Safeguarding America
Associate Dean of Graduate Studies, Research, and Outreach **John Mason** was appointed to the Transportation Research Board's (TRB) tort liability and risk management committee. The TRB is a unit of the National Research Council, a private, nonprofit institution that is the National Academy of Engineering's principal operating agency.

A team of four Penn State faculty members received a four-year, $1 million grant from the National Science Foundation's Nanoscale Interdisciplinary Research Team (NIRT) program. The team consists of **Darrell Velegol**, assistant professor of chemical engineering and principal investigator of the NIRT grant; **Kristen Fichthorn**, the Merrill R. Fenske Professor of Chemical Engineering; Christine Keating, assistant professor of chemistry; and **Theresa Mayer**, associate professor of electrical engineering. The grant is titled, "Bottom Up Assembly of Metal and Semiconductor Nanowires: Fundamental Forces to Nanoelectronic Circuits."

**Terry L. Friesz** was named the first Harold and Inge Marcus Chaired Professor of Industrial Engineering. Friesz holds a Ph.D. in operations research and spatial economics from Johns Hopkins University. The chair is named in honor of Harold (IE '49) and Inge Marcus of Olympia, WA.

**David Miller**, adjunct professor of electrical engineering, was the first recipient of the North American Molecular Beam Epitaxy Innovator Award. The award, co-sponsored by Veeco Instruments, was created to honor individuals whose innovations have significantly advanced molecular beam epitaxy.

Engineering science and mechanics faculty members **Vijay Varadan** and **Akhlesh Lakhtakia** were each awarded the distinguished professor title.

**Andrea Schokker**, assistant professor of civil and environmental engineering, won the American Concrete Institute (ACI) Young Member Award for Professional Achievement. ACI cited her for "contributions to the concrete industry through service on ACI's technical committee and leadership as the first chair of the Faculty Network Coordinating Committee."

*R&D Magazine* named the EnergyPlus Building Simulation Program, created with the aid of Penn State engineers, as one of the 100 most technologically significant products of 2003. EnergyPlus is a computer program that models heating, cooling, lighting, ventilating, and other energy flows in commercial and residential buildings. The Penn State effort consisted of **William Bahnfleth**, associate professor of architectural engineering, and graduate students **Edward Clements** and **Cynthia Cogil** (MS '98). *R&D Magazine*’s R&D 100 Awards are widely considered the "Oscars of Invention."

**Judith A. Todd**, the P.B. Breneman Department Head Chair of Engineering Science and Mechanics, was named to the Franklin Institute’s Committee on Science and the Arts board. The committee recommends the awarding of the Benjamin Franklin Medals in chemistry, computer and cognitive science, earth science, engineering, life science, and physics. Todd will serve on the board for three years.
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About the Cover

From agricultural and biological engineering to mechanical engineering to civil engineering, faculty members across the College are researching new ways to keep our country safe from threats both foreign and domestic. The research featured in this issue is a small sample of the efforts taking place across the College.
Combating terror at home

Keeping America safe has become the mission of engineers from many disciplines.
As World War II raged and U.S. troops headed overseas, the American home front remained relatively secure. That isn’t to say that signs of war weren’t evident at home, however.

To help in the effort, Americans planted victory gardens, women headed to the factories, and supplies were rationed. Campaigns such as “Loose Lips Sinks Ships” reminded people that enemy spies and saboteurs could be anywhere, and constant rumors swirled of an impending Japanese invasion of California.

With the war’s end, the feared Japanese invasion never came to pass, and the American homeland remained secure throughout the campaign.

But with the events of Sept. 11, the rules by which wars are fought have completely changed. Soldiers still head to far-flung hot spots, but the American homeland is no longer an untouchable, safe haven from the war on terror.

Instead, home has become another front in the conflict.

Though the job of protecting the public falls to the government and law enforcement agencies, researchers at the College of Engineering are also finding new ways of ensuring public safety, including blast resistance, bomb detection, sensors, and food safety.
The rotation produced by the blast at the structure’s connections is typically used to assess structural damage. The team’s analysis showed that all the connections exhibited very large rotations or outright failure, indicating that all such connections could be expected to fail.

Krauthammer says, “The failure is localized in the vicinity of the explosion. However, the local failure could compromise the stability of the entire multi-story building if it triggers progressive collapse. Our on-going studies are aimed at addressing the issues raised during this investigation, including consideration of progressive collapse of multi-story buildings.”

Finding the bombs

Stopping terrorists bent on using conventional bombs or nuclear weapons remains a high research priority.

Gary Settles, professor of mechanical engineering and director of the Gas Dynamics Laboratory, recently patented a device that “sniffs” traces of explosives from a person.

Working much like an airport’s metal detector, the engineer’s device is a portal a person stands in to be tested for explosives. As the subject stands in the portal, the machine generates small jets of air to carry the molecules in a person’s “thermal plume” to a sensor.

A standing person generates a thermal plume, which is a mingling of body heat and air. When you smell perfume or cologne as someone strolls past, you’re sniffing the remnant of their thermal plume.

“We’re sampling your plume because that’s where the trace chemicals are,” Settles says.

In addition to a person’s choice of deodorant, the thermal plume also contains clues to what that person has come in contact with, including explosives. Settles says explosives have a tell-tale chemical signature that the portal is designed to detect.

“It scans people and does it in a very unobtrusive manner,” Settles explains. “We used extremely small explosive samples
in developing it, so if you handle explosives, it’s very likely that you’ll be detected.”

The device, which has taken a number of years to develop, has been licensed for production by General Electric’s Ion Track Division.

Even as his portal is being put into production, Settles is looking for other ways to apply his trace detection technology. The mechanical engineer says he’d like to develop a portable version of his detection device to test cargo containers.

“Cargo is a very big deal,” he states. “There are millions of sea shipping containers coming into this country that can’t all be opened for inspection. How can we make sure that what’s inside is safe?”

Settles believes that a probe-like version of his machine could be used to screen containers without having to open them.

“One person could go out on a dock and sample dozens of containers,” he says. “Instead of sampling what’s on your body, it’s sampling what’s in a box.”

Finding a hidden nuclear device has been the focus of Bernhard Tittmann, the Schell Professor of Engineering Science and Mechanics.

Tittmann is studying ways to use nuclear acoustic resonance to detect fissile materials.

Until now, one of the main ways of detecting nuclear material was through the use of a Geiger counter. The device, Tittmann says, has its shortfalls.

“The standard Geiger counter is a very passive device,” he says. “It only detects radiation and can’t distinguish between weapons-grade material and something more harmless.”

Instead, Tittmann is proposing what he calls an active detection scheme. His idea is to send sound waves in two frequencies, one high and one low, at an object. The combination of these two frequencies and the ambient magnetic field enable what’s called the Pound-Overhauser effect.

“This effect provides a unique signature of materials, both fissile and non-fissile materials,” he states. “You see, the combination of the two frequencies and the magnetic field allows us to identify every nucleus. We can distinguish between weapons-grade plutonium and Uranium 235 on the basis of their signatures.”

The idea is already being used in other technologies. “It’s very similar to nuclear magnetic resonance imaging, where you can look inside bones and such,” Tittmann says. The problem is that the electromagnetic waves used by an MRI can’t penetrate metals. “The material is self-shielding to magnetic waves. That’s why MRI is used exclusively for non-metallic media.”

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Tittmann’s nuclear acoustic resonance approach doesn’t have that problem, however. “We can actively interrogate materials that are hidden,” he says.

With funds from the Department of Energy, Tittmann is building a proof-of-concept device with the help of the Lawrence Livermore National Laboratory.

**Standing guard**

Keeping the country safe also means securing sensitive or vital areas, but doing so poses a logistical challenge for heads of security.

A team led by David Swanson, associate professor of acoustics and senior research associate at the University’s Applied Research Laboratory, and Nick Nicholas, also a senior research associate, has developed an inexpensive method of fitting new or existing fences with the ability to detect, locate, and classify intruders.

The new system uses an inconspicuous tensioned wire as an extended sensor. The wire can be attached to any new or existing fence and is used to monitor vibrations in the fence.

“The approach uses geophones—inexpensive, rugged, off-the-shelf ground sensor technology hooked up to the tensioned wire—and a low-cost embedded PC and software,” Swanson states.

The software, developed at ARL, enables the user to suppress background or environmental vibrations, sort through the signal carried by the wire, and pinpoint information that indicates intrusion.

The new approach locates the site of intrusion by monitoring vibrations in the fence and precisely detecting the time of arrival of signal from two or more signals. Measured differences between the signal’s arrival times indicate the point at which the intrusion occurred. The system can also classify the type of disturbance as well as locate the point of contact along the fence.

“Using the new approach, you can have the fence call you when there is an intrusion. You can also manage how sensitive you want the response,” Swanson says. “For example, you can have the fence call whenever a squirrel goes by or only when a larger animal gets through the fence.”

Even careful climbing by an intruder would change the loading on the fence and signal that a human intruder was present rather than a squirrel.

Swanson envisions the fence being used for large areas, such as airports, cattle ranches, military bases, schools, and embassies.

In addition to being sensitive, rugged, and inconspicuous, the new system is cost effective. Competing systems equipped, for example, with microwave or co-axial cable technology, are much more expensive. A high-tech prison fence can cost about $165 per linear foot. The Penn State approach is estimated to cost less than $1 per linear foot, plus about $5,000 for the central processor to retrofit a typical existing fence.

Another system developed by Penn State engineers is an underwater sensor system that could be used to protect reservoirs.
Outreach course helps engineers and others protect property and lives

In the absence of updated information on blast-resistant design, engineers and architects often over-design their projects, increasing building costs. Others simply leave the safety level undefined, endangering occupants and rescue personnel.

But a short course offered by Penn State’s Protective Technology Center (PTC) can help. Modern Protective Structures, taught by Theodor Krauthammer, professor of civil engineering and director of the PTC, provides engineers, architects, and safety and security managers with the information they need to protect buildings and their occupants from bomb blasts.

Krauthammer, who has taught Modern Protective Structures at Penn State since 1995 and internationally since 1989, collaborated with others in the field to develop the week-long course on protective construction analysis and design. The class, which runs from July 12 through 16 this year, includes practical background information on performance and design requirements for hardened facilities, as well as comprehensive reviews and advanced research and development topics that are designed to augment the technical capabilities of hardening and forensic engineers and scientists.

A review of blast damage assessment issues provides forensic and rescue personnel with additional background information.

The course takes a case-study, problem-solving approach, incorporating hands-on, guided analysis and design activities. Participants receive take-home copies of computer programs for analysis and design of protective structures, along with an extensive design manual and reference materials.

Krauthammer, an internationally recognized researcher in enhanced structural performance and safety, has more than thirty years of experience in protective structures. He has served as a technical consultant to government and industry in the U.S. and abroad and is the former chairman of the American Concrete Institute (ACI) Committee 370 on Short Duration Dynamics and Vibratory Load Effects. He is also a member of five technical committees of ACI, chairman of the American Society of Civil Engineers (ASCE) Task Committee on Structural Design for Physical Security, chairman of the ASCE ACI Committee 421 on Design of Reinforced Concrete Slabs, and a member of the ASCE Committee on Shock and Vibratory Effects.

More information about the course can be found on the Web at http://outreach.psu.edu/C&I/ProtectiveStructures/.
Periodically, the network sends data through the system. Each node sends its sensor data to its parent node. That node sends the received data and its own data to its parent node until all the data are received by the uplink node, which converts the signal from acoustic to radio frequency and sends the information through the air to the command, or central, computer for display and evaluation.

The host node stores the sensor data from all the nodes in its memory, preserving the identity of the node that produced the data so that water-monitoring personnel can track unusual readings or contaminants to their source location.

The researchers designed the nodes so that the chemical sensors are immersed in water separate from the communication electronics, making it easy to change the sensors on the nodes without having to alter the signaling network.

A terrorist-free diet

While some research in the College focuses specifically on stopping terrorist threats, other work is being adapted for use in homeland security.

Research by faculty members in the Department of Agricultural and Biological Engineering is not only being used to keep the nation’s food supply from going bad, but also to keep the bad guys out of our food.

Joseph Irudayaraj, associate professor of agricultural and biological engineering, originally developed infrared spectroscopy techniques to identify multiple pathogenic microorganisms in food. The technique measures the transmission and absorption of light at different wavelengths coupled with a data analysis protocol for rapid detection.

Irudayaraj has also used this technique in food adulteration and authentication studies in honey, olive oil, and grains.

“Tracing the origin of a product can be a very important issue,” he says. “For example, we have olive oil from Spain and Italy, but one fetches a much higher price than the other.”

He continues, “The use of spectroscopy is the interaction of light and matter. Depending on the composition of

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For years, the world's military and police forces have been employing non-lethal weapons—hardware that can be used to stun a suspect or disperse rioters without inflicting death or permanent injuries. Understanding how deadly these non-lethal weapons are is the job of John Kenny, a research engineer with the University’s Applied Research Laboratory (ARL) and assistant director of ARL’s Human Effects Advisory Panel.

“There are companies that are trying to design new weapons that will give the police and the military options that won’t kill people,” Kenny says. “Our job is to try to make predictions about how the human body will react to these things.”

In most cases, the Department of Defense’s Joint Non-Lethal Weapons Directorate will send proposals and research to Kenny’s group for evaluation.

“I'll get together a panel of experts from around the country,” he explains. Physicists, psychologists, physiologists, and epidemiologists are among the specialists called in to help.

“We don’t want to give the impression that we’ve stacked the deck to be favorable or unfavorable to the sponsor,” Kenny says. In addition to Kenny, the group is allowed to have one other University expert, who is usually a faculty member from Penn State’s Milton S. Hershey Medical Center.

“We act as an independent body. We do peer reviews of research,” he says. The panel looks at everything from the research’s validity to the developer’s conclusion.

“We had one project that proposed a laser plasma weapon. In theory, if you fired it, it would create an ultrasound wave which would cause a sensation in a body,” Kenny recalls. “So the developer used an ultrasound wave to stimulate an animal limb and claimed the device would work.”

The panel, however, didn’t concur.

“We then said, ‘Well, you only proved that you could do it with ultrasound waves, but there wasn’t anything to link it to the laser plasma,’” Kenny says.

The group also looks at the technical feasibility of a proposed system, as well as the system’s “mission.”

“There are a lot of questions that need to be asked and answered when you develop these non-lethal systems. For example, what is the engineering challenge of taking something from a laboratory and turning it into something that can be used in the field?” Kenny asks. “What do you mean when you say you want to incapacitate someone? Does it mean an aversion response, or do you want to knock them down?”

The Human Effects Advisory Panel will go as far as to consider some of the cultural implications of a proposed weapon.

“There’s a public acceptability component to these things,” he says. “What might be considered acceptable in one country or culture might be frowned upon in another.”

Kenny continues, “The bottom line is that we want to give law enforcement or the military the tools to make things right.”

—Curtis Chan

| 1. Each style of munition fired is measured to determine the degree of accuracy. Accuracy is defined as the smallest diameter circle that could include all the impacts. |
| 2. “Beanbags” are sometimes referred to as stun bags and can be launched from shotguns or tear gas or grenade launchers. |
| 3. The munitions to be tested are sorted by style, caliber, and configuration before they are fired. |
| 4. Less lethal impact munitions are designed to be fired from a number of weapons. |
| 5. The “pendulum” measures the kinetic energy of projectile impacts. |
| 6. An officer fires a grenade launcher containing a bean bag. |
The technique, with modification, has potential to detect biological agents in food, a key security issue.

“We will be able to tell if a specific pathogen is present,” Irudayaraj says.

The engineer is also developing optical biosensors based on imaging methods to monitor multiple reactions. Until now, reaction tests had to be done separately—a time-consuming process. Irudayaraj’s team is building microarrays on gold chips that are a mere 50 to 60 microns in diameter.

“The idea is to see if we can detect the presence of multiple organisms or toxins in a single pass,” he explains. “Whenever there’s an interaction, there is a corresponding change in the optical response. We are trying to monitor antibody-antigen or DNA interactions label-free using an image-based response.”

Finding new ways to clean food has been the specialty of Ali Demirci, assistant professor of agricultural engineering. Demirci has explored numerous technologies for cleaning fruits and vegetables. One technology, electrolyzed oxidizing (EO) water, can be used to decontaminate biological agents.

By passing very dilute salt water through an electrical field, EO water is created. The combination of low pH, chlorine content, and strong oxidation-reduction potential makes EO water an ideal candidate for getting rid of biological agents.

“The acidic water is used for inactivation while the alkaline water acts like a detergent for cleaning,” he says.

Demirci originally applied the technique to disinfect farm equipment and buildings from animal diseases. But with the continuing terrorist threat, he is finding his EO water pressed into a different kind of service.

“The EO water can be used to disinfect biological agents, whether they’re there unintentionally or intentionally,” he says. “What we did used to be called food safety. But now it’s also homeland security.”

—Barbara Hale, Andrea Messer, and Curtis Chan
Engineers develop new fractal-shaped tiles for antennas

Penn State engineers have developed innovative design methods for a new class of antennas composed of an array of fractal-shaped tiles that offer anywhere from a 4:1 to 8:1 improvement in bandwidth compared to their conventional counterparts.

The new broadband antennas are composed of irregular but self-similar, repeated fractal-shaped unit tiles or “fractiles” which cover an entire plane without any gaps or overlaps.

Developed by a team led by Douglas Werner, professor of electrical engineering and senior scientist at the University’s Applied Research Laboratory, the concept is the first to introduce a design approach for broadband phased array antenna systems that combine aspects of tiling theory with fractal geometry.

Werner’s team has shown that a fractile array made of unit tiles based on the Peano-Gosper curve offers performance advantages over a similar-sized array with conventional square boundaries.

Architectural engineering builds new lighting laboratory

Researchers and students in architectural engineering can experiment in a new lab where the lights can be switched on or off from a block away or half a world away.

Martin Moeck, assistant professor of architectural engineering, says the lighting lab is flexible enough that individual lights can be dimmed, as well as turned on and off.

“The control system is based on a system that’s used in Europe,” he explains. The room uses the Digital Addressable Light Interface (DALI), and each circuit is wired with standard telephone wire.

Moeck states that DALI uses an open source protocol. “Anyone can write control software to dim these lights according to some input,” he says. “By connecting the controls to the Web, you can control the lights. Facility managers, for example, can shut off the lights in individual rooms or parts of rooms from anywhere there is an Internet connection.”

The system could also allow individual employees in large work areas to adjust lighting in their own part of the office to their liking, he says.

The new lab, located in Engineering Unit A, has already been incorporated into two architectural engineering courses.

“It has totally changed my teaching style,” Moeck says.
Apple harvesting methods strain workers

Hot cider and pies are just two of the tasty treats associated with apples, but according to a Penn State engineer, getting those apples to millions of Americans is a difficult and sometimes painful job.

Despite awareness and advances in ergonomics, Andris Freivalds, professor of industrial engineering and director of the College’s Center for Cumulative Trauma Disorders, says that apple-harvesting methods have changed little over the years.

“All of the picking is done by hand,” Freivalds explains. “Only the cleaning and washing are automated.”

Freivalds says apple harvesters typically carry a bucket-like container with a single or double strap as they gather apples. With a bucket firmly attached, a laborer routinely bends over to pick apples and climbs ladders to get hard-to-reach fruit throughout the work day. These repetitious actions can cause strain on workers’ elbows, shoulders, torsos, hips, knees, and ankles.

Study suggests lower height for crash guards

Penn State simulation testing suggests that barriers, called underride guards, placed on the rear of heavy trucks to prevent cars from sliding underneath and being crushed in rear-end collisions may be less effective if placed lower or higher than 16 inches from the ground.

The National Highway Transportation Safety Administration regulations set a maximum ground clearance of 22 inches and no minimum for underride guards on new trucks.

The Penn State simulation study also showed that underride guards that include diagonal struts increase impact resistance. When the struts were used, vehicle penetration under the truck was fairly small in the simulations.

Moustafa El-Gindy, director of the Vehicle Simulation Research Center at the Pennsylvania Transportation Institute, headed the study. His team used a commercially available computer simulation program, called LS-DYNA, to model different underride guard designs and a Geo Metro computer model from the National Crash Analysis Center as a representative of small passenger vehicles.

A simulation shows extensive damage to a car after it collides with a truck that has a strut-less underride guard at 64kph.

After a 64kph collision with a truck equipped with an underride guard with struts, only the car’s front end sustained damage.
Copper wire shown to be competitive with fiber optic cable for LANS

Penn State engineers have developed and simulation-tested a copper wire transmission scheme for distributing a broadband signal over local area networks (LANS) with a lower average bit-error rate than fiber optic cable that is 10 times more expensive.

Mohsen Kavehrad, the W.L. Weiss professor of electrical engineering, director of the Center for Information and Communications Technology Research, and study leader, says, “Using copper wire is much cheaper than fiber optic cable, and wire is often already in place. Our approach can improve the capability of existing local area networks and shows that copper is a competitor for new installations in the niche LANs market.”

“In the existing copper gigabit systems, each pair of wires carries 250 megabits per second. For a 10 gigabit system, each pair will have to carry 2.5 gigabits per second,” Kavehrad explains. “At these higher speeds, some energy penetrates into the other wires and produces crosstalk.”

The Penn State scheme eliminates crosstalk by using a new error correction method the team developed that jointly codes and decodes the signal and corrects the errors in decoding.

Minority Engineering Program undergoes name change

The College’s Minority Engineering Program has changed its name to the Multicultural Engineering Programs (MEP).

MEP officials said that the change was brought about by a desire for a name that is more descriptive of the services the program offers. Although the program’s name has changed, officials stress that the services and activities offered by the MEP office remain the same.

Established in 1985, MEP’s mission is to recruit and retain underrepresented students of color. The program offers students tutoring, seminars, recruitment and summer bridge programs, employment information, and scholarships.
Smaller, lighter power adaptors take the weight off laptops

As notebook computers become thinner and lighter, the ever-present bulky power adaptors used for line current approach the weight of the laptops. But smaller and lighter adaptors may be on the way, thanks to piezoelectric technology, according to an electrical engineer.

“Electromagnetic transformers are shrinking slightly, but there are theoretical limitations in reducing the general size,” says Kenji Uchino, professor of electrical engineering. “A piezoelectric motor and transformer can be much smaller and lighter.” One advantage of piezoelectric PC power adaptors is that they do not produce the heat that conventional electromagnetic transformers produce. Electromagnetic power adaptors not only produce heat, but also noise and interference. Piezoelectric power adaptors operate in the ultrasonic range so humans cannot hear any sound produced and they do not produce electromagnetic interference.

Other devices that could use these smaller, lighter power converters include printers, CD and DVD players, tape recorders, and other appliances that operate on both battery and wall plugs.

Study rates road weather information Web sites’ ease of use

Participants in a University usability study of three Web-based, statewide, roadway weather information systems rated Maryland’s easiest to use for trip planning.

Pennsylvania’s road weather Web site was ranked next by the study participants. Ohio’s, which has since undergone an overhaul, had the lowest ease-of-use rating.

Paul Jovanis, professor of civil and environmental engineering, says, “Sites were rated lower if they required several ‘mouse clicks’ to obtain information. Study participants said the capability to specify an origin and destination on an initial site map would greatly enhance site usage.”

The research team noted that public awareness of Web-based, statewide, roadway weather information systems is not high. Among the 98 people in the study, only seven percent had ever used a state-based Web site previously for roadway weather. Nearly 60 percent of the participants relied on the TV weather channel. About 45 percent used other Web-based sources.

Maryland: www.mdot.state.md.us
Pennsylvania: www.dot.state.pa.us
Ohio: www.dot.state.oh.us
Camp to give girls taste of engineering

Girls entering grades 9-12 who are curious about engineering can get hands-on experience this summer at the College’s MTM ’04 Engineering Camp for Girls. The camp takes place July 19-23 and includes experiences in agricultural and biological engineering, bioengineering and optics, environmental construction and design, product innovation, and robotics.

The camp, sponsored by the Women in Engineering Program, invites girls who enjoy math and problem solving to explore engineering careers while making new friends.

For more information and registration, call 814-863-1080 or go online to www.engr.psu.edu/wep. Registration deadline is June 11.

Doped liquid crystals allow for real-time holography

The addition of buckyballs or carbon nanotubes to nematic liquid crystals changes their properties and makes them low-cost alternatives for holographic and image processing applications, according to Penn State electrical engineers.

“By incorporating nanotubular and nano carbon 60 structures into liquid crystals, we make the nonlinear optical properties a million times bigger than all other existing materials,” says Iam-Choon Khoo, professor of electrical engineering.

The addition of these carbon structures alters the crystalline alignment of the liquid crystals and changes the optical properties. Just as some materials react to an electrical current, these doped liquid crystals react to light. The liquid crystal, when exposed to light, changes its axis of refraction.

One image processing application where this doped liquid crystal film can be used is in focusing optical telescopes. Using the film as the capture material for a holographic image of the starfield, the garbage created by optically viewing very distant and weak stars can be eliminated and a holographic view of the starfield in real-time provided.

These films can be used to create real-time holographic movies and can also be used in low-light situations as they are very sensitive to light.
There is a good chance that first-year engineering students taking ED&G 100 will never look at used corrugated cardboard the same way again.

**Andrew Lau**, associate professor of engineering, and **Liz Kisenwether**, assistant professor and director of the engineering entrepreneurship minor, developed a project which challenges students to use cardboard to design a useful piece of furniture for a college dorm or apartment. Students then have to consider the structural issues associated with using cardboard and determine the best way to market the final product to other college students.

“One of the main goals of the class is to teach sustainability—meeting the needs of the present without compromising the ability of future generations to meet their own needs,” explains Lau. “Part of sustainability is ‘green design,’ building products that are less harmful to the environment by reducing the pollution generated in manufacturing and decreasing use of non-renewable materials.”

Teams of three or four students work together to survey other students on what type or piece of furniture they can use. The teams then have six weeks to analyze their survey results and define a product, research the design and construction of the product, develop detailed drawings of the product, produce and test a prototype, put together a Web-based product brochure, and submit a final report.

“Students get creative with cardboard”

“If we can make a chair out of cardboard, it makes me wonder what else it can be used for.”

— Terry White
Students are challenged to make a final product that is ninety-five percent corrugated cardboard.

Lau and Kisenwether visited the Centre County Solid Waste Authority to get some of the cardboard for the project. Some students found their own ways to get supplies. “My project mates and I will be dumpster diving behind the Hammond Building looking for materials to use for our television stand!” says Valerie Costa, an industrial engineering major.

Lau says students feel like they are getting something out of the course because they can actually use their finished products. Nicholas Tomaine, an aerospace engineering student, adds, “What other class would allow you to build an eco-effective card table out of cardboard and commend you for it?”

In addition students can examine the entire life cycle of a product. Where does it come from? How is it made? How is it used? What happens when it is done being used?

Terry White, a first-year civil engineer, sums up his experience. “If we can make a chair out of cardboard, it makes me wonder what else it can be used for.”

—Stefanie Tomlinson
Underneath the mask

Who is the Nittany Lion? Here’s a hint: for the second year in a row, he’s an engineer.

This time around, he’s Stephen Soung, a fourth-year mechanical engineering senior from Pittsburgh, PA.

Although he admits he’s a busy student, Soung says he wanted more than just an engineering degree before leaving Penn State.

“I was looking at my college experience, and I wanted to commit to something that lets me interact with the local and University communities,” he says of trying out for the furry mascot. “The lion was the way to go.”

He adds, “Penn State is such a broad and diverse university. It’s only now that I’m realizing there are all of these opportunities here. For example, I’m taking these great classes in jazz and foreign languages.”

Soung says he enjoys serving as Penn State’s premier ambassador while studying mechanical engineering.

“There’s a side of me that’s serious,” he explains. “But as soon as I put on the lion suit, I can open up my other side and let loose and do stuff like play with kids.”

He’ll don the lion’s mask for two years and will complete his mascot tenure when he graduates in 2005.

Soung also volunteers with the United Way, serves as a mentor in the Schreyer Honors College and the College of Engineering, and is a member of the Phi Sigma Pi honor fraternity.

As for mechanical engineering, he says that’s also a great fit. The son of Taiwanese natives, Soung credits his father, a chemical engineer, for helping him cultivate his strengths in math and the sciences.

He’s already completed internships with the University of Pittsburgh Medical Center, Bechtel Bettis, and 3M. Those three internships have allowed him to work in tissue engineering, design work, and fuel cells.

“You can do so much in mechanical engineering,” Stephen says. “I really enjoy building things and tearing things apart. It is a pretty good match.”

—Curtis Chan
AE students’ portfolios go digital

Architectural engineering students who want to show off their portfolios no longer need to lug around stacks of papers or large cases, thanks to a new architectural engineering department initiative.

Students who are working on their senior thesis, also known as the senior capstone design project, incorporate their efforts into the Capstone Project Electronic Portfolios (CPEP). CPEP is the brainchild of M. Kevin Parfitt, associate professor of architectural engineering and director of the senior thesis program, and Jonathan U. Dougherty, co-instructor for the capstone course and doctoral candidate.

The portfolios are stored on a Web site that is designed, created, and maintained by the engineering students. The e-portfolios include all aspects of the capstone project, from student résumés to project abstracts, technical assignments, and progress reports.

Students can use the e-portfolio as an extension of their résumés to offer potential employers insight into their background and capabilities through the comprehensive senior project.

“In recent years, the building industry has seen a tremendous increase in the use of information and communication technologies (ICT),” Dougherty explains. “The firms, who have implemented ICT solutions, are expanding their knowledge base by hiring recent engineering graduates who not only possess strong technical competencies, but are also able to function in an increasingly technology-savvy marketplace.”

Dougherty continues, “Engineering educators, especially those who teach capstone design courses, must continue to foster an academic environment that will prepare engineering students for the realities of their chosen careers. CPEP introduces future professionals to the ideals of project management and knowledge management through the adoption of ICT and thus, enhances their potential for success.”

The e-portfolios will also serve as an archive for department faculty, future students, and the architectural engineering department.

CPEP was selected by the ePortConsortium to be part of its Electronic Portfolio White Paper. ePortConsortium collaborated with the American Association of Higher Education (AAHE) to prepare the e-portfolio academic project summaries that appear as part of the paper. CPEP will also be included in AAHE’s Portfolio Clearinghouse, an international database for electronic portfolio projects and resources.

—Curtis Chan
From your president

Dear Engineering Alumni and Friends,

As my term as president will end this June, I have been reflecting on the past two years, especially the progress made on the goals we set for PSES. First, we celebrated the 45th anniversary of PSES in fall 2003. This was a significant event for the group—the first of its kind at University Park. A great deal of planning and collaboration among members made this event a night to remember. The following day, the Decade of the PSES Golf Tournament was held at Tofrees Country Club and Golf Course. A poll of the attendees was nearly unanimous that we continue this activity, which supports an endowed undergraduate engineering scholarship.

A second goal of adding new members to the board was accomplished this fall by adding four standing members: Ed Heckman (ESci '66), Jerry Kolbe (EE '86), Sue McNulty (ABE '99), Anita Todd (ME '89) and new members John McKeown (Aero '65), John Mikita (IE ’67), and Dean Butler (AE ’77).

Our first committee, established in 1993 to recruit first-year students, has undergone a major change. Beginning this spring, the recruitment committee will target only those students who are still deciding which colleges or universities to attend. Hopefully, this personal approach will be helpful in bringing these new students to Penn State.

For the second time, PSES members attended the College’s Open House for prospective students. This year, a record number of would-be students and their parents attended, attributed partly to the sudden warm weather we had that weekend. The purpose of PSES involvement in this event is to let the students and parents know about the businesses who hire Penn State graduates and that there are job opportunities out there for successful students.

My two years as president have been very fulfilling and busy. I look forward to continuing as the immediate past president and supporting Ken Martin (EE ’72) as our new president.

PSES means:
- Interaction with students, faculty, and engineering alumni.
- Awareness of and support for meeting the academic and professional needs of students.
- Active involvement with the College and the University.

A note to recent graduates:
You are now a member of PSES! We welcome your participation, so please call me to find out how to stay involved with the College of Engineering.

For more information, contact:
PSES
c/o Cindy Jones
101 Hammond Building
University Park, PA 16802
Tel: 814-863-3384
Fax: 814-863-4749
e-mail: cjjdo@engr.psu.edu
Marc T. Apter (EE ’64) has been elected vice president of regional activities for the Institute of Electrical and Electronics Engineers (IEEE). His responsibilities include overseeing all IEEE geographical and student organizations.

Carl D. Murphy (ChE ’65) retired from Celanses Chemical Company in July 2003. Currently, he is a visiting associate professor in the Department of Chemical and Natural Gas Engineering at the Kingsville campus of Texas A&M University.


David E. Weida P.E. (AE ’71) is founder and president of Business Growth Concepts, Inc. The consulting and training firm, which recently celebrated its tenth anniversary, specializes in sales, sales management, leadership development, and business navigation for professional service firms. In addition to his Penn State degree, Weida holds an MBA from Wayne State University. He and his wife, Barbara, have two children, Sara and Taylor, and reside in Akron, OH.

Herman D. Walter (ME ’82) has been elected a member of the Certification Board Center of the Project Management Institute, an international not-for-profit professional association. The center’s mission is to develop and administer project management credentialing programs and related services for the global project management community. Walter will serve a three-year term.

Anita Arora (EE ’99) announces her engagement to Joseph Trnka. The future bride is employed as a service implementation manager by Vital Network Services in Tampa, FL, and is currently pursuing an MBA at the University of South Florida (USF). Her fiancé, also a student at USF, is majoring in biomedical sciences. The couple will wed on Sep. 18, in Clearwater, FL.

Michelle Blisard Fauzio (EE ’96) and her husband, Billy, announce the birth of their son, Jacob Lawrence, on July 9, 2003. Fauzio is an electrical manufacturing engineer with Mack Trucks, Inc. She and her family live in Nesquehoning, PA.

Jason R. Kretschmer (IE ’95) and his wife, Tami Allen Kretschmer (LIB ’95) announce the birth of their daughter, Alicia Marie, on Jan. 26. Jason is a senior engineer with Amscan in Chester, NY; Tami is an office manager with Geovation in Florida, NY. The Kretschmers live in Bloomingburg, NY.

Robert L. Osborne III (ME ’97), director of engineering for Roush Racing, Inc.’s Nextel Cup programs, has been named crew chief for Jeff Burton and his No. 99 Ford.

Charles Wilfong Jr. (AE ’96) has been appointed information management manager for Johnson & Johnson’s newly formed Information Management Center of Excellence. Wilfong’s responsibilities include global information management in partnership with Centocor, Inc.’s medical affairs functions located in Horsham, PA.

June 3–6
Traditional Reunion Weekend

June 4
PSES meeting
Industrial Engineering Open House (Leonhard Building)

Aug. 14
Summer commencement

Aug. 31
Fall classes begin

Sep. 17
Resumania

Oct. 1
PSES meeting

Oct. 2
PSES Golf Classic
$5 million gift creates dean's chair

A pledge from Harold and Inge Marcus of Olympia, WA, has endowed a dean's chair in Engineering.

The Harold and Inge Marcus Dean's Chair in the College of Engineering will have a major impact on the College. At the dean's direction, income from the endowment could be used to assist students, attract high-caliber faculty, create innovative educational programs and instructional approaches, fund important research initiatives and professional development grants for faculty, purchase key laboratory equipment, and support renowned visiting professors.

"For years, Hal and Inge have been among Penn State’s most generous donors," Penn State president Graham Spanier said. "We are extremely grateful for this latest gift. The Marcus Dean’s Chair will strengthen our ability to attract highly talented men and women to leadership positions in one of our largest academic colleges."

Dean David Wormley added, "This generous gift by Hal and Inge gives our college the ability to make important educational and research opportunities available to our students and faculty."

Harold “Hal” Marcus said he thought that creating the dean's chair was a logical way to help the College of Engineering.

"It seemed like it could be a valuable asset to a dean who’s faced with the myriad of challenges running a college like Penn State Engineering," he observed.

Last year Penn State named the Marcuses the 2003 Philanthropists of the Year. The award is one of the University’s highest distinctions, recognizing exceptional generosity and philanthropic leadership that improves the quality of life for the Penn State community.

In 1998 the Marcuses committed $5 million to the Department of Industrial and Manufacturing Engineering. The program is the oldest of its kind in the nation and also considered one of the best. The department was renamed the Harold and Inge Marcus Department of Industrial and Manufacturing Engineering in 1999 in the couple’s honor.

Previously, they established the Marcus International Exchange in Industrial Engineering—a Partnership Between Penn State and Technion (Israel Institute of Technology). This unique program has utilized technology to provide unprecedented international exchange and collaboration for students.

The Marcuses also support Penn State Hillel, the Foundation for Jewish Student Life.

A native of Brooklyn, Hal Marcus graduated from Penn State in 1949 with an industrial engineering degree. He went on to an international career in his field and later developed a real estate company. He holds a master’s degree from the University of Southern California and is president of Hal Marcus, Inc., and American Villages, Inc., real estate development and management companies.

In 1998 the College of Engineering named him an Outstanding Engineering Alumnus. In 2000, he received a doctorate of humane letters from St. Martin’s College in Olympia, which he has served in many capacities, including president of the college’s board of trustees.

Originally from Copenhagen, Denmark, Inge met and married Hal while he was on a three-year engineering assignment in Denmark in the early 1960s. Inge earned her B.S. in biology from St. Martin’s College and an M.S. in health sciences from Chapman University. She serves St. Martin’s as an assistant professor in biology.

The Marcuses are members of the Mount Nittany Society, Laurel Circle, President’s Club, and President’s Club Circle of Pride, and lifetime members of the Penn State Alumni Association. They are also avid fans of Nittany Lion football.
Chemical engineering alumnus receives prestigious award

The International Institute of Synthetic Rubber Producers (IISRP) has named Penn State engineering alumnus Albert Moore as the recipient of its 2004 Technical Award. The Technical Award is one of the highest honors granted by the IISRP. Moore, who retired from DuPont Dow Elastomers in 1996, earned his B.S. in chemical engineering from Penn State in 1956. He went on to earn a Ph.D. at the Massachusetts Institute of Technology and then joined DuPont’s Research and Development Center in 1961 as a research engineer in the elastomers chemicals department. Moore is being honored for his technical contributions to the research, development, and industrialization of specialty ethylene propylene diene terpolymers and fluoroelastomers. He holds more than 20 process patents and has applied his knowledge of catalyst kinetics and viscosity relationships to construct computer models to control polymerization processes. Until his retirement, he provided much of the technology for new product industrialization at DuPont Dow. He was a DuPont Fellow and was the only recognized Senior DuPont Dow Scientist at the time of his retirement. He received DuPont’s Lavoisier Medal Award for technical achievements in 2000. The IISRP is an international not-for-profit trade association with 45 corporate members in 21 countries producing more than 90 percent of the world’s supply of synthetic elastomers.

Giving to Penn State?

If you’re thinking about donating money to Penn State, check to see if your company has a matching gift program. Corporate matching gifts are a great way for Penn State alumni, parents, and friends to maximize personal contributions to the University and increase the impact of a gift.

By taking advantage of a company’s matching gift benefit, donors may be able to double or even triple the amount of a contribution. A page on the “Give to Penn State” Web site allows donors to find out which companies match gifts to Penn State and how to get the process started. Check it out at www.matching.psu.edu. Questions can be directed to Richard Swails, director of development, at rgsdo@ engr.psu.edu or 814-863-3848.
Continuing Education

Topics in Modern Bearing Technology: Advanced Concepts of Bearing Technology
June 7-11—University Park
T. Harris
Presented in conjunction with the American Bearing Manufacturers Association, this course is designed for engineers with a B.S. in engineering or a related field, who have either attended the Essential Concepts course or who have two to three years of work experience in the bearing or a related industry.

Corrosion Short Course
June 13-18—University Park
B. Shaw
This course features morning lectures on the fundamentals of corrosion and afternoon, hands-on laboratory sessions that highlight the most commonly used experiments to assess corrosion. The course is a continuing education service of the College of Engineering, the College of Earth and Mineral Sciences, and the Penn State Corrosion Center sponsored by GAMRY Instruments.

Computational Methods in Stormwater Management
June 21-23—University Park
T. Seybert
This course covers a comprehensive array of hydrologic and hydraulic tools for stormwater management design, detention facility design, and subdivision planning. The Virginia Tech/Penn State Urban Hydrology Model (VT/PSUHM) will be used to illustrate how these tools can assist in the design of stormwater management facilities. Each attendee receives a set of notes documenting standard stormwater computational methods, speaker presentation notes, and a copy of the IBM-compatible VT/PSUHM program.

Modern Protective Structures
July 12-16—University Park
T. Krauthammer
Sponsored by the College’s Protective Technology Center, this course gives engineers, architects, and safety and security managers practical background information relating to the performance and design requirements for hardened facilities. Comprehensive reviews and advanced research and development topics are designed to augment the technical capabilities of hardening and forensic engineers and scientists. In addition, a review of Blast Damage Assessment (BDA) issues provides forensic and rescue personnel with additional background information. Lectures are supplemented with case studies and hands-on computer simulations.

HEC-RAS River Analysis Program—Introductory Course
Aug. 16-20—University Park
A. Miller
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.

Rotary Wing Technology
Aug. 16-20—University Park
B. McCormick
This course, designed for engineers, presents a comprehensive introduction to rotor craft technology. The lecturers, well recognized in their respective disciplines, will cover a range of major topics, including: aerodynamics, dynamics, stability and control, structural design, acoustics, and (new for this year) propulsion and drive systems.

Essential Concepts of Bearing Technology
Aug. 30-Sep. 1—University Park
T. Harris
Presented in conjunction with the American Bearing Manufacturers Association (ABMA), this course is designed for engineers and others with a technical background, who have little history in bearings, and who need to either adapt their technical training to bearings or would like to upgrade their technical knowledge. The curriculum includes both quantitative and conceptual materials.

Smoke School/Visible Emissions
Sep. 14-15—McKeesport, PA
Sep. 21-22—Allentown, PA
Sep. 28-29—University Park
V. Irwin
This lecture/laboratory course covers the regulation and behavior of visible emissions (plumes) from industrial processes. Each individual’s ability to evaluate plumes will be tested, using a smoke generator. Those who pass the tests will be certified in accordance with EPA Method 9.

For more information
Additional information about these and other engineering conferences can be found on the Web at: www.engr.psu.edu/cde.
You may also contact Engineering Continuing Education directly at:
Phone: 814-865-7643
Fax: 814-865-3969
E-mail: TJR10@psu.edu
This year the College of Engineering conferred degrees on 749 undergraduate and 242 graduate students. At each of these ceremonies, our degrees were conferred with the statement, “With all the rights, privileges and responsibilities thereunto appertaining.” This phrase is based on ceremonies that have taken place for centuries and we might ask what are these rights, privileges and responsibilities—particularly in the context of the world today, which is so different from when the phrase was first spoken. Not only has the world’s geopolitical landscape changed dramatically, but the influence of technology has continued at an increasingly rapid pace, producing ever stronger coupling between continents. However, even in these rapidly changing times, there are certain fundamental truths and practices that do not change. In fact, these may be some of the most important elements we associate with education.

As we confer degrees on our graduates, let us consider the portion of the phrase: “rights and privileges.” Our graduates are a very special group of people in our nation and in the world. A small fraction of the world population receives college degrees. Many of our graduates have benefited from the support—and in many cases sacrifices—of family and friends. Often an exceptional teacher or mentor somewhere along the way has given a special word of encouragement or advice that lit the spark to engage in college education. Students have had the privilege of studying and working with colleagues, teachers, and professors who have helped them to gain new and more mature insights into how the physical and human worlds behave. Our students have had the opportunity to work and learn from fellow students who have a variety of different cultural and geographic origins. In short, college graduates are privileged to have gained levels of knowledge, understanding, and skills that will stay with them throughout their lives.

Now let us consider the second part of this phrase: “responsibilities thereunto appertaining.” As our graduates move into the world, there are implicit if not explicit obligations and responsibilities that they have incurred based on their education. By virtue of their education, graduates gain the privilege of working in a profession where they can truly make a difference. They have incurred a responsibility to help ignite a spark in another person who will also benefit from education. As we consider these responsibilities in light of the shrinking distances in the world, it is particularly important that graduates appreciate and value each individual’s contributions and cultural backgrounds and recognize that different individuals will make different types of contributions to society. This is an important part of their responsibilities. It is equally important that our graduates realize that they must also work in unison with other colleagues. It has become abundantly clear that most worthwhile accomplishments in today’s world are achieved by a group or groups of people working together. Thus, an education provides a level of understanding that helps each individual to be valued for their diverse capabilities and to be valued as a team member as well.

An important part of our graduates’ responsibilities results from the fact that each of them represents the best and brightest of their generations and thus, they have a responsibility to continue learning throughout their lives. In citing the need to keep learning, Leonardo da Vinci said, “Learning is the only thing that the mind never exhausts, never fears and never regrets.”

We are hopeful that our educational experiences in the College of Engineering have helped prepare our students so that they can truly achieve “with all the rights, privileges and responsibilities thereunto appertaining.”
IST Building opens for business

On Jan. 22, the University officially dedicated the Information Sciences and Technology (IST) Building, a 199,000-square-foot facility housing faculty members and classes for both the Department of Computer Science and Engineering and the School of Information Sciences and Technology.

The building includes the latest technology, laboratories, and classrooms, as well as a Cybertorium and café overlooking North Atherton Street. It also features a pedestrian walkway that links east campus and west campus.

Attending the ribbon-cutting ceremony were, from left, Michael DiBerardinis, secretary of the Pennsylvania Department of Conservation and Natural Resources; Edward R. Hintz Jr., former chair of Penn State’s Board of Trustees; State Sen. Jake Corman, chair of the Senate Communications and Technology Committee; Penn State President Graham B. Spanier; James B. Thomas, IST dean; David N. Wormley, Harold and Inge Marcus Dean of the College of Engineering; and Rafael Viñoly, principal, Rafael Viñoly Architects P.C.