The Great Salt Lake covers approximately 1,700 square miles (75 miles by 30 to 50 miles) with a maximum depth of about 35 feet.
- The lake is about three to five times saltier than the ocean and area salt industries extract about 2.5 million tons of sodium chloride and other salts and minerals from it each year.
- The Great Salt Lake's prehistoric freshwater predecessor, Lake Bonneville, was ten times larger than the present day lake.
- No fish live in the lake, and the water's largest natural residents are brine shrimp and brine flies.
- The Great Salt Lake serves as one of the largest migratory bird magnets in Western North America and is part of the Western Hemisphere Shorebird Reserve Network.
- Salt Lake City was originally called Great Salt Lake City by Mormon leader Brigham Young in 1847.

Source: U.S. Geological Survey
treatment plants. Because there are no obstacles to slow the lake’s expansion, local officials installed pumps on the lake’s western end in 1987.

“It wasn’t particularly successful, but they felt they had to do something because they thought the lake would continue to rise,” Duffy says. “Interstate 80 had to be raised and the railroad that crosses the lake had to be rerouted around the lake.”

Duffy believes further study of the lake will help create a better understanding of how it impacts surrounding communities. He says the Great Salt Lake’s location in the Great Basin makes it the perfect model for examining long-term climate change.

“It’s ideal for studying the effects of geology, hydrology, and climate variations because of the area’s unique topography,” Duffy says. “It’s a terminal lake—no rivers leave the region. Water only leaves by evaporation.”

The lake offers a miniature version of how groundwater impacts river flow and levels. Duffy says in many respects, the way water flows from Utah’s Wasatch Mountains into the Great Salt Lake is not unlike the way water flows down Pennsylvania’s Susquehanna River into the Chesapeake Bay.

“This is a totally different way to look at rivers,” Duffy explains. “Part of the reason why our models don’t predict floods or droughts very well is this slow variation in the background.”

The Penn State researcher has developed a dynamic model of this behavior, which seems to explain how low-frequency cycles dominate the Great Salt Lake level. He hopes to look at the tree ring data, a record of rainfall and the water table, to correlate with his findings.

“This phenomenon is critical to interpreting all river flows—not just the Salt Lake,” Duffy says.

—A'ndrea Messer

Dr. Duffy can be reached at (814) 863-4384 or by e-mail at cxd11@psu.edu.
A $150,000 grant from the Pennsylvania Department of Environmental Protection’s “Growing Greener” Program is helping Penn State’s Center for Sustainability turn a dream into reality. The grant will fund construction of a Living Machine™, a water purifying system that will bring to life the Center’s vision of an ecologically sound wastewater treatment and research facility on campus.

Patented by Ocean Arks International, a non-profit organization based in Burlington, VT, a Living Machine restores polluted water to a pristine state by passing it through a series of complex ecosystems housed in a succession of tanks. Modeled after natural systems, each tank contains its own unique habitat and biology—a diverse array of microorganisms, algae, freshwater shrimp, snails, goldfish, koi, grasses, water plants, and trees—designed to break down specific wastewater components in a stepwise fashion.

“What’s waste for one thing is food for another” is the motto of the Living Machine. The first stop in the Penn State Living Machine is a 2,000-gallon underground anaerobic septic tank, an oxygen-free environment where solids begin settling out and microbes feed on organic material in the waste.

Next is a closed anoxic, or partly aerobic, reactor. This 5-foot tall, 5-foot diameter tank creates a “steep edge” transition between the Living Machine’s anaerobic and aerobic ecosystems. Here, denitrifying microorganisms go to work converting dissolved nitrates to nitrogen gas.

Biological treatment of wastewater will work without the steep edge of an anoxic reactor—but at a much slower rate.
A closed aerobic reactor is the next step. Gaseous byproducts from the closed aerobic and anoxic reactors are captured and passed through a biofilter, a planted layer of organic material on top of the tank. Microorganisms in the biofilter scrub odors from the gas, while below, other microbes significantly reduce levels of organic waste matter. Aerobic bacteria begin to dominate, using oxygen to convert ammonia, a major component of human waste, into nitrates that will be processed further on in the system.

Chemical engineering senior Erin English (right) is part of a student group that has constructed several desktop Living Machines. Above, she demonstrates how they work at last year’s campus-wide reunion.

In the three open aerobic tanks, ecosystems become more complex, with shrimp, snails, algae, and fish living among a diversity of plants. Here, nitrifying bacteria complete the conversion of ammonia to nitrates, and snails consume a large percentage of the remaining solids.

for something else.” explains Tania Slawecki, projects director for the Center for Sustainability. “The idea is to identify those relationships.” Slawecki is an assistant professor in the College of Engineering’s Science, Technology, and Society (STS) Program and teaches STS 497D, Projects in Sustainable Living.

The idea for a Living Machine at Penn State came from Barbara C. Anderson, assistant professor of science, technology, and society and...
director of the Center for Sustainability. Anderson and her colleagues at STS originally hoped the Living Machine could be housed in a replica of the greenhouse that once stood next to Old Botany Building. The STS program office is headquartered in Old Botany, and the Living Machine could have been used to treat wastewater produced by STS faculty and staff.

But the Old Botany greenhouse reconstruction project proved too costly, and University officials are looking at other locations on campus. “The Pennsylvania Department of Environmental Protection is very eager to see a Living Machine built at Penn State,” says Slawecki, explaining how the project is moving forward despite the setback.

Last spring, students enrolled in Slawecki’s Projects in Sustainable Living completed the preliminary design for the Living Machine. With assistance from Michael Shaw of Ocean Arks International, who spent a week at Penn State in February 2000, the class came up with a system that will handle up to 700 gallons of wastewater a day.

During the summer session, Slawecki’s students constructed a small-scale, functioning model of the proposed Living Machine. Complete with a 50-gallon constructed wetlands, a 20-gallon fish pond, and three 25-gallon aquaculture tanks housing plants, snails, and sucker fish, the model is being “fed” blended food wastes—and is working just fine.

One student who has played an active role in the Living Machine project is Erin E. English, a senior in chemical engineering. English first became interested in the concept of sustainability while visiting Central America during her freshman year. Inspired by what she saw there, English sought out opportunities to explore the concept at Penn State by enrolling in the Projects in Sustainable Living class and working at the

Plants racked on the water surface of the open aerobic tanks have large root masses, providing an ideal environment for enhanced microbial activity. Secondary functions include nutrient removal and gas exchange.

In the quiescent clarifier, dead bacteria and remaining solids settle to the bottom of a non-aerated tank. The solids are recycled to the anaerobic septic tank or moved to an outdoor reed bed for composting.
Center for Sustainability.

English spent last summer interning with Ocean Arks International, where she helped design a “restorer,” a floating Living Machine that’s used to clean polluted waterways. She will join Ocean Arks as a full-time engineer when she graduates in May.

English is excited about the future of Living Machine technology. While the process is currently used to treat municipal waste in several U.S. communities (South Burlington, VT, for example, treats 10 percent of its sewage with a Living Machine), she feels the true value of the technology lies elsewhere. Living Machine ecology can be adapted to treat a diverse array of water pollution problems, she explains, from industrial and agricultural waste to surface water pollution. “They have an amazing power to heal water,” she says.

Slawecki sums it up this way: “The concept is that nature is a lot smarter than humans, and the ingenuity built into natural systems is far more complex than we can begin to understand.”

As it turns out, Mother Nature knows best after all.

—Jane Harris

Clean water coming from the constructed wetland can be used for irrigating greenhouse plants, filling a pond outside the greenhouse, or flushing toilets.

Final polishing takes place in an 10-foot by 10-foot indoor constructed wetland. Filled with rocks, this subsurface wetland provides a second anoxic ecosystem. Cattails, reeds, lilies, and papyrus thrive here.

The Center for Sustainability is an intercollege, multidisciplinary initiative that supports faculty, students, and members of the community working together to search for ecologically sustainable and socially responsible ways of living. More information on the Center and the Living Machine at Penn State can be found on the Web at www.psu.edu/dept/cs/.

Dr. Slawecki can be reached by phone at (814) 865-2224 or by e-mail at tms9@psu.edu.
Sniffing for clues
Mechanical engineer patents revolutionary method to detect explosives, illnesses

On a quiet, late December night in 1988, Pan Am Flight 103 left London’s Heathrow Airport bound for New York. Many of the 259 passengers and crew were heading to the United States to celebrate the holidays with family and friends.

The plane never made it.

Before it could reach John F. Kennedy Airport, it exploded over Lockerbie, Scotland, killing everyone aboard plus eleven people on the ground below.

More than a decade later, the trial for the two Libyan suspects accused of destroying the flight has finally ended and terrorism is a grim fact of life in a post-Cold War world. Terrorism on American soil is also on the rise, with memories of Oklahoma City and the World Trade Center seared into the national consciousness.

A December 2000 report to the president and Congress by the Advisory Panel to Assess Domestic Response Capabilities for Terrorism Involving Weapons of Mass Destruction calls for the creation of a new White House Office for Combating Terrorism, stating, “Because the stakes are so high, our nation’s leaders must take seriously the possibility of an escalation of terrorist violence against the homeland.”

A new defense

But terrorists with designs on bombing something might want to think twice, as a Penn State researcher has patented a new explosives detection device similar in appearance to the...
metal detection portals passengers are asked to step through at airports.

Gary Settles, professor of mechanical engineering and director of the Gas Dynamics Laboratory, says the new portal could also potentially detect trace amounts of illegal drugs as well as chemicals used in weapons, bombs, or other contraband. The portal samples the “human thermal plume,” a layer of warm air that surrounds and ascends from a person’s entire body. The air in the plume, heated by the skin, rises naturally from the ankles, legs, and torso, creating a boundary layer that moves constantly upward and flows off the top of the head and shoulders.

The plume carries in it microscopic flakes of a person’s skin and other particles, bearing trace amounts of the materials with which the person has been in contact.

The thermal plume moves constantly upward and every surface of the body contributes to it. So no matter where a person tries to conceal explosives or other contraband, traces would appear in the buoyant air stream that eventually rises above the body in the thermal plume. Normal clothing does not significantly interfere with the process.

“We think of this approach as an elegant solution to the problem of sampling airborne trace materials from the human body,” Settles says.

A certain air about him ...

His fascination with the human thermal plume began at 16, when he built a science fair project to illustrate how the phenomenon works. His interest in the subject eventually led him to build a full-sized schlieren system at Penn State—an optical system that takes advantage of thermal differences in the flow of air.

Schlieren, meaning “str eaks” in German, is used to “see” the invisible plumes of cold air that spill out of a freezer or w aves of heat from a grill. Schlieren systems, however, are very small because of the expensive, sensitive optical equipment required to construct them. So any research utilizing the system must be scaled down to accommodate the schlieren’s limited size.

But Settles devised a new approach to constructing schlieren devices that allowed for a large, full-scale version to be built. This permitted researchers to study airflows without using scale models.

For example the full-sized version enables the observation of airflow and heat transfer in commercial kitchen ventilation units. The schlieren system is also used to study airflow in buildings in an effort to alleviate “sick building syndrome,” as well as under stand how dogs’ noses are so effective in detecting explosives in land mines.

Fighting terrorism

The idea to use the technology as a weapon to combat terrorism didn’t occur to Settles until a chance meeting in 1992 with Federal Aviation Administration officials. The FAA came to Penn State to meet with Mark Maughmer, an associate professor of aerospace engineering who attended Princeton with Settles. Maughmer pointed the FAA in Settles’ direction.

“They were talking about air craft issues and the topic of explosives came up, and Mark said, ‘You should talk to this colleague of mine in mechanical engineering,’” Settles recalls. “I could see a kernel of a solution. I could see it was in the thermal plume.”

The FAA began funding his research, and in June 2000 Settles received a patent for the explosives detection device.

Right now, a breadboard portal, developed with and built by Ion Track Instruments of Wilmington, MA, can perform an analysis in ten seconds, he says. When a person steps into the portal, a blower at the top pulls the thermal plume into a funnel where it contacts a special trap that collects the particles in it. Any vapors from the plume also condense there.

The trapped material is then analyzed by Ion Track’s patented ion trap mobility spectrometer. Explosives and other chemicals that contain nitrates are detectable, and the device differentiates among a variety of
explosives. The commercial version of the device, called “Entry scan,” is expected to debut this year.

Settles is quick to remind people that when he was developing the device, no real explosives were ever used. “The stuff we’re using is not dangerous and will not explode. We are using trace materials or non-explosive stimulants,” he explains. “You see, military-grade TNT isn’t pure and is always contaminated with certain materials. These are the same materials that we think dogs can smell when they detect explosives, so we use these contaminants, which are safe to handle. They give off the same signal as real explosives.”

The same holds true for nitroglycerine, another favorite weapon of terrorists. Rather than using explosives nitroglycerine, Settles used medical nitroglycerine, a non-explosive relative used in the treatment of heart disease.

He adds that with more research and funding, the portal has the potential to detect chemical and biological weapons terrorists might use.

Settles hopes to combine the portal with a metal detector that would enable airport employees, for example, to check passengers for bombs and explosives at the same time they are being checked for guns and knives.

“Terrorists are going to think twice before walking through this thing because they will get caught.”

Smelling ill

Settles’ portal could potentially save even more lives. He believes the machine can be used as a non-intrusive test for diabetes, gangrene, some skin disorders, tuberculosis, and some cancers based on biological signals sampled from the human thermal plume.

“It’s actually known by the medical establishment that certain illnesses will release certain chemical signals from the body,” Settles states. Diabetes, for example, has a sweet, fruity, decomposing apple smell associated with it.

“There’s a mix of effluents that’s associated with health y humans, and a change in that is what we’re looking for,” Settles says. “A dog is so much more sensitive than we are to smell. Apparently, pets are so attuned to their owners that they can detect something wrong and send an alert.”

The trick, Settles says, would be to calibrate the portal with a type of electronic nose that could pick up these olfactory clues. This new area of research is a major priority for the Gas Dynamics Laboratory this year.

“We have the ability to see invisible phenomena in the air, and they have many, many applications.”

—Curtis Chan and Barbara Hale

Dr. Settles can be reached at (814) 863-1504 or by e-mail at gss2@psu.edu. More information about the Gas Dynamics Laboratory can be found on the Internet at www.me.psu.edu/psgdl/

In addition to bomb detection, the new portal may in the future be used to detect drugs and illnesses.

<table>
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<tr>
<th>Smelling something wrong</th>
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<tr>
<td>Historically, odors have been a valuable tool for doctors to make their diagnoses:</td>
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<tr>
<td><strong>Odor</strong></td>
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<tr>
<td>Butcher shop</td>
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<td>Freshly baked brown bread</td>
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<td>Freshly plucked feathers</td>
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<td>Fruity “menagerie”</td>
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<td>Putrid</td>
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<td>Sour or musty bread</td>
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AE challenge grant aims at continuing excellence

One of the top-rated architectural engineering programs in the country, Penn State boasts what many other institutions can only dream about: it is one of the handful of AE programs in the country; it is the only department offering a doctoral degree in architectural engineering; it hosts the largest architectural engineering career fair in the country; and it is one of the few universities that offers its undergraduates the opportunity to earn both a bachelor’s and master’s degree in a special five-year program.

But Architectural Engineering Department Head Richard Behr and alumnus Gene Bard (AE ’68) think it can be even better.

For the department to reach an even higher level of excellence, Behr and Bard both believe that it needs a source of funding that allows architectural engineering the flexibility necessary to capitalize on new opportunities.

Bard, who is today president of Bard, Rao & Athanas in Boston, decided to start the Architectural Engineering Academic Excellence Endowment. The endowment provides funds to the department head to respond to unexpected opportunities and to develop and support architectural engineering’s cutting-edge strengths. The funds may be used to recruit new faculty, equip new laboratories, support student conferences and programs, or support new, exciting research programs.

Behr says the department pays for many student activities. For example, in February the structural engineering student group took a field trip to New York City for a special tour of the World Trade Center that was led by the structural engineer who designed the towers. The department also pays for an “opportunities social,” bringing in professionals from AE specialties such as structural, mechanical, lighting and electric, and construction management to chat with students and offer them advice on which career path is best for them.

The recent move of the industrial engineering and engineering science and mechanics departments to West Campus freed up additional space for AE. Although the University has done some basic renovations to the now empty spaces in Engineering Unit B, Behr plans to convert the added 5,000 square feet into instructional laboratories, demonstration spaces, meeting areas, and graduate student areas.

Behr cautions that doing this, however, isn’t without cost. The new AE Academic Excellence Endowment will go a long way to help meet these expenses, but the fund itself is still a work in progress.

Bard has created a “challenge grant”—putting down the first $100,000 if AE alumni and friends can come up with an additional $100,000.

The endowment principal is $200,000, which is then carefully invested by the University. The investment creates a steady stream of income for the department, and a portion of the return is placed back into the endowment principal, ensuring the fund’s continued growth ahead of inflation.

Charles Matts (AE ’56) has already responded to Bard’s challenge and contributed $50,000 to the new department fund.

“It sounded like a good idea,” says Matts. “They’re trying to build the program, and I wanted to help out.”

Behr says it’s the generosity of alumni such as Bard and Matts that will ultimately make the difference for the department.

“It’s all of the extra things that Penn State architectural engineering does that make this program excellent,” he says.
Honoring the past, investing in the future
The story behind professorships in the College of Engineering

Paying tribute to the past and investing in the future are the cornerstones of named professorships in the Penn State College of Engineering. A named professorship honors both its faculty recipient as well as its namesake.

For the select few who hold a named professorship, it is one of the highest marks of distinction a faculty member can attain. It signifies that he or she has reached an unparalleled level of achievement in their field and that their future holds an even greater promise of success in their teaching, research, and service efforts.

The College of Engineering is fortunate to have such strong support from its alumni and friends and is pleased to announce that three named professorships have been formed since fall 2000:

• The Gifford H. Albright Professor of Architectural Engineering
• The John L. and Genevieve H. McCain Chair in Engineering
• The George Guillet Professorship in Mechanical Engineering

Although the reasons for forming professorships vary from donor to donor, one overriding theme is clear: the desire to create the best opportunities for the top academics in Engineering.

For Marilyn Ott, a 1950 agriculture and biochemistry graduate, creating the George Guillet Professorship in Mechanical Engineering was an expression of her love for her father, a long-time faculty member, and her love for Penn State. “State College was a wonderful town in which to grow up, and I wanted to do something for Penn State because it benefited our whole family,” she said recently.

Love, too, was a motivating factor for John McCain (IE ’37) in establishing the John L. and Genevieve H. McCain Chair in Engineering. When trying to decide how to honor the memory of his wife of 57 years, McCain thought a chair would be a perfect idea.

He said that Genevieve did not go to college because she believed it would be better for her brother to be the one in the family who attended college.

Gifford Albright, founding head and professor emeritus of architectural engineering, says endowing a professorship sends a clear signal that the University is committed to excellence. Albright created the Gifford H. Albright Professor of Architectural Engineering. Not only does the professorship’s prestige attract the best talent to Penn State, it helps to keep it here as well.

Endowed professorships provide the necessary support for faculty in their teaching, research, and service efforts. Funding from a professorship can help pay for new research areas, develop new ideas, fund preliminary investigations, and equip teaching and research laboratories.

The benefits of an endowed professorship also go beyond its holder. Undergraduate and graduate students will have the fortune of studying under the top minds in the field and fruits of the faculty’s efforts will not only benefit Penn State, but society as a whole.

“We have been extremely privileged to have such strong support from our friends and alumni,” said Dean David Wormley. “The establishment of these endowed professorships will allow the Penn State College of Engineering to offer some of the best opportunities out there for bright, talented faculty. We’re pleased and encouraged by these new endowments.”

For more information on creating an endowed professorship, contact the College of Engineering’s Office of Engineering College Relations at (814) 863-3848 or by e-mail at rgsdo@engr.psu.edu.

Belated thanks

John R. and Bernice R. Mentzer were inadvertently omitted from the 1999-2000 issue of the Dean’s Report of Philanthropy. Their names should have appeared in the listing of donors to the Challenge Society ($10,000+). Thank you Dr. and Mrs. Mentzer, for your continued support and your patience!
Award-winning faculty

Lily Elefteriadou, associate professor of civil engineering and research associate at the Pennsylvania Transportation Institute, and Penn State alumnus John McFadden, assistant professor of civil engineering at the University of Alabama, received the Fred Burggraf Award from the National Transportation Research Board for their paper, “Development of a New Procedure for Evaluating Horizontal Alignment Design Consistency of Two-Lane Rural Highways.”

Linda M. Hanagan, assistant professor of architectural engineering, received the Outstanding Young Alumni Award from Virginia Tech.

Bruce Logan, Kappe Professor of Environmental Engineering, was named the first recipient of the Association of Environmental Engineering Professors/Malcolm Pirnie Frontier of Research Award.

John M. Mason, Jr., associate dean for graduate studies and research in the College of Engineering and professor of civil engineering, was appointed a member emeritus of the Transportation Research Board’s Committee on Geometric Design.

Barnes W. McCormick, professor of aerospace engineering, has been given the first Honorary Alumni Lecturer Award by the Department of Aerospace Engineering. The annual award recognizes the outstanding achievements of distinguished aerospace alumni. Because of McCormick’s long career of service and achievement, the award was also renamed in his honor as the McCormick Honorary Alumni Lecturer Award.

Robert G. Melton, associate professor of aerospace engineering, was elected vice president, technical, of the American Astronautical Society.

Ramanathan Nagarajan, professor of chemical engineering, has been elected a Fellow of the American Institute of Chemical Engineers.

H. Randolph Thomas, professor of civil engineering, was named the 2000 Peurifoy Construction Research Award winner by the American Society of Civil Engineers.

The International Electrical and Electronics Engineers Electron Devices Society has named Christopher R. Wronski, Leonhard Professor of Microelectronic Materials and Devices, recipient of the William R. Cherry Award.

New MEP director named

Amy L. Freeman has been named director of the College of Engineering’s Minority Engineering Program (MEP).

As director of MEP, Freeman will work to increase the percentage of ethnic engineering students—African Americans, Hispanics, and Native Americans—in the College.

Freeman joins Penn State after eight years at Lock Haven University, where she served as director of Human and Cultural Diversity. In this position she advised equity groups that included women, students of color, and international students. She also coordinated programs to raise awareness of minority concerns, directed special initiatives to address academic progress for minority populations, and advised minority student organizations.

From 1991 to 1998, Freeman also served as an advisor for the Bloomsburg University Gospel Choir, a minority retention program at that school.

Prior to that, Freeman worked in construction management for seven years, first as a construction engineer at Rockwell International in Hanford, WA, and then as owner of two construction management firms in the Lock Haven area.

“I have a lot to share with ethnic engineering students,” says Freeman. “I can draw upon my own experiences as an ethnic engineer to help others complete their engineering education.”

Robert N. Pangborn, associate dean of undergraduate studies in the College of Engineering, agrees.

“Amy’s experience as a small engineering business owner and in project management in a large company setting will significantly enhance her interactions with engineering students just beginning their technical study and careers.”

Freeman holds a bachelor’s degree in construction management from Washington State University and a master’s degree in architectural engineering from Penn State.
Bookshelf

Hayek authors mathematical reference text; Lakhtakia co-edits book on unconventional materials and structures.

Sabih I. Hayek, distinguished professor of engineering mechanics, has authored a book titled Advanced Mathematical Methods in Science and Engineering. Designed to be a comprehensive reference/text for solving science and engineering problems, Advanced Mathematical Methods in Science and Engineering covers an extensive range of mathematical topics, including integral methods, field equation derivations, and operations applicable to modern science systems.

The book features more than 900 detailed examples and exercises, as well as appendices covering infinite series, special functions, curvilinear coordinate systems, generalized functions, and plots of special functions. Advanced Mathematical Methods in Science and Engineering will be used as a textbook in several graduate-level engineering mechanics courses. The book was published by Marcel Dekker, Inc, and is available at local bookstores at a reduced rate of $85, a savings of $100 off the list price. Penn State faculty, staff, students, and alumni may also purchase the book directly from the publisher at a reduced rate by contacting Regina Efimchik at refimchik@dekker.com and mentioning their Penn State affiliation.

Akhlesh Lakhtakia, professor of engineering science and mechanics, has co-edited a new book titled Electromagnetic Fields in Unconventional Materials and Structures. The 489-page book is part of the Wiley Series in Microwave and Optical Engineering and was co-edited with Onkar N. Singh of the Banaras Hindu University's Department of Applied Physics, in Varanasi, India. Fourteen authors from six countries contributed their research and reviewed parallel developments on electromagnetic fields in unconventional materials and structures for the text.

Their aim is to engineer geometry at nanoscopic, microscopic, and/or macroscopic length scales in order to realize materials and structures with unusual and innovative performance characteristics in optical, infrared, and millimeter-wave regimes. Lakhtakia contributed a chapter on isotropic materials with microstructural handedness and co-wrote a chapter on sculptured thin films with Vijay Venugopal, a former graduate student. The book is intended for researchers and doctoral students. All royalties from the book are being donated by the publisher directly to UNICEF.

New report puts Penn State first in engineering degrees awarded

A new report on Engineering & Technologies Degrees by the Engineering Workforce Commission named Penn State as the top university in number of baccalaureate engineering degrees granted.

During the 1999-2000 academic year, Penn State’s College of Engineering awarded 1,263 B.S. degrees. Georgia Tech was second with 1,243 and Illinois third with 1,136.

Robert Pangborn, associate dean of undergraduate studies, says the numbers are encouraging for both students and employers. “The new engineering graduates are enjoying an extraordinarily attractive employment market,” Pangborn said. “A survey of students graduating from the College of Engineering during the 1999-2000 academic year indicated that students were invited to visit three companies on average and received two job offers. The demand is strong in every engineering discipline. The new baccalaureate graduates in 1999-2000 reported accepting entry-level positions at salaries averaging $45,700.”

Penn State also ranked third in total number of engineering degrees awarded, including B.S., M.S., and Ph.D. degrees, with 1,834 for 1999-2000. Georgia Tech had the most with 2,019 and Michigan followed with 1,853.

Other rankings issued by the EWC placed the College of Engineering sixth in the number of bachelor’s degrees awarded to women and eighth in total degrees (B.S., M.S., and Ph.D.) to women.

The College also ranked ninth in number of master’s degrees awarded and tenth in number of doctoral degrees awarded.
Dear Engineering Alumni and Friends,

In my last column, I wrote about the need for more ACTIVE alumni participation in PSES. I am pleased to report that we have added new active members to our Membership/Marketing and Student Recruitment Committees. I also am happy to be writing to you about the Spring PSES activities. I can imagine as you read this, the snow will have melted, the spring flowers will be budding, and the Penn State campus will be a great place to visit.

First, I want you to know that despite the harsh weather, PSES has been active this winter. The Membership/Marketing Committee met, via conference call, early in January. They brainstormed about ways that more of you alums can be involved in PSES here at University Park or from your hometown. Some of you have received materials in the mail and I hope you will seriously consider active participation in your alumni society.

We also posted our call for nominations for the 2001 Student Service Award in the engineering student newsletter. The winning recipient was recognized at the Faculty and Staff Awards program on March 30. PSES is pleased to offer this $500 cash award to recognize those special students who go beyond the classroom and volunteer their time, not only for College and University organizations, but to help community service programs as well. The 2001 Student Service Award recipient will be highlighted in the next issue of this magazine.

The PSES Student Recruitment Committee held a training session in February at University Park. I am pleased that this, our “oldest” committee, continues to help the College with its recruiting efforts. This year, we are doing a lot more “correspondence” by e-mail, but this is the best way to reach high school students and let them know that Penn State has the very best engineering program!

I urge you to check our Web site periodically at www. engr.psu.edu/alumni/. We are keeping it up-to-date with news, activities, and calendar information. And, especially for the golfers—the 2001 PSES Golf Classic has a change of date and location. We will be playing at the Toftrees Resort and Golf Course on Saturday, September 15, with a tee-off at 8:30 a.m.

Happy Spring!

Will Kresge
March Madness—PSES style!

The Society’s meeting was held on Mar. 30, at the Nittany Lion Inn, University Park, beginning at 9 a.m.

Highlights of this meeting were:
- the Membership/Marketing Committee report on its new active membership drive in the Northeast and California; updates from the Recruitment Committee on efforts to contact and persuade high school seniors to accept admission offers from the College; announcement of the Student Service Award recipient for 2001; and preliminary reports on plans for the Resume Review Days and the 9th Annual Golf Classic activities in early September.

Following the meeting, PSES members attended the Faculty/Staff Awards Program and Reception in the Nittany Lion Inn. Because board members participate in the selection process, it is especially interesting to meet the faculty and staff who receive the awards. This program was originally conceived by PSES in 1972 when the Society recognized Dr. Clifford Holt for his exceptional skills in advising. Today, the College honors faculty and staff for excellence in teaching, research, and service.

June reunion and PSES meeting

Penn State’s traditional reunion activities will be held May 31–June 2. The College of Engineering will hold an Open House Saturday morning, June 2, from 9 to 11 a.m. in the Kunkle Activities Center, including tours of the departments and new West Campus facilities.

PSES will meet at 9:30 a.m. on Fri., June 1, in the Stavely Conference Room in Hammond Building. All returning reunion alumni are welcome to stop by and visit this meeting. We will be happy to meet members of the Classes of 1951, 1956, 1961, and all Pioneers.

PSES thanks departing board member

Priscilla Guthrie (EE ’70) will conclude her six-year term as a board member at the June 2001 meeting. The Society thanks her for her energy, enthusiasm, and eagerness to help the College, especially in the area of student involvement. We all hope Priscilla will return often to Penn State and know that she will continue to be an advocate of PSES.
1950s

Richard D. Foster (ME ’55) of Los Alamos, NM, received the 2000 Bennettts Valley Alumni Distinguished Service Award. Foster was honored for his involvement in youth and church activities, Habitat for Humanity, Global Volunteers, and social justice organizations. Foster is also active in local politics.

Leroy “Bud” D. Loy, Jr. (CE ’53) is chairman of the board of Skelly and Loy, Inc., which was named to three “top” lists compiled by the Central Pennsylvania Business Journal for 2000: Central Pennsylvania’s Top 100 Private Companies (No. 93), Central Pennsylvania’s Top 50 Fastest Growing Companies (No. 28), and Central Pennsylvania’s Top Women-Owned Businesses (No. 2). Skelly and Loy is an engineering consulting firm based in Harrisburg with offices in Pennsylvania, Maryland, West Virginia, and North Carolina. Loy’s daughter, Sandra Loy Bell (BUS ’84) is the firm’s chief executive officer.

1970s

Eric A. Gimbal (EE ’72) is president and CEO of sales and marketing at Integra- tion, Inc. Integration designs business solutions that link people, processes, and programs associated with sales and marketing with other critical business systems. Gimbal and his wife, Andrea Marone Gimbal (EDU ’72), reside in Ambler, PA. They have two sons.

1980s

Jeffrey L. Marshall (ChE ’86) is a semi-works pilot plant manager for Ecolab in Eagan, MN. Marshall is responsible for new product and process development of cleaning systems in the institutional, food and beverage, vehicle care, and professional products areas. He and his wife, Shelly, reside in Lakeville, MN. They have two daughters, Brianne and Kaitlyn.

Kenneth R. Miller (EE ’87), an electronics engineer at the Naval Air Warfare Center in Patuxent River, MD, recently earned a master’s degree in electrical engineering at Johns Hopkins University. Miller resides in California, MD.

George Piccioni (IE ’86) and his wife, Christine, announce the birth of a son, Christian Michael, on July 19, 2000. The Piccioni’s live in Powell, OH, and have two other children, Carmen and Gabriel.

1990s

Thomas E. Fuchs (CE ’94) has relocated to Bel Air, MD, where he works for Bechtel Telecommunications, a construction management firm specializing in wireless communications. Bechtel Telecommunications is managing the construction of AT&T’s wireless network throughout the United States.

Shawn R. Lepley (AS EET, AS TelCom ’96) is Philadelphia Operations Manager for Qwest Communications, the fourth largest long distance company in the United States.

David W. Mazycz (CE ’95, MS EnvE ’96, PhD EnvE ’00) has joined the faculty of the University of Florida as an assistant professor of environmental engineering.

Brian K. Paul (PhD IE ’95) is associate professor of industrial engineering at Oregon State University, where he received the Engelbrecht Young Engineering Faculty Award for 2000. Paul has also been honored with the 2000 Hamed K. Eldin National Young Faculty Award.

Philip Tsang (Aero ’96) is a senior staff member at MITRE Corporation, a not-for-profit engineering and information technology company that partners with the federal government to address issues of national importance. Tsang’s position supports the organization for the Assistant Secretary of Defense for CAS. He lives in Rockville, MD.

Matthew W. Weston (CmpE ’93, MS ’95) received a Ph.D. in chemical engineering from Georgia Tech in December 2000, where his research explored the biological activity of cells in heart valves. Weston is employed as a research engineer in the Heart Valve Division of St. Jude Medical, Inc. He and his wife, Kristen, reside in St. Paul, MN.

Eric J. Williamson (CmpE ’97) joined Nortel Networks in Richardson, TX, in September. Williamson is a member of Nortel’s scientific staff and works on wireless Internet applications. He resides in Garland, TX, and will marry Suzanne Sheppard, a software engineer, in July 2001.

Joyce Y. Xu (ChE ’97) graduated from Columbia Law School in May 2000. She is an associate at Davis Polk & Wardwell in New York City.

2000s

Roger H. Jones (AS MET ’00) and his wife, Carolyn, announce the birth of their first child, Abigail Victoria, on September 27, 2000. Jones is a maintenance project engineer with P.H. Glatfelter Company. He and his family live in Spring Grove, PA.

Got news? We’ll be the first to admit that campus hasn’t been the same since you graduated and went out into the real world. We’re dying to know what you’ve been up to. Have you gotten a new job, a promotion perhaps, or even married? Now telling us your news is easier than ever. Just go online to our website at www.engr.psu.edu/alumni and fill out the handy dandy alumni news form! We’ll make sure your news appears in an upcoming issue of Engineering Penn State Magazine. You may also send your news through regular mail to:

Jane Harris
Engineering Penn State Magazine 101 Hammond Building University Park, PA 16802 jharris@engr.psu.edu

Photographs are also welcome. Pictures may be sent or e-mailed to us (please scan them at 300 dots per inch). Please include a return address if you wish the photos to be sent back to you.

Looking forward to hearing from you!
Jenna L. Estep was named student marshal for the College of Engineering at Penn State’s commencement on Dec. 16, 2000. Estep received both a B.S. and an M.S. in industrial engineering and operations research. She chose Natarajan Gautam, assistant professor of industrial engineering, to be her faculty escort.

College of Engineering student marshals are chosen for their outstanding academic achievements and contributions to engineering student life. Estep is the daughter of Lee and Ron Estep of Harrisburg, PA. She is a 1995 graduate of Central Dauphin High School, where she was valedictorian.

Estep received numerous awards, scholarships, and honors during her academic career. She was named a Schreyer Scholar and an Evan Pugh Scholar. She received an Academic Excellence Award and was the recipient of the Benjamin Niebel Graduate Fellowship in Industrial Engineering, the Nelson/McGraw Foundation Scholarship, the William R. Bastian Scholarship, the Inyong Ham Scholarship, and the IE Faculty/Staff and Alumni Scholarship. Estep holds membership in several honor societies, including Phi Eta Sigma, Phi Kappa Phi, Order of Omega, and Alpha Pi Mu.

Estep participated in many extracurricular activities while attending Penn State. She was active in several professional groups, including the Institute for Operations Research and the Management Sciences, the Institute of Industrial Engineers, the Society of Professional Groups, and the Society of Women Engineers. She also served as assistant treasurer and president of the Student Society of Engineers, the Society of Professional Groups, and the Society of Women Engineers.

Blind student named Rhodes scholar

Extraordinary would only begin to describe Penn State senior Zachary Battles. Maintaining a near-perfect grade-point average, the Schreyer Scholar graduates this May with not one, but three degrees—a bachelor’s in math, a bachelor’s in computer science, and a master’s in computer science, along with a minor in French.

During the winter holiday break, Battles went to the Ukraine for a second time to teach English and also attended a two-week theater course in London. And he has been blind almost since birth.

Battles was recently named one of 32 Rhodes scholars, having earned one of the most prestigious academic fellowships in the world. Established in 1902 by British philanthropist Cecil Rhodes, scholarship winners study for two or three years at Oxford University in England. Criteria for the scholarship include academic achievement, personal integrity, leadership potential, and physical vigor.

The 21-year-old Battles is one of only 32 selected out of a national pool of 950 applicants. Battles, who will study numerical analysis at Oxford, is only the second student in Penn State history to be named a Rhodes scholar.
Chemical engineering student named co-op student of the year

Alexandra E. Noel, a chemical engineering major, was named Penn State Engineering Cooperative Education Student of the Year for 2000. Students participating in cooperative education gain valuable on-the-job experience by alternating semesters of classroom study with semesters of career-related employment.

“I loved the way that co-op made everything I was learning in my classes come together,” says Noel. “I got hands-on experience and saw how what I was learning about could be applied to jobs that I might have in the future.”

Noel also finished second for national co-op of the year from the Cooperative Education Association and the Cooperative Education Division of the American Society for Engineering Education (ASEE).

Noel completed three co-op terms with Dow Chemical Company in Midland, MI, where her assignments included performing analytical tests on the first commercial model of a new calorimeter developed by Dow and recommending improvements prior to production. During her most recent assignment, Noel was part of a project team responsible for consolidating a series of batch processes into a new plant design for production of an allergy medication ingredient.

“One of my main projects was the preparation and presentation of a reactive chemicals review, which is required prior to starting up a project,” explains Noel. “This review is presented to a committee that identifies potential hazards of the project and adds input for improvement.

“After start up of the new plant design,” Noel continues, “I was given responsibility over one of the processes that was new to the building. This was difficult at first, since this process had never been run this way before, but as I saw batches run and how things worked, it became a lot easier to predict what was going to happen with the process.”

In addition to her co-op activities, Noel is active in Penn State’s Women in Engineering Program, where she works as a student envoy, mentor, and instructor. She is a member of Alpha Chi Omega sorority and serves on the communications committee for the Penn State Dance Marathon, the largest student-run philanthropy in the country.

Noel has an internship with ExxonMobil lined up for the summer and will return to Dow in the fall to complete her final co-op rotation. She will receive a B.S. in chemical engineering in May 2002 and plans to work in industry for several years before returning to college for an M.B.A.

Engineering offers summer camp for girls

Girls entering their junior or senior years of high school can apply for the Visit in Engineering Camp (VEC-Tour), scheduled for July 23-27. The students will stay on the Penn State campus for this hands-on, interdisciplinary camp sponsored by the College of Engineering and the College of Earth and Mineral Science.

The girls will be introduced to numerous areas of engineering, including bioengineering, environmental engineering, materials, and acoustics. Activities will include building thermoacoustic devices, LED devices, and bioengineering and environmental projects.

The cost for VEC-Tour is $299 and scholarships are available.

Younger girls also have an opportunity to check out engineering at the GIRLZ in Engineering Day Camp from June 11-15. This on-hands camp is designed for girls entering 4th, 5th, and 6th grades. Cost for the camp is $50.

More information on the summer camps can be obtained by contacting Barbara Bogue, director of the Women in Engineering Program, at (814) 863-5790 or by e-mail at bbogue@enr.psu.edu.
Heart sounds

First, find your pulse on the side of your neck. Now breathe normally for several seconds. When you feel a regular pulse, exhale once, then inhale slowly and deeply. Did you feel your heartbeat speed up slightly?

What you’ve just felt is called respiratory sinus arrhythmia. Don’t worry—there’s nothing wrong with you. Respiratory sinus arrhythmia is an example of normal, healthy heart-rate variability.

Ankit Chander, an engineering science major, has studied heart rate variability since summer 1999.

“What is interesting,” he says, “is that this field, on numerous occasions, has been shown to be a significant indicator of health. The first time this was recognized was in 1965, when two obstetricians realized that fetal mortality was highly correlated with how metronome-like the fetus’s heart rate was. The more metronome-like it was, the less likely the fetus was to make it. So when you— he takes a deep breath and taps his chest— feel that increase, that shows the health of your autonomic nervous system.”

The autonomic nervous system keeps functions like body temperature, heart rate, and blood pressure within normal ranges. It is separated into two active parts: the sympathetic and the parasympathetic. When the sympathetic part is dominant, the heart rate and blood pressure increase and digestion slows down. Conversely, when the parasympathetic part is dominant, heart rate and blood pressure decrease and digestion increases.

Take respiratory sinus arrhythmia, for instance. When you inhaled deeply, receptors in your heart recognized that the blood flow to the heart had increased, and they sent that message to your brain. “In the cardiovascular system, supplying oxygenated blood to the body is a primary concern,” Chander says. “If the heart sees lots of blood ready to enter it, it is highly advantageous to get that blood going into the heart, into the lungs, and back to the body that needs the oxygen.”

To do this, the autonomic nervous system temporarily weakened your parasympathetic responses. That’s why your heart rate increased—your sympathetic responses strengthened for a few seconds.

Last summer, working with James Pawelczyk, associate professor in the College of Health and Human Development, Chander used a technique called signal analysis to create models for the relationship between heart rate and blood pressure. “Signal analysis is, essentially, time-to-frequency conversions,” he explains.

“Let’s say I was graphing your heart rate, so say I have your EKG.” He grabs my notebook and meticulously draws a few squiggles: one small, one big, one medium, flat line, then small, big, medium again. He points to one of the big peaks. “So this is your heart’s big contraction. So, lubb,” he says, then moves his finger to a point to the right of that peak, “dup. Those are the heart sounds that you hear: So what I’ll do from that is I’ll graph this distance versus time.”

He indicates the distance between the first big peak and the second, which is the heart rate measured in milliseconds. “So when these peaks are really far apart, you get a slow heart rate. And then from that I can graph frequency.”

Once he has made his calculations, he can use mathematical transfer functions to predict blood pressure from heart rate, and vice versa.

Chander plans to use his summer research as the basis for his honors thesis. He is thinking of using signal analysis to study left ventricular assist devices—devices placed in the heart after congestive heart failure which cut down on the energy the heart exerts to pump, allowing it to heal more quickly. After these devices are in place, patients’ heart rates tend to vary more.

Chander remarks, “The autonomic nervous system affects the entire body—it affects the digestive system, it affects respiration—so the fact that we’re just trying to heal the heart with these devices and we’re seeing restoration to a normal state everywhere in the body ... that’s a very positive thing.”

—Marleah P. Peabody
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The Last Word—
Where are the new engineers for this millennium?

by David N. Wormley, Dean

During the last decade, the country has experienced a period of dramatic economic vitality—significantly propelled by technological advances in information systems, materials and devices, and the life sciences. The contributions and the role of the engineering profession to this progress have been substantial. When has there been a decade more influenced by “engineering contributions to society?”

Yet, as we enter the new century, the number of students receiving engineering baccalaureate degrees has decreased in this country. In 1985 the United States produced more than 77,500 engineering bachelor degrees while this past year approximately 64,000 degrees were awarded. Over the last decade, the demand for new engineering graduates and their relative starting salaries have been the best in years. But what are the issues behind this decreasing supply in the face of increasing opportunity and what are we doing about them?

Many national studies have referred to this dilemma as the “leaky pipeline problem.” This predicament is characterized by a dwindling number of students who have an interest in engineering and are prepared from secondary school through college to enter the field. Students are not being drawn to the basic math and science courses in secondary school and therefore are not well prepared to enter an engineering degree program.

This translates into a decreased interest in pursuing engineering study among college freshmen—first-year students interested in engineering dropped from 21 percent of the total number of students entering college to just over 15.2 percent from 1980 to 1999. Additionally, of the students who enter college with an interest in engineering at major universities, approximately half leave engineering before graduation. Thus, from a potentially large student pool in secondary schools, the number of students who actually graduate with engineering degrees is significantly smaller as students leave engineering or leak from the engineering education pipeline from secondary school through college.

In the College of Engineering, we have undertaken many initiatives to address parts of the leaky pipeline problem. I will focus on two of these initiatives. We have partnered with the Penn State College of Education to develop a course, Fundamentals in Science, Technology, and Engineering Design, to train secondary school teachers how to integrate learning experiences into the curriculum which introduce students to the creative practice of engineering—specifically its contributions to solving society’s problems. This year two sections of the course are being offered to respond to the increasing interest of future secondary teachers.

We have also made major changes in our curriculum, particularly in the first two years, focusing on producing graduates who will become World-Class Engineers. Our studies indicate these changes have increased student retention in engineering at Penn State:
• We have introduced first-year seminars focusing on the profession to bring students and faculty together.
• We have partnered with faculty in math and science to introduce educational experiences illustrating the ways in which these fundamental disciplines are utilized in engineering practice.
• We have revitalized the first-year engineering design subject to incorporate active learning, team-building skills, and communication skills.

• We have created a leadership development minor and courses in entrepreneurship. These changes, along with many others, taken in concert tie our early college experiences for future engineers to the genesis of the engineering profession and its commitment to the betterment of society.

While some of our pipeline initiatives will take some years to bear fruit, we believe that others have already had an impact. Although engineering enrollment has declined nationally during the last decade, College of Engineering enrollment has remained relatively steady. This past year the Engineering Workforce Commission announced that we awarded more bachelor’s degrees in engineering (1,263 degrees) than any other institution in the country.

While we take pride in being first in producing engineering graduates, we also believe the quality of students entering our engineering program has increased and the education which future engineers receive continues to improve significantly.

With further efforts in the College and by our colleagues at other institutions, not only will the number of engineers produced nationally increase, but more importantly, the quality of their education will improve, reinforcing engineering’s contributions to a vital and healthy society.
Middle School Engineering Day

On Nov. 28, 2000, 24 eight-graders from Park Forest Middle School in State College joined the Minority and Women in Engineering Programs for a day of engineering-related activities. The students broke into teams for “Penn State Survivor,” a hands-on, creative design project planned by Engineering undergraduate volunteers. The students also built and tested their own rocket cars and competed to construct the highest paper tower.