ENGINEERING
insights
College of Engineering University of Notre Dame
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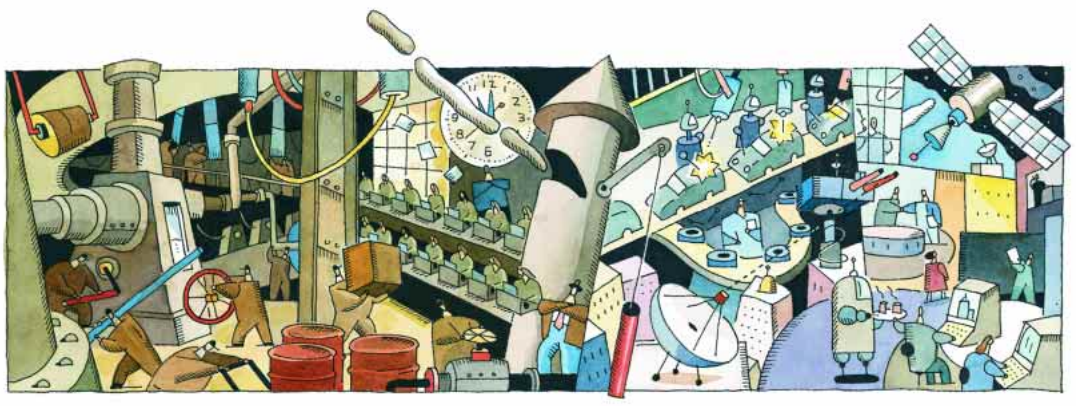
A New Age of Invention, a New Era of Discovery, and a New Approach to Educating Engineers

Some say this new millennium is six months old. Others say it won't begin for another six months. In either case no one can dispute the wonders modern technology and good old-fashioned ingenuity have introduced to the world. The changes in the last 100 years alone are staggering. Mankind has seen the introduction of automobiles and aircraft. Food can be processed and stored for long periods of time in cans and in dried or frozen forms. Life-saving vaccines have been developed and surgery can be performed with lasers, leaving few if any scars and greatly reducing recovery times. Even cloning has become a reality and is no longer in the realm of science fiction.

Using the internet and satellite technology, people on one side of the globe can communicate with their friends and family on the other side with the click of a mouse. Jets traverse the globe in a matter of hours. Astronauts spend months in space. And, computers talk back, interacting with their operators in seemingly human ways. Many people view these milestones positively. They call it progress. But progress has also been described in negative terms, especially with respect to technology's effect on the environment, education, and — at times — ethics.



Engineers of the future must learn how to better assess the effects of technology on human welfare and to interact with other professionals from diverse backgrounds as part of an interdisciplinary team. These skills are not found in textbooks, but they are being addressed by the College of Engineering as it seeks to combine them with a solid background in engineering basics.

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inside

from the **dean**

Since coming to campus two years ago, I have been struck by many aspects of the Notre Dame community, not the least of which is the loyalty and affection of alumni for the institution. These feelings are unmistakable, if not overwhelming, during Alumni Reunion Weekend. I have experienced two such weekends, and the enthusiasm and spirit are infectious.

During Alumni Reunion Weekend, I have used the time allocated to the College of Engineering to provide a 20-minute presentation of opportunities and challenges confronting the College and to then engage the alumni in a free-wheeling discussion of any and all issues of interest to them. This format worked well last year and exceeded all expectations this year. The open discussion continued for over an hour and was followed by one-on-one interactions for at least another half hour. The diverse and incisive views expressed by the alumni, many of whom had well honed thoughts about the evolving nature of technology and the role of engineering education, were stimulating and will become an important part of the mix of inputs we use to shape our programs. It was particularly interesting to hear from alumni whose children are now studying engineering at Notre Dame. Some things change, and others remain the same, like the work load associated with an engineering education.

As you plan to return to campus for future reunions, please take the time to join us on Saturday morning. We want to meet you and to engage you in a discussion of issues of mutual interest.

The past academic year has seen several initiatives blossom. In an effort to expose our first-year engineering intents to the nature and excitement of engineering, two courses, EG111 and 112, were developed and offered to a small subset — 25 students — of this year's freshmen. By all measures, the courses were a success and will be taken by all first-year students this autumn. The courses have several important attributes, not the least of which is their cross-disciplinary nature. Faculty from all of our departments are involved with planning and teaching the courses, thereby blurring distinctions between aerospace, chemical, and other specialized forms of engineering. This kind of melding of curricula across disciplines is not easily done, but I believe we're doing it well and that we will have a truly unique set of courses. The courses also involve collaborative and interactive learning experiences, as well as hands-on activities of the analyze, design, build, test, and communicate nature.

Shed a tear if you will, but Cushing 117, the engineering auditorium, is no more. Renovation is nearly complete, and this autumn it will serve as a Learning Center, primarily to support collaborative and experiential activities in EG111 and 112, but also to enable the enhancement of such activities in each of our departments. The Center, a 4,000-square-foot facility, is also intended to be a test bed for developing innovative teaching and learning methods. What we, as faculty, learn through such efforts will allow us to effectively configure and utilize an expanded — 15,000-square-foot — Learning Center, which will be a centerpiece in the proposed new engineering building. The facility will be used by all departments, as well as by students in the first through fourth year of studies.

Another educational initiative pertains to establishment of a three-course sequence that is at the interface between engineering and business practice. We are currently in a planning stage, but following presentation to and discussions with our Advisory Council in September, we will proceed with implementation.

We have also made significant progress in research. In previous newsletters, I have noted that, because we are a comparatively small college, we can't commit to a full portfolio of research activities. Instead, we must focus on areas that we believe to be critical to life in the 21st century and that best leverage the talents of our faculty. In these areas, we must also be open to collaborations with faculty from other colleges and universities.

The Center, a 4,000-square-foot facility, is also intended to be a test bed for developing innovative teaching and learning methods.

Last year we established a Center for Nano Science and Technology, which includes faculty from the Colleges of Engineering and Science. The Center has demonstrated its ability to compete at a national level through receipt of two multi-million dollar grants from the federal government, as well as a one million dollar grant from the Keck Foundation. After considerable planning and discussion, a second center having to do with Molecularly Engineered Materials is being established, and it too will have strong linkages to the College of Science. We have been successful in securing other large multi-faculty grants, as in the areas of minimally invasive orthopedic surgery and fluid-based microelectromechanical systems (MEMS), and have seen significant program enhancements in areas such as wireless communications and environmental technology/science.

In summary, we feel we are making progress on our goals to achieve preeminence in undergraduate education and distinction in selected areas of research.

Frank P. Incropera

Frank P. Incropera
McCloskey Dean of Engineering
Brosey Professor of Mechanical Engineering

The Cushing Auditorium is in a state of change. It's becoming the new Engineering Learning Center. Scheduled to open in August 2000, the Learning Center will be used by departments and students throughout the College. Standing in the new Center are: (front row, left to right) Salma R. Saddawi, associate professional specialist in chemical engineering; Frank P. Incropera, McCloskey dean of engineering; Lauren Destino, a senior in chemical engineering; Eugene W. Henry, professor of computer science and engineering; and (back row, left to right) Jason L. Garza, a sophomore in aerospace engineering; Scott T. Stender, a junior in computer engineering; and Justin L. Smith, a junior in computer engineering.

According to the Semiconductor Industry Association's National Technology Roadmap for Semiconductors the CMOS technology used in today's chips may not last beyond 2012.

Fact or Fiction:

What will the future look like?

Books like Jules Verne's "2000 Leagues Under the Sea" and George Orwell's "1984" were considered science fiction when they were published. Today, many of their "predictions" are fact. Given recent trends in industry and the market factors that often drive the development of new products, services, and technologies, what types of breakthroughs might occur in the 21st century?

- Voice activated wearable electronic devices
- The ability to grow replacement organs through human tissue engineering
- A permanent settlement on the moon or Mars
- Economical ways to harness, use, and store solar energy
- Development of specialty materials that combine the properties of one material with those of other materials
- Unrestricted trade across all international boundaries

Bits-to-Chips student Ronald Setia, right, cleans silicon wafers in the College's Fabrication Laboratory as Gregory L. Snider, assistant professor of electrical engineering, looks on.

BITS-TO-CHIPS:

Interdepartmental Course Sequence

One example of how the College of Engineering has been changing the way it educates students is the Bits-to-Chips Program. Bits-to-Chips is a National Science Foundation sponsored initiative that focuses on the interactive nature of electrical engineering and computer science and engineering.

Three years ago these two departments began outlining an interrelated set of courses that would emphasize the technical and human aspects of microelectronic system development. "Our goal," said Peter M. Kogge, Ted H. McCourtney professor of computer science and engineering, "was to give students a broad background so they could understand computer technology, how transistors work, and how to build them." In fact, during the course of the program, students design, build, and test their own CMOS large-scale integrated circuits. Each of these chips contains approximately 3,000 transistors, making them slightly more complex than the world's first microprocessor, which was developed in 1971.

Why is it important that these students experience the step-by-step process of creating a system? Because there are limitations to today's technology. The capstone course of Bits-to-Chips, "Frontiers in Microelectronic Systems," discusses these limits using a document called the National Technology Roadmap. It is an industry generated forecast of the state of technological advances and the need for innovations over the next 15 years. The Roadmap suggests that the CMOS technology used in today's chips may not last much beyond 2012. There are physical barriers that are even now coming into play. According to Gary H. Bernstein, professor of electrical engineering, when students experience the interfaces among all the aspects of chip design and manufacturing — technological, intellectual, architectural — they come to accept change as something they will constantly be facing in their careers.

In addition to the collaborative nature of the program — close interaction between the two departments, faculty, and student teams — Bits-to-Chips has an Industrial Advisory Board consisting of representatives from major manufacturers of integrated circuits: Delco, IBM, Intel, Hewlett Packard, Lockheed Martin, and Motorola. They met on campus last spring to review the program and provide feedback from a corporate perspective. Ideally, they will continue to provide valuable feedback to help keep the course on track and a realistic model of what students can expect in their careers.

EG111/112:

Hands-on Engineering for First-year Students

Nothing exists in a vacuum. A practicing engineer often works with other engineers, scientists, researchers, and technologists in a variety fields, including different areas of engineering. For example, changes in a mechanical system may affect its electrical attributes, the chemical nature of a product may affect its packaging requirements, and so on. Because of such factors, it is important that students learn how to deal with systems from a multidisciplinary point of view. EG111 and EG112, two courses for first-year engineering students, stress the interactive and collaborative nature of the world the students will be entering.

The 1999-2000 academic year introduced the prototype versions of these courses to students. Through guest lecturers, special projects, and by using computers to solve a variety of practical problems, students in these prototype courses explored the many fields open to them as engineers.

More than 300 students, all first-year engineering intents, will participate in the course sequence this fall. Students in these courses will be the first to use the new 4,000-square-foot Learning Center, which opens in August. The goals, as they were with the prototype courses, will be to help first-year students understand engineering, to assist those students in developing and applying fundamental engineering skills, and to provide the students with practical design experience. This fall's issue of *Insights* will detail the full course sequence, give a description of the new Learning Center, and introduce the faculty and staff who have made this course sequence a reality. It's an exciting time in the College of Engineering.

Prototype versions of the courses EG111 and EG112 were offered to 25 first-year engineering intents. In this course sequence students learn how to solve engineering problems from a multidisciplinary viewpoint.

NANOTECHNOLOGY:
Transistorless Computing and Digital Applications

One of the nation's largest philanthropic organizations focused on supporting engineering, science, and medical research, the W.M. Keck Foundation awarded the University's Center for Nano Science and Technology a $1 million grant in December 1999. The Center is a result of 15 years of faculty research and educational development. It is also one of the best examples of a campus-wide research focus.

The Foundation is not alone in its recognition of nanoscience, the study of molecule sized elements, as an emerging technology. Earlier this year President Clinton asked Congress to increase the federal government's investment in this area for the coming year — from $270 million to $497 million. Additionally, in a report entitled "Shaping the World Atom by Atom," the White House Office of Science and Technology Policy stated that nanotechnology could lead to another industrial revolution.

Nanoscience and technology are also hot topics on Capitol Hill. In fact, James L. Merz, vice president for graduate studies and research and Freimann professor of electrical engineering, was part of a roundtable discussion in the Russell Senate Office Building earlier this year. Invited by the Science and Technology Caucus of the Senate, Merz and three other participants presented the potential economic benefits and scientific applications of nanoscience and the implications for related discoveries on U.S. research and science policy.

Merz and other College of Engineering faculty continue to lead a University-wide team of researchers as they explore nanoconcepts for industrial applications. What does it mean for students? Notre Dame's successes in nanoelectronics

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the pursuit of **leadership** ...

After four years of intense study in engineering and with the opportunity to make more than $50,000 immediately out of college, it's easy to understand why many graduating seniors are lured into industry. Companies promise high starting salaries, signing bonuses, and future fortune. Absolutely nothing is wrong with that, if that's what the student has determined is best for him or her. However, more and more students are exploring other options and opportunities.

"What I usually tell undergraduates thinking about graduate school," said James L. Merz, Dean of the Graduate School at Notre Dame, "is that the Ph.D. is less a consideration of financial benefit — the principal benefits are not economic; a B.S. student can get a high-paying job, while a graduate student loses five to six years of income that takes time to make up — than it is opting for a position of strong potential leadership in the future, for personal satisfaction in terms of leadership."

Kara M. Young, Ph.D. candidate in civil engineering and geological sciences, works with Professor Robert L. Irvine to monitor the treatment potential of organisms in a bench-scale sequencing batch reactor (SBR). Notre Dame is a leader in bioengineering, which focuses on the biological treatment of municipal and industrial wastewater and hazardous materials. SBRs, which were initially developed at the University by Irvine and Lloyd Ketchum, an associate professor of civil engineering and geological sciences, are the fastest-growing water treatment systems in the world.

What does Merz mean? Consider this: many high-ranking executives in companies like General Electric, Kodak, Hewlett Packard, AT&T, and Texas Instruments have advanced degrees in engineering, chemistry, and physics. In fact, many of the people who provide vision, direction, and leadership for today's technology — and those who will do so in the future — are those with graduate degrees.

That's not to say that all students should pursue graduate degrees, or even do so immediately after graduation. There are several factors to consider. A student who earns a master's degree is probably better prepared to go into industry with better prospects for a career. That extra year or two allows a student to pursue a subject more deeply than one possibly can as an undergraduate. On the other hand, an individual could gain valuable experience in industry before seeking a graduate degree. In fact, many companies offer financial assistance for the continuing education of their employees. Industry experience also makes an individual a more attractive master's level candidate. Prevailing opinion is that students seeking a doctorate remain more focused if they go straight from the bachelor's degree. Otherwise they might lose the discipline, energy, and total commitment needed for a Ph.D.

What can also sway a student's decision is his or her area of interest. Whether choosing to remain at an alma mater or pursue an advanced degree elsewhere, there are many questions to answer. What is the ranking of a particular graduate program? Are the faculty national leaders in their field(s) of study? What resources are available — computers, laboratories, etc. — to help the student achieve his or her goal? And, what is the student-to-faculty ratio?

Answering these questions is where many Notre Dame graduate engineering programs shine. For example, the graduate program in aerospace engineering and mechanical engineering hold national rankings. Additionally, faculty from the Department of Aerospace and Mechanical Engineering include a member of the National Academy of Engineering, several Fellows of the American Institute of Aeronautics and Astronautics, several Fellows of the American Society of Mechanical Engineering, an ASME Freeman Scholar Award winner, two winners of the prestigious Humboldt Prize, a National Science Foundation Young Investigator, an Office of Naval Research Young Investigator, two NSF CAREER Award winners, and many other distinguished faculty. The electrical engineering graduate program includes a team of faculty who are experts in the field of nanoscience and were the first to demonstrate the applicability of a novel nanodevice, Quantum Cellular Automata, to transistorless computing.

As in the other departments throughout the College of Engineering, graduate students work closely with their faculty advisors. The graduate student-to-faculty ratio in most cases is on the order of three to one.

Notre Dame's engineering graduate students frequently attend national conferences where

Outstanding Graduate Student Teacher Awards

The University's Kaneb Center for Teaching and Learning has honored the following engineering graduate students who have distinguished themselves as teaching assistants in classrooms, laboratories, and lecture halls. They are:

AEROSPACE AND MECHANICAL ENGINEERING
Corey Bourassa
Gerardo C. Diaz
Edward J. Fitzgerald
Denis A. Lynch
Karinna M. Vernaza

CHEMICAL ENGINEERING
Jason M. Keith
Robert W. Maier

CIVIL ENGINEERING AND GEOLOGICAL SCIENCES
Tracy L. Kijewski-Correa

ELECTRICAL ENGINEERING
Joydeep Ganguly
Gang Jin
William MacDonald

Engineering Graduate Students: Doing More than Making the Grade

One option available to many undergraduates is the opportunity to continue their studies in the College of Engineering as graduate students. Many of our master's and doctoral candidates participate in groundbreaking research. Several of them have been recognized for publications in engineering and science journals, for their dissertations, and for their overall excellence in teaching. Here are just a few of the outstanding graduate students who have made news this academic year.

ISLAMSHAH AMLANI graduated in 1999 with a Ph.D. in electrical engineering. A native of Karachi, Pakistan, he came to Notre Dame in 1994. Upon graduation he continued to work in the department as a postdoctoral student. Amlani was a valuable member of the Nano Devices Team at the University, a multidisciplinary group of researchers investigating the possibilities of Quantum-dot Cellular Automata (QCA). One result of his research is that he placed first in the Merrill Lynch Innovation Grants Competition this year. A global contest, the Grants Competition challenges doctoral students to identify commercial possibilities of their dissertation research. Amlani is now a research engineer for Motorola in Tempe, Ariz. He is continuing his work in the area of nanotechnology.

CHARLES L. ARVIN, a Ph.D. student in the Department of Chemical Engineering, has been named the recipient of the IE & EE Division Student Achievement Award from The Electrochemical Society. Arvin received a B.S. in chemical engineering and translator Russian in 1993 from Rose Hulman Institute of Technology in Terre Haute, Ind. He then moved to Savannah, Ga., where he worked as a process engineer for Union Camp Corporation while also completing his master's degree in business administration. His time at Union Camp emphasized the effects chemicals can have on equipment, specifically the corrosion process. He is currently studying the mechanism through which hexavalent chromium inhibits corrosion.

The Skidmore, Owings & Merrill (SOM) Foundation awarded the 2000 Structural Engineering Traveling Fellowship to TRACY L. KIJEWSKI-CORREA, a doctoral candidate in the Department of Civil Engineering and Geological Sciences. Originally from East Chicago, Ind., she will travel to the Far East to study wind effects on some of the tallest buildings in the world, including the Petronas Towers in Kuala Lumpur and Jin Mao Tower in Shanghai. Kijewski-Correa has received numerous honors during her tenure at Notre Dame, including a fellowship from the University's Center for Applied Mathematics, the Dondanville Family Graduate Award for Excellence in Teaching by a Graduate Student, and a National Defense Science and Engineering Fellowship.

South Bend resident MICHAEL T. NIEMIER is a Ph.D. student in computer science and engineering. He just passed his qualifying exams in pursuit of his doctoral degree. In addition to winning the Arthur J. Schmitt Fellowship from Notre Dame in 1998, he received a National Science Foundation Fellowship in 1999, recognizing his research and exceptional work in low-level circuit design using QCA. Niemier recently placed third in the Design Automation Conference Student Design Contest. His paper, co-authored by computer science and engineering senior Michael J. Kontz, will be presented in a regular conference session, an outstanding accomplishment for a student paper.

SUSAN OLSON, a Ph.D. candidate in aerospace and mechanical engineering, focuses on experimental aerodynamics, airframe noise reduction, and aeroacoustics. She has been named the recipient of the Zonta International Amelia Earhart Fellowship Award, an honor given annually to women pursuing graduate study in aerospace related sciences and engineering. In 1997 she also received the Clare Booth Luce Fellowship. She is currently doing research on lift-degrading and acoustically radiating flow unsteadiness associated with high-lift wing systems, an effort supported by a grant from NASA's Ames Research Center. Olson is from Henderson, Ky.


AMLANI


ARVIN


KIJEWSKI-CORREA


NIEMIER


OLSON

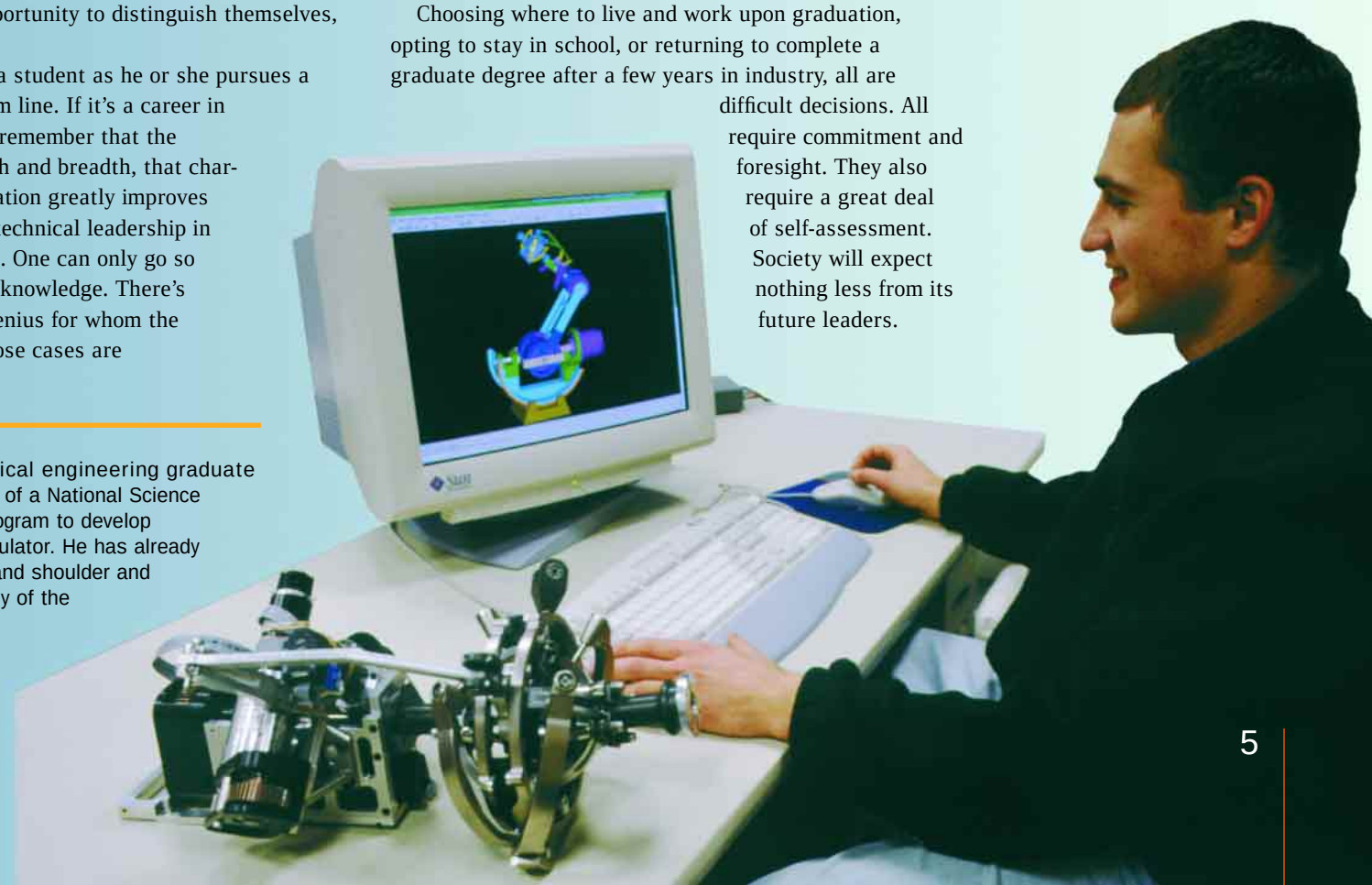
they present their findings. This activity allows students to develop peer relationships with others in their field and interact with national leaders. Having the resources available to perform research is also important. Notre Dame's computing resources are outstanding, providing students the access, capacity, and speed for their computations.

Current laboratory facilities are also top-notch and include nationally recognized sites such as the Hessert Center for Aerospace Research, featuring one of the country's few anechoic wind chambers; the Structural Dynamics and Control/Earthquake Engineering lab, the Environmental Hydraulics lab, and the Wireless Communications lab. Graduate students using these facilities have ample opportunity to distinguish themselves, as they often do.

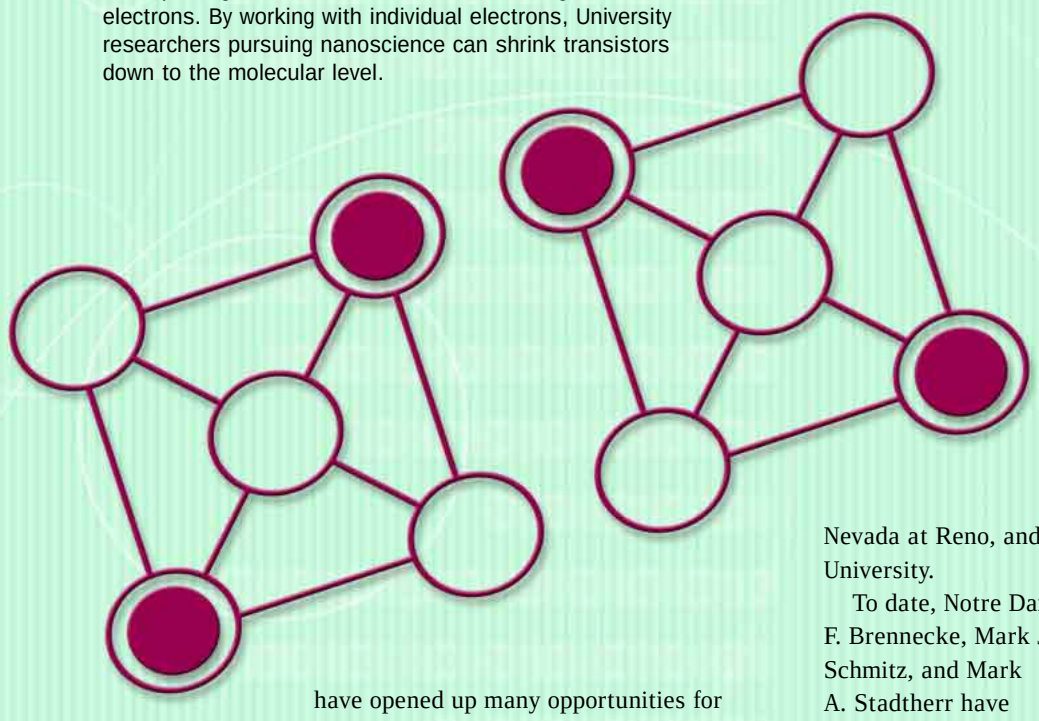
What will best serve a student as he or she pursues a career? That's the bottom line. If it's a career in industry, students must remember that the kind of thinking, in depth and breadth, that characterizes graduate education greatly improves prospects for providing technical leadership in a corporate environment. One can only go so far on experience-based knowledge. There's always the occasional genius for whom the rules don't apply, but those cases are exceptions. On the whole people who provide leadership in technology-driven organizations have advanced technical degrees, broad interests, and honed interpersonal skills.

Those seeking careers in academia might want to consider what will be happening across college campuses during the next ten years. Even now universities are experiencing a period of faculty transition never before seen in this country. Approximately a third of the current engineering faculty nationwide will be retiring by 2010. Why? It's simple. The first big wave of engineering Ph.D. graduates in the U.S. occurred in the late 1950s and early 1960s. As they retire, numerous opportunities for new Ph.D. graduates could be available.

Choosing where to live and work upon graduation, opting to stay in school, or returning to complete a graduate degree after a few years in industry, all are difficult decisions. All require commitment and foresight. They also require a great deal of self-assessment. Society will expect nothing less from its future leaders.



Aerospace and mechanical engineering graduate student Jack Feix is part of a National Science Foundation sponsored program to develop a complete robotic manipulator. He has already designed the upper arm and shoulder and will oversee final assembly of the entire machine.



Quantum-dot cellular automata is based on encoding binary information, similar to today's microelectronics but replacing the current switch with an arrangement of electrons. By working with individual electrons, University researchers pursuing nanoscience can shrink transistors down to the molecular level.

have opened up many opportunities for engineering students — undergraduates and graduates alike. In fact, several of our graduate students have already received recognition for their efforts as part of this initiative. This is a trend the College expects to continue.

"GREEN" ENGINEERING:
Preventing Pollution before It Begins

Man's track record in pollution prevention and remediation is less than ideal. However, the past 30 years have brought about many changes in environmental policies. The way engineers look at pollution — how to prevent it and reclaim contaminated areas — has also changed. Faculty in the Department of Civil Engineering and Geological Sciences have received much national attention for their research in preventing pollution and removing contaminants, but pollution prevention is a relatively new thrust of chemical engineers. Previous programs in the field have focused on remediation techniques. Current efforts seek to "reduce" pollution by using the fundamental principles of chemical engineering to develop pollution-free processes. It is always easier and less costly to avoid creating pollution than it is to clean it up.

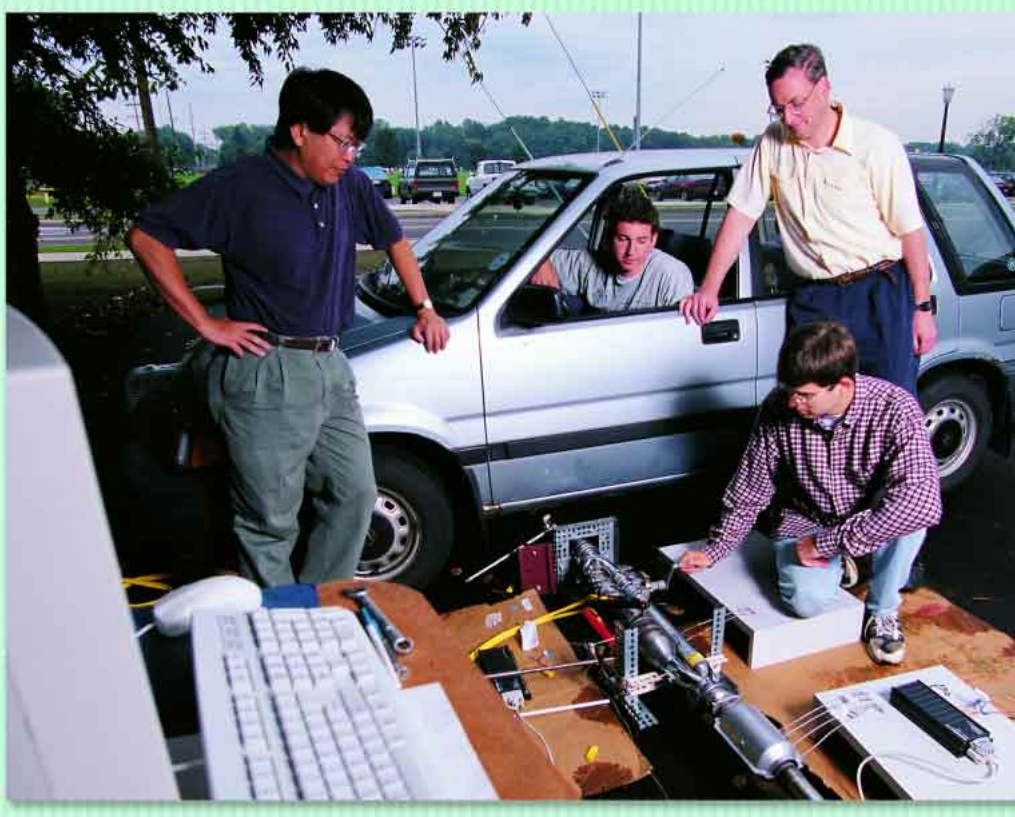
Faculty in the Department of Chemical Engineering are linking ecology with engineering processes. Obviously, that link needs to occur in industry to be effective, but they believe the groundwork needs to be established in the educational process. Teaching students how to design chemical processes that minimize the production of pollutants is the goal. Part of this activity involves Notre Dame's participation in the Combined Research Curriculum Development Program (CRCD), a cooperative effort between the University of Notre Dame, the University of Nevada at Reno, and West Virginia University.

To date, Notre Dame professors Joan F. Brennecke, Mark J. McCready, Roger A. Schmitz, and Mark A. Stadtherr have developed two courses that address environmentally conscious chemical process design. The group is currently working to integrate aspects of these new courses into all courses in the department's curriculum.

Another component of the CRCD program centers around the use of supercritical fluids and ionic liquids for extraction and separation processes. A supercritical fluid is a compound that has been heated or pressurized above its critical point, the highest temperature/pressure at which its liquid/vapor equilibrium can exist. The two most popular of these fluids are carbon dioxide (CO_2) and water. Both are non-toxic, non-flammable, and inexpensive.

Supercritical fluids are already used in the food industry. Much of the world's tea and coffee is decaffeinated using supercritical CO_2. To better understand supercritical fluids, students in CRCD courses have been experimenting with different extraction methods.

One of their projects involved comparing the conventional method of extracting soybean oil to an extraction process using supercritical CO_2. There were advantages and disadvantages to both extraction processes, but the study provided the students with a glimpse of the opportunities offered by using a supercritical fluid. More important, it made them think not only of the end result of the extraction — usable soy bean oil — but of the environmental impact associated with the by-products of each reaction.



Graduate student Jason Keith, kneeling, has worked closely with Hsueh-Chia Chang, Bayer professor of chemical engineering, standing left, and David T. Leighton Jr., associate professor of chemical engineering, standing right, to develop a faster-acting, and thus cleaner-running, automotive catalytic converter. The team can now increase the temperature of the fuel faster, leading to a more rapid reaction for an estimated pollution reduction of 50 percent. As the project continues, the group expects to refine their design to reduce pollution as much as 90 percent below current levels. Also shown in the photo, seated in the car, is Eric Sherer, a participant in the College's 1999 Research for Undergraduates summer program.

And, that's the goal of the College. By giving students hands-on opportunities, treating them as engineers, introducing them to the multidisciplinary and interactive nature of the engineering profession, the College will produce graduates better equipped to face future challenges and find the solutions needed for life in the 21st century.

Designing environmentally friendly chemical processes is a focus of Professors Mark A. Stadtherr, Joan F. Brennecke, and Keating-Crawford Professor Roger A. Schmitz, shown left to right. They, along with Mark J. McCready, chair of the Department of Chemical Engineering, lead a multi-university initiative to integrate aspects of ecology into engineering curricula. Major components of the new courses include mathematical modeling and computer simulations.

APMEP Ends Its Fifth Year in Typical Distance-learning Style

The Ameritech Pre-College Minority Engineering Program (APMEP) is an after-school instructional program designed to stimulate interest in engineering among minority middle school youth. Since its inception five years ago, the program has received numerous awards and much deserved recognition. The most recent honor was its recognition by the Northern Indiana Project Athena Consortium for "offering innovative studies in engineering for minority students through the Vision Athena Distance Learning Network."

During the first four years of the program, participants from middle schools in the South Bend/Mishawaka area gathered twice a month, from October through May, at four different sites. Two-way interactive video delivered the programming, enabling each site to participate in real time with instructors and other students in the program. This year the APMEP expanded to include a site in Indianapolis — Harshman Middle School, part of the Indianapolis Public School Corporation. Students there, and the students in the South Bend area, examined the many different facets and opportunities available in engineering. They spoke with practicing engineers, performed experiments, and took virtual field trips, exploring companies like Lockheed Martin and talking with some of the engineers there.

On Friday, May 5, 31 minority middle school students, their parents and families, and the staff and volunteers of the APMEP celebrated the end of another successful year in a closing awards ceremony. Typical of how the program is run, the closing ceremony was also conducted via distance-learning technology with audiences in each of the four program sites. Since this was their first year as participants, the Indianapolis students and staff were especially excited as honors were distributed.

Dr. John Sekula arranged, organized, and led APMEP students on a virtual field trip of Lockheed Martin's Advanced Technology Center. Students discussed solar activity, the sun's corona, sunspots, mapping stars, and the Earth's magnetic field. Other Lockheed Martin engineers who participated in the field trip were Drs. Tom Berger, Dave Chenette, Jack Doolittle, Steve Fusilier, Paul Robb, Aiden Roche, Bill Rosenberg, Alan Title, Ken Triebes, and Richard Vassar.

Each student received recognition for participation in the 14-session program that began in October. They were given a Class of 2000 blue ribbon, an APMEP T-shirt, and a certificate of completion. In addition, several students were singled out for their individual efforts and achievements.

Brittany Clark and Arman Sabagghi, students from Clay Middle School in South Bend, received the APMEP's highest honor, the Leo Dilling Award. This award, named for a strong supporter of the APMEP and member of the College of Engineering Advisory Council, is given to those students deemed the best of the best. It is based on superior academic performance in school and outstanding participation and progress in the APMEP. Recipients must receive straight A's in school and score 85 percent or better in the APMEP, including homework assignments and oral reports. The Dilling Award includes a certificate toward engineering camp and/or related programs until the student graduates from high school.

In South Bend awards for attendance and homework went to Dwayne Jeter, Dominique Moore, Erica Scott, Marcos Flores, Alicia Highsmith, Lyla Azar, Michael Bueno, Adam Cecil, Joshua Sanders, Rosalyn Wells, and Hermon Zounlome. Academic Excellence Awards were bestowed upon Lyla Azar, Michael Bueno, Jeremy Marshall, Christian Barbary, Arman Sabbaghi, Dwayne Jeter, Erica Scott, and Brittany Clark. Erica Scott received the Alvarez Leadership Award, named for former APMEP participant Rachel Alvarez and presented for a consistent demonstration of initiative and maturity.

Indianapolis participants Corrine Morrion, Miguel Jones, Brandie Wright, LaPrecious Johnson, and Ja'Nieka Conley were recognized for honor roll membership at their respective schools. Awards for perfect attendance during the second half of the year went to Dwight Wyatt and Jason Canady, and several other students received honors for positive attitudes, reliability and consistently high effort, enthusiastic participation, and grade improvement in school work.

Closing ceremonies for the Ameritech Pre-College Minority Engineering Program (APMEP) were held on May 5 simultaneously in South Bend and Indianapolis. Student participants and teachers were honored for their efforts. While some students received specific awards, each student was presented with an APMEP T-shirt, a certificate of completion, and a Class of 2000 blue ribbon.

Ameritech

A Special MEP Thank You

For the last five years the Minority Engineering Program has had the opportunity to introduce more than 200 minority students to engineering through the Ameritech Pre-College Minority Engineering Program. Still with all the technology and planning involved at the University of Notre Dame, the program would not be successful without the hard work and dedication of the many teachers, volunteers, and parents who are actively involved in the students' education. The Minority Engineering Program would like to take this opportunity to say a special thank you to all who have participated, most recently those involved in this year's program:

Harshman Middle School, Indianapolis
Mrs. Donna Chastang
Mrs. Linda Gagyi
Mrs. Joyce Pachiarz
Ms. Yolanda Taylor, an IUPUI student

Adams High School, South Bend
Mr. Enos Inniss
Mr. Miguel Marquez
Mrs. Theresa Phillips
Mrs. Yolanda Turner-Smith
Mr. Justin Smit

University of Notre Dame, Notre Dame
Mr. Jucain Butler
Mrs. Julie Cramer
Mr. Chris Harris
Mr. Robert Minniti
Mrs. Karen Morris
Ms. Yesenia Valencia, a Notre Dame student

Washington High School, South Bend
Ms. DeVetta Blakely-Nelson
Mr. Tim Hardt
Mrs. Dana Marsh
Mr. John Scroggins, a Notre Dame student

In Recognition of Academic Achievements

The College of Engineering is proud to announce that the National Science Foundation has awarded graduate fellowships to Keli Engvall and Nicholas Glassmaker. Engvall is a civil engineering major from Grand Rapids, Mich. Glassmaker, who also received a fellowship from Tau Beta Pi, the national engineering honor society, is a mechanical engineering major from Cherokee, Iowa.

Another senior and a junior engineering student have received James J. Burke Scholarships for 2000. Each year the Department of Electrical Engineering awards Burke Scholarships to students who demonstrate interest in pursuing careers in the electric power and associated industries. This year Thomas A. Cullen, a senior from Boca Raton, Fla., and Paul T. Ratz, a junior from Annapolis, Md., were honored. The Burke Award was established by James J. Burke ('65, EE) in 1996 after receiving the Award for Excellence in Power Engineering from the Institute for Electrical and Electronic Engineers.

Rebecca E. Glatz received a Barry M. Goldwater Scholarship and Award for Excellence in Education. Nominated by faculty from the College, she is one of only 309 students nationwide to receive this award. Glatz is a junior geosciences major from Ames, Iowa. She also works as an undergraduate research assistant in the Department of Civil Engineering and Geological Sciences' Environmental Mineralogy & Crystal Structures Laboratory.

Rev. Thomas A. Steiner Awards

An 1899 civil engineering graduate of Notre Dame, Father Thomas A. Steiner, C.S.C., was Dean of the College of Engineering from 1928 to 1938. Father Steiner, while making a great impact on the course of the College, made an even greater impact on the lives of his students. In 1948 his former students established the Reverend Thomas A. Steiner Prize. This award is presented annually to seniors within the College of Engineering who exhibit a dedication to the application of engineering principles, a zeal for learning, outstanding leadership abilities, and a commitment to the values and tenets of the University.

This year's Steiner Award recipients are: Lauren Destino, Scott Durbin, Nicholas Glassmaker, Kathryn Hammel, and Kevin O'Neill. Each of these students was nominated by their individual departments and eventually selected as Steiner honorees on the basis of their cumulative grade-point averages, campus activities, and off-campus service.

Lauren Destino, a chemical engineering senior and native of DePere, Wis., has been involved in numerous activities, honor societies, and professional societies during her time at the University. She was corresponding secretary for Tau Beta Pi, the national engineering honor society, and a member of the American Institute of Chemical Engineers. She was active in dorm life serving on the Freshmen Orientation Committee and the student Judicial Board. A member of the Dean's Student Advisory Committee, she was a collaborative learning leader in chemistry and served as a tutor in the Learning Resource Center. Destino served as a volunteer in the Chapin Street Clinic in South Bend, the HUGS program, and for GED classes. She completed the pre-med option of the engineering program, which required her to use electives for biology courses.

According to his professors, Scott Durbin was academically skilled and willing to do the extra work to make his university experience more valuable. While at Notre Dame, he served as an officer in two separate engineering honor societies and a member of the American Society of Civil Engineers. He participated in the January 2000 Haiti Seminar, traveling to the country to fix and replace hand pumps, interact with villagers, and establish a permanent locally-owned safe drinking water supply. He also established the first student chapter of a Christian volunteer organization, Lifewater International, whose mission is to improve the quality of life in Third-World countries by providing clean water supplies.

A mechanical engineering student with a grade-point average of 3.975, Nicholas Glassmaker was involved in many activities outside the classroom. He was a four-year member of the Notre Dame Marching Band and the Concert Band. He also participated in the Varsity Band and Brass Ensemble. Glassmaker served as a grader for the Math department for three years and is a member of Tau Beta Pi, the American Society of Mechanical Engineers. He also served as an officer in Pi Tau Sigma, the mechanical engineering honor society. Additionally, he won his department's Novotny Thermal Science Award and recently received graduate fellowships from Tau Beta Pi and the National Science Foundation. Last summer — and winter break — he conducted research at Los Alamos National Laboratory. Glassmaker, the salutatorian of the Notre Dame's Class of 2000, is from Cherokee, Iowa.

Kathryn Hammel, a computer science and engineering student, served as a member of the Notre Dame Council of International Business Development, a tutor for the First Year of Studies program, and a volunteer in South Bend's Big Brother/Big Sister program. A member of the women's rowing team, she was also played interhall football. In 1997 she spent her summer as a day camp counselor at the Arthur Jordan YMCA camp in Indianapolis, her hometown. She participated in the London Summer Engineering Program in 1998, and last year she interned at the Xerox Corporation in Rochester, N.Y. During commencement exercises, Hammel was named Outstanding Computer Engineering Senior by her department.

With a grade-point average of 3.920, Kevin O'Neill of Mayville, Wis., ranked second in the College. He has served as an Appalachia Seminar volunteer, a member of Habitat for Humanity, and a participant in interhall basketball. O'Neill, a mechanical engineering student, is a member of Tau Beta Pi, Pi Tau Sigma, the Society Automotive Engineers, and the American Society of Mechanical Engineers. His summer internship with Ricardo Inc., a leading British consulting firm specializing in internal combustion engine design, netted O'Neill a glowing commendation. His supervisor at Ricardo indicated that he acted as a fully functioning member of the staff who left a noticeable gap when the summer internship program was over.

"Many of our students make us proud," said Dean Incropera. "These particular students have exhibited their talents and skills in ways that demonstrate their all-around excellence. We celebrate their accomplishments to date and look forward to the exciting contributions they will make throughout their careers."

Steiner honorees for 2000 were, front row, left to right, Nicholas Glassmaker and Scott Durbin; back row, left to right, Kathryn Hammel, Kevin O'Neill, and Lauren Destino. Destino, Glassmaker, and O'Neill were all valedictorian candidates for the Class of 2000.

Senior Honors and Departmental Awards

AEROSPACE AND MECHANICAL ENGINEERING

Jerome L. Novotny Design Award in Thermal Science
Nicholas Glassmaker

Patrick J. Deviny Scholarship Award
Noel Lucero

Sigma Gamma Tau Honor Award
Stacie Rupiper

Vince P. Goddard Award for Aerospace Design
Margaret Watson

Zahm Prize for Aeronautical Engineering
Kyle Shaw

CHEMICAL ENGINEERING

Alumni Award
John Barry
Bryan Leitenberger

Faculty Award
Lauren Destino

Outstanding Chemical Engineering Senior
James Kacmar

Research Award
William Janosik
Thomas Norton
Michael Savrovsky

CIVIL ENGINEERING AND GEOLOGICAL SCIENCES

James A. McCarthy Scholarship
Rik Vandermeulen

Kenneth R. Lauer Award
Keli Engvall

Leo D. Graves Academic Improvement Award
Keli Engvall

Raymond C. Gutschick Award
Erin Keppel

Sydney Kelsey Outstanding Scholar Award
Thomas Weiler

William L. Shilts Award for Undergraduate Achievement
Rik Vandermeulen

COMPUTER SCIENCE AND ENGINEERING

Outstanding Computer Engineering Senior Award
Kathryn Hammel

Outstanding Computer Science Senior Award
Lisa Hannan

ELECTRICAL ENGINEERING

Arthur J. Quigley Award
Lizbeth Vazquez

Basil R. Myers Award
Brian Christ

IEC William L. Everitt Award
James Cochran
Michael Vogelpohl

James L. Massey Award
Jami Meteer

Lawrence F. Stauder Award
Christopher Russo

Alumni Honor Awards

Acknowledging outstanding alumni — those who represent both the academic and industrial faces of engineering and its many applications — is a privilege. The efforts and examples of our alumni, especially the five selected to receive this year's College of Engineering Alumni Honor Award, serve as an inspiration to the College and its students. Honored this year are: James G. Berges, Dennis F. Murphy, Thomas M. Rohrs, Michael A. Smith, and J.C. Stoffel.

Shown from left to right are: Thomas M. Rohrs; Dennis F. Murphy; J.C. Stoffel; University President Rev. Edward A. Malloy, C.S.C; Michael A. Smith, and James C. Berges.

Personally and professionally, these individuals have demonstrated their dedication to engineering. They embody an engineer's pursuit of excellence, and they have served their professions and communities.

James G. Berges is the president of Emerson Electric in St. Louis, Mo. He joined General Electric in 1969 after graduating from Notre Dame with a bachelor's in electrical engineering. His trainee position in their Manufacturing Management Program quickly led to managerial positions. In 1976 when he joined Emerson, he was responsible for company-wide inventory, productivity, and cost-reduction programs. By 1979 he was appointed vice president of operations for the Louisville Ladder Division.

He returned to St. Louis in 1980, working for Emerson in a variety of capacities. In 1995 he led the acquisition of Control Techniques, a U.K. based manufacturer of electronic motor controls and Northern Ireland's F.G. Wilson, an assembler of diesel generating sets. In 1996 he negotiated a joint venture with Caterpillar to combine genset packaging operations. His appointment as vice chairman and election to the Emerson Board of Directors was followed by another well-deserved promotion in 1999 as Emerson's president.

Berges is a member of the boards of The Good Shepherd School for Children and the St. Louis Housing Alliance and has served on the boards of the Greater St. Louis Arts & Education Council and the St. Louis United Way.

Since his graduation from Notre Dame in 1971 with a bachelor's degree in civil engineering, Dennis F. Murphy has been a vital member of the Kiewit Engineering Company. He started as a field engineer for the company and quickly progressed to project engineer, job superintendent, and project manager. Murphy has worked for the company in several states and around the world on projects such as the Berkeley Bridge in Norfolk, Va.; Hibernia Oil Platform in Newfoundland, Canada, and the Great Belt Tunnel in Denmark. He has also served the company as a senior engineer/estimator and quality assurance director for construction operations. He is currently a vice president of the corporation, overseeing all estimating and design functions.

Murphy is a member of the American Society of Civil Engineers, American Society of Mechanical Engineers, American Society of Quality Control, and the Construction Systems Technology Department Industry Advisory Committee at the University of Nebraska at Omaha. Long-time supporters of Catholic education, Murphy and his wife Ellin, established the Dennis & Ellin Murphy Foundation dedicated to improving American Catholic education.

Upon earning his bachelor's degree in mechanical engineering from Notre Dame in 1973, Thomas M. Rohrs received a master's in business administration at Harvard. He spent time teaching Operations Management in the Babson College MBA Program in Wellesley, Mass., before joining Hewlett Packard. In 1989 he joined MIPS Computer Systems as senior vice president for manufacturing and customer service. By 1992 he had moved to Silicon Graphics, where he held several positions, including vice president and general manager of customer support.

In 1997 Rohrs joined Applied Materials, Inc. He is group vice president of global operations and is responsible for the operational strategy and performance of all business groups and regions within the company.

Rohrs is an active member in Parish Renew activities, most recently serving meals at soup kitchens. He coaches his oldest son's basketball team, his youngest son's little league baseball team, and regularly volunteers during fundraising events for their local school. He enjoys golf and running in 10K races.

Dean Frank P. Incropera congratulates J.C. Stoffel, Director of Research & Development for Eastman Kodak Company, as he presents the College of Engineering Alumni Honor Award.

Michael A. Smith is president of Lockheed Martin Ocean, Radar & Sensor Systems. Prior to this appointment, Smith held a variety of positions in aerospace businesses. In 1993 he was employed by GE Aerospace when it was acquired by Martin Marietta. Smith remained an important contributor to the new corporation, serving first as president of Astro Space for Martin Marietta and then as vice president of marketing. Following the merger of Lockheed and Martin Marietta, he became vice president of international business development, a position he held until his current appointment.

Smith's resume of community service is as full as his professional vitae. Currently, he is chairman of the United Way Campaign of Greater Syracuse. He has chaired the Juvenile Walk for Diabetes in Upstate New York, is a board member of the Museum of Science and Technology, serves on the Graduate and Research Advisory Board of Notre Dame, and participates in various professional associations.

In 1965 he graduated from the University with a bachelor's degree in aerospace engineering; he received a master's degree in 1967, also from Notre Dame.

The director of Research & Development for Eastman Kodak Company in Rochester, N.Y., J.C. Stoffel is responsible for the company's global research and development initiatives — all Kodak laboratories worldwide. He joined the company in 1997 as vice president and director of Electronic Imaging Products Research & Development, where his expertise in the electronics and digital world proved invaluable. In 1998 he was elected as a corporate officer and vice president, where he served prior to his current appointment.

Stoffel began his career with the Xerox Corporation, where he held various positions of increasing responsibility in research, product development, manufacturing, and marketing. His career at Xerox spanned 25 years.

Currently, Stoffel serves on the board of directors of Kodak Polychrome, LLC. He is also a member of the electrical engineering department's advisory board at Stanford University, the advisory board at Clarkson University, and is on the executive committee and board of the Information Technologies Industries Association in Washington, D.C.

Stoffel received a bachelor's degree in electrical engineering from Notre Dame in 1968. As an NDEA Fellow at Syracuse University, he received his master's degree in 1970 and his doctorate in 1972. He is the author of "Binary and Graphical Image Processing," a reference book for graduate students in engineering and science, and he holds more than 25 U.S. patents.

John A. Kaneb Teaching Awards

The Kaneb Awards were created in 1999 through a gift from University Trustee John A. Kaneb. They are bestowed by individual colleges and departments on faculty who have been active in full-time undergraduate teaching for a minimum of five years. Nominees are chosen based upon recommendations of fellow faculty, current students, and recent graduates. This year the College of Engineering was proud to honor the following faculty for their outstanding service as educators and examples to engineering students.

A professor in the Department of Electrical Engineering, Panos J. Antsaklis has co-authored a graduate textbook, "Linear Systems," with A.N. Michel and has edited four books. He is active in several professional societies, particularly the Institute of Electrical and Electronics Engineers, for which he served as president of its Control Systems Society. Antsaklis is responsible for the redesign of the undergraduate control systems laboratory, which now more accurately reflects the department's philosophy and needs. By integrating physical systems and software tools, he has made it easier for students to use the software packages, run simulations, check the validity of their designs, and apply their designs to physical systems. Students can perform their control designs in the systems lab or in any computer cluster on campus. In addition to his duties as a professor, Antsaklis was recently named director of the University's Center for Applied Mathematics.

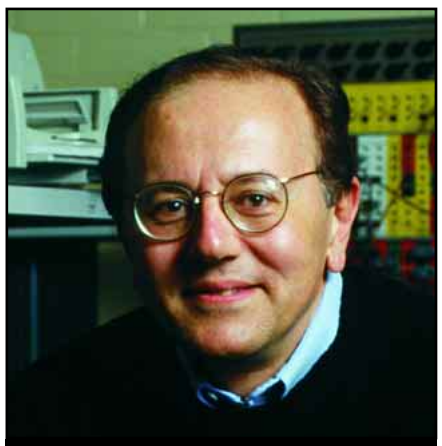
Jay B. Brockman, an associate professor in the Department of Computer Science and Engineering, has played a pivotal role in the development of the Bits-to-Chips Program, a joint educational initiative between the computer science and engineering and electrical engineering departments. He has also provided significant leadership in the development of a course sequence for first-year engineering intents, EG111/112. His enthusiasm and effectiveness in teaching and teaching others how to teach is demonstrated by the fact that four of his graduate assistants have won teaching awards. Additionally, Brockman leads graduate teaching seminars at Notre Dame's Kaneb Center and participates on the Carnegie Foundation Committee on Scholarship in Teaching.

According to his colleagues, the three distinctive features of David T. Leighton Jr.'s teaching style are the rigorous nature of the courses he teaches, the time he spends with individual students, and how much he cares about student performance. An associate professor in the Department of Chemical Engineering, Leighton is helpful outside the classroom, often assisting students with programs in the computer lab and even holding spontaneous evening "help" sessions for difficult assignments. Students often comment about how meaningful and challenging they found his courses. Leighton, in addition to his teaching responsibilities, works on a variety of research projects. His interests are in the area of fluid mechanics and separation processes.

Craig S. Lent joined the Department of Electrical Engineering 14 years ago. His research focuses on a nanoelectronics paradigm developed at Notre Dame called Quantum-dot Cellular Automata, and he is part of the Center for Nano Science and Technology that was established in late 1999. Lent is known for the time and attention he gives his students and has developed a new course for the department. This course applies the Maxwell theory of electromagnetic waves to practical problems in waveguides and antennas. What intrigues students about the course is that Lent involves them in building problem-solving tools. The students develop full-featured applications with graphical user interfaces and gain hands-on experience in engineering design.

In addition to nomination by his peers and students as a Kaneb honoree for 2000, Steven R. Schmid, associate professor of aerospace and mechanical engineering, has recently received two other awards. He is one of nine individuals selected to receive the John T. Parsons Outstanding Young Manufacturing Engineer Award, and he was named the Burt L. Newkirk Award winner for significant research contributions in the field of tribology. Schmid has co-authored three books as well as various journal and conference papers. He is also a member of the Society of Manufacturing Engineers, the American Society of Manufacturing Engineers, the Society of Tribologists and Lubrication Engineers, and the Materials Research Society. Most important, his students echo the energy and excitement for engineering that he exhibits on a daily basis.

Expertise and enthusiasm are two of the words students and fellow faculty use to describe Joannes J. Westerink, associate professor of civil engineering and geological sciences. He has high expectations of the students in his courses and also requires much of those students who conduct research under his direction in the Environmental Hydraulics Laboratory, where he works with students to develop and apply computational models with which to predict the flow of surface water bodies such as lakes and coastal oceans. Westerink's genuine care and concern for the education of his students is readily evidenced by his interaction and communication with them.



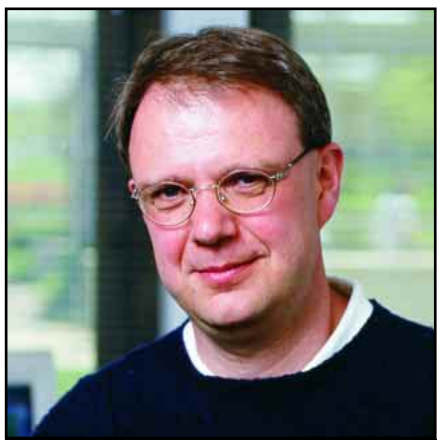
Panos J. Antsaklis, professor of electrical engineering

Craig S. Lent, professor of electrical engineering

Jay B. Brockman, associate professor of computer science and engineering

Steven R. Schmid, associate professor of aerospace and mechanical engineering

David T. Leighton Jr., associate professor of chemical engineering



Joannes J. Westerink, associate professor of civil engineering and geological sciences

The good teacher explains.
The superior teacher demonstrates.
The great teacher inspires.

Every year the College of Engineering honors the tradition of learning that began in 1877, the year engineering was added to the academic programs at Notre Dame. In recognition of the excellent instructors and gifted students who have become part of engineering history at the University, the College selects one faculty member whose outstanding example merits special emphasis. This year, during a ceremony in McKenna Hall, the College honored Joan F. Brennecke, professor of chemical engineering, with the Outstanding Teacher of the Year Award.

Since joining the faculty in 1989, Brennecke's impact has been substantial. "We're especially proud to honor Joan Brennecke for her efforts as an educator and a researcher," said Dean Incropera. "Her classroom teaching, student mentoring, research, and service efforts on behalf of the University and the chemical engineering profession are exemplary."

Many of her students agree with Dean Incropera's assessment. They often comment about her energy in the classroom and accessibility outside of it. One in particular put it very succinctly, "Dr. Brennecke's talent for teaching, her desire to include pertinent and timely concerns into chemical engineering courses, and her 'connectedness' to students qualify her to be Teacher of the Year."

A member of the American Institute of Chemical Engineers, the American Chemical Society, and the American Society for Engineering Education, Brennecke is one of the chemical engineering faculty members spearheading the University's efforts as part of the Combined Research Curriculum Development Program (CRCD), a cooperative program between the University of Notre Dame, the University of Nevada at Reno, and West Virginia University. The goal of CRCD is to teach students how to design and operate chemical processes that minimize the production of pollutants, integrating aspects of ecology and environmentally friendly manufacturing processes into courses in chemical engineering departments across the country. This dovetails with her research interests which are in the areas of supercritical fluid technology and thermodynamics, specifically the use of supercritical carbon dioxide and supercritical water as environmentally benign solvents for extractions, separations, and reactions.

Brennecke received a B.S. in chemical engineering in 1984 from the University of Texas. In 1987 she received a M.S. degree from the University of Illinois where she also received a Ph.D. in 1989. Later that year she joined the faculty of the College of Engineering as an assistant professor. She received a Presidential Award from the University in 1998 and was also promoted to professor in 1998.

Teacher of the Year

Humboldt Awards Update

Established in 1953 by the Federal Republic of Germany as an expression of gratitude to the United States for its post-World War II aid, the Alexander von Humboldt Prize is Germany's highest research honor for senior American engineers and scientists. It is awarded to no more than 40 scholars each year. Among past winners of this prestigious prize are 31 Nobel laureates. The Prize itself includes 12 months of research support at a German university or one of the Max Planck Institutes.

Several faculty from the College of Engineering have received the Humboldt Prize. Most recently, Daniel J. Costello Jr., professor of electrical engineering was recognized for his contributions in error control coding related to digital communications. He will continue his research with Dr. Joachim Hagenauer at the Technical University of Munich. Costello joined the faculty in 1985.

Also receiving the Humboldt this year is Mohamed Gad-el-Hak, professor of aerospace and mechanical engineering. He will spend 12 months in Germany continuing his research in fluid mechanics with an emphasis on the performance of future air and water vehicles, as well as microelectromechanical systems (MEMS) involving fluid motion. In addition to being honored by the German government, he was granted a Japanese Government Research Award for Foreign Scholars.

Costello is one of the faculty from the Department of Electrical Engineering to receive the Humboldt. Freimann professor Ruey-Wen Liu received the award in 1999. He begins his research this summer at the Institute for Network Theory and Signal Processing of the Technical University of Munich, where he will be studying blind identification and estimation of multichannel systems. He was also recently appointed a visiting professor at Stanford University for the Spring Quarter 2000. Liu has been a member of the College faculty since 1960.

Anthony N. Michel, Freimann professor of electrical engineering, received the Humboldt Prize in 1998. He spent the bulk of his time at the Ruhr University in Bochum, Germany, where he conducted research on the stability of dynamical systems. Michel joined the University faculty in 1984 and served as Dean of the College of Engineering from 1988 through 1998.

Frank P. Incropera, McCloskey Dean of Engineering and Brosey professor of mechanical engineering, received the Humboldt Senior Scientist Award in 1988. He conducted his research on advanced electronic cooling technologies at the Technical University of Munich.

History of the Humboldt

A German naturalist and explorer, Alexander von Humboldt was a major figure in the area of science now known as earth sciences and ecology. His book "Kosmos" made a great contribution to the popularization of science as a field of study. Later in life his representation of isotherms and isobars on weather maps helped lay the foundation for today's comparative climatology.

His pioneering studies on the relationship between a region's geography and its flora and fauna proved invaluable, as did the conclusions he drew from his study of the Andean volcanoes, which involved eruptive forces and metamorphosis in the development of the Earth's crust.

Throughout his life, especially in his latter years, Humboldt often provided financial support and encouragement to young researchers.

Atassi Receives Acoustics Award

Hafiz M. Atassi, Viola D. Hank professor of aerospace and mechanical engineering

Viola D. Hank professor of aerospace and mechanical engineering Hafiz M. Atassi works to reduce the noise produced by jet engines by studying the aerodynamic mechanism of sound generation and developing mathematical and computer models for its control. In June he received the American Institute of Aeronautics and Astronautics Aeroacoustics Award. Established to honor excellence in technical or scientific achievements in the field of aircraft noise reduction, the citation for the award reads, "For outstanding and exceptional scientific achievement and leadership in theoretical and computational aeroacoustics." The award was presented at the Joint Aeroacoustics Conference of the American Institute of Aeronautics and Astronautics and the Consortium of European and Aeronautical Societies.

Batill Honored with the Atwood Award

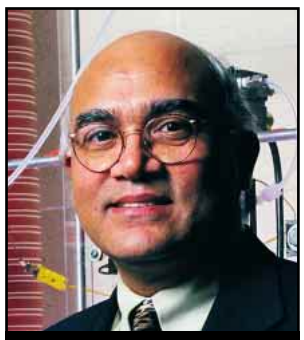
Stephen M. Batill, associate dean for educational programs and professor of aerospace and mechanical engineering, was selected to receive the John Leland Atwood Award for 2000. Sponsored by the American Institute of Aeronautics and Astronautics and the American Society for Engineering Education, the Atwood Award is presented annually in recognition of exceptional contributions to aerospace education. Batill has been a leader in design education for more than 15 years. His most recent developments in multidisciplinary system design and optimization have been acclaimed by his University colleagues and adopted by a large number of faculty at universities across the country.

Stephen M. Batill, associate dean for educational programs and professor of aerospace and mechanical engineering

In addition to his efforts in aerospace education, Batill's numerous contributions to research in aerodynamics, aircraft structures, and systems design — specifically the application of artificial neural systems to engineering decision making — have been recognized by instructors, researchers, and others within the aerospace and mechanical engineering communities.

Varma Receives National Award

The Chemical Engineering Lectureship Award was presented to Arvind Varma, Arthur J. Schmitt professor of chemical engineering, at the American Society for Engineering Education annual meeting in St. Louis, Mo. Sponsored by Union Carbide Corporation, this award is bestowed annually on a distinguished engineering educator in recognition of outstanding achievements in chemical engineering theory or practice.



Arvind Varma, Arthur J. Schmitt professor of chemical engineering

Recipients have made lasting contributions to the theory or practice of chemical engineering through books and research articles, and have also achieved success as mentors and teachers. Varma, whose interests are in chemical and catalytic reaction engineering and synthesis of advances materials, has published more than 190 archival journal articles, co-authored three books, and co-edited two books.

Spencer Named to White House Advisory Committee

B.F. Spencer Jr., Leo Linbeck professor of civil engineering and geological sciences, was appointed by the White House Office of Science and Technology Policy to serve on an advisory committee to assess U.S.-Japan Science and Technology Relations. Formation of the committee was the result of a 1999 meeting between Japan's former Prime Minister Obuchi and President Clinton.

B.F. Spencer Jr., Leo Linbeck professor of civil engineering

The goal of the committee was to define joint research projects for the coming decade that address critical issues for both countries. Topics included natural hazard mitigation, energy, health, environmental protection, new scientific frontiers, improvement of the public's understanding of technology, and the ethical responsibilities of the technical community.

On May 2 the committee's final report, titled "An Agenda for Future U.S.-Japan Scientific & Technical Cooperation," was submitted to President Clinton and Prime Minister Yoshiro Mori.

Clive R. Neal, associate professor of civil engineering and geological sciences, is the director of the Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) facility. Operating since 1992, the ICP-MS provides a precise analytical method for obtaining high-quality multi-element analyses at trace (parts per million to parts per billion) and ultra-trace (parts per trillion and lower) levels. The facility is housed in a clean room within the College of Engineering and is one of the most sophisticated and well equipped analytical research labs in the country. A current project of Neal's involves testing the alloy NASA is proposing to use on Mars sample containers.

focusing on the fine points

Notre Dame's ICP-MS Facility

What do geological and environmental sciences, nuclear power and semiconductor manufacturers, materials science, medicine, agriculture and food industries, and biological sciences have in common? At some point in time — researching a new product, creating a new material, developing a new medicine or pesticide, or identifying the source and scope of a contaminated area — each of these fields needs a way to identify what is in a substance. That's a broad generalization of what happens in the Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) Research Facility. To put it simply, the facility counts atoms.

Located in the Department of Civil Engineering and Geological Sciences, the ICP-MS provides a versatile and precise technique for measuring a variety of materials. "The data that can be obtained from the ICP-MS is really quite incredible," said Clive R. Neal, associate professor and director of the ICP-MS facility. "We can determine the chemical composition of a wide variety of samples — including biological, geological, mineralogical, medical, and synthetic — at trace and ultra-trace levels." Trace levels are part-per-million to part-per-billion concentrations; ultra-trace levels are part-per-trillion concentrations and lower.

Established in 1992 with a grant from the National Science Foundation and matching funds from the University, the lab has been operating for eight years. It is equipped with a number of different sampling techniques, including electrothermal vaporization; flow-injection for concentrated solutions; a hydride generator for hydrocarbon-rich samples; a laser sampling system for solid samples; an autosampler for large sample batches; and an ultrasonic nebulizer for ultra-trace element analyses.

All equipment is contained in a clean room that is kept under positive pressure to reduce contamination. In addition to installing polypropylene cabinetry and workbenches, the facility uses a HEPA filtered flow bench and ultrapure water. Technicians also double-distill the acids used in the preparation procedure.

At first this might seem like overkill, but not to Neal and Jinesh C. Jain, lab manager and assistant professional specialist. They believe the reason the lab has been so successful is the ability to run control samples and eliminate interference from other materials and contaminants that might be in the room environment.

"Our results are precise and accurate," said Neal. "If you're looking for a particular mass, there are combinations of molecules that can skew the actual sample count. Our turnaround time may not be as quick as other labs, but the quality is unmatched." Neal explained that, unlike most ICP-MS data, the Notre Dame facility provides a 2σ error for each analysis that is propagated through the data reduction procedure.

Companies like Sherwin Williams have employed the facility to study the lead content of paint products. Phytotec commissioned the lab to study uranium and cesium content in groundwater samples. The Environmental Protection Agency has asked Neal and Jain to participate in developing analytical protocols for groundwater analyses, and the U.S. Geological Survey asked the lab to define new reference materials. The ICP-MS facility has also completed work for the University of Quebec and the University of Saskatchewan in Canada, the University of Hawaii, and the U.S. Department of Agriculture.

Most recently, Neal and Jain received a call from the National Transportation and Safety Board requesting a bid on ICP-MS analysis of the wreckage of TWA Flight 800. Contract discussions have been initiated. However, Neal was encouraged by the call. "We've worked very hard to build the reputation of this facility," he said. "This confirms that our methods provide quality information." The facility has also developed quite a reputation internationally with requests for analyses coming from countries such as Finland, India, and Turkey.

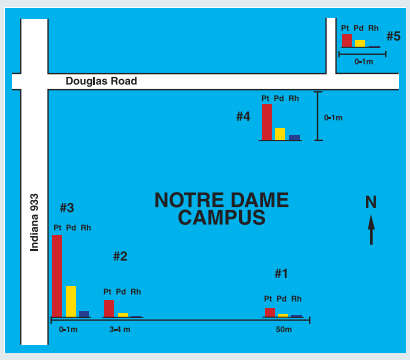
Not only are projects of worldwide scope within reach of the lab, so are analyses of a cosmic nature. Neal's group has already been analyzing Martian meteorites and materials from the moon. He'd like the lab to be one of the first to receive samples from Mars when they come back. And, with the reputation the lab is building, it's a real possibility.

Neal and Jain are just two of the researchers who work in the lab. Postdoctoral fellow and research associate James C. Ely worked with them to develop the analytical technique now used in the facility. Doctoral students Cathleen McGinnis, Amy Birkhold-VanDyke, and Bill Chazey as well as undergraduates Joshua Cahill, James Seidler, and Jennifer Ryan have all worked in the lab on various projects. They have and will continue to uphold the standards Neal and Jain have set for ICP-MS analyses.

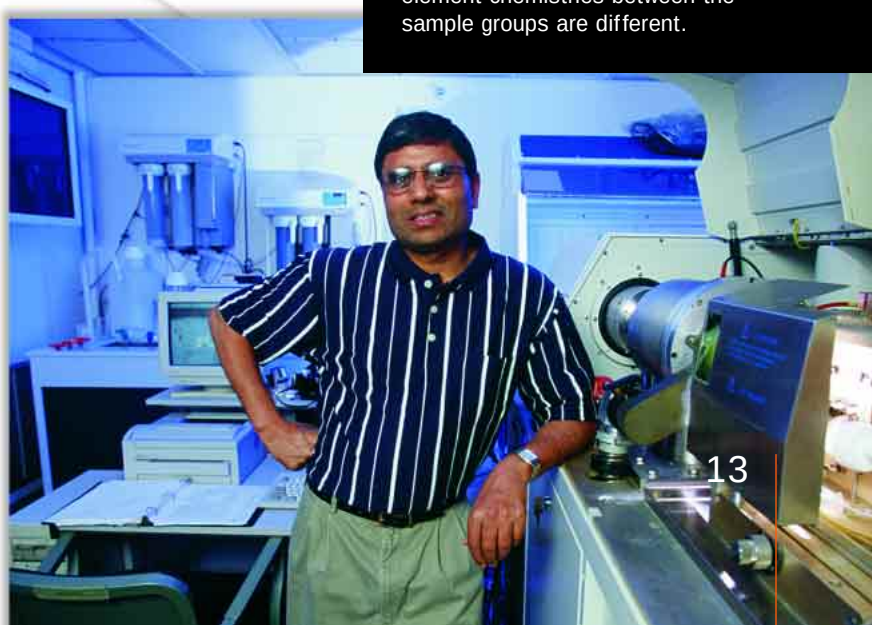
Past and Present ICP-MS Projects

The ICP-MS facility is an incredibly versatile tool that can provide data for a variety of research. Examples of some of the samples that have been studied in the facility include:

- Apollo 11, 12, 14, and 17 lunar basalts
- Apollo 12 and 14 lunar highlands samples
- Martian meteorites
- Basalts from oceanic plateaus
- Trace metals in lake water
- Analysis of cadmium and other toxic elements in durum wheat
- Brain tissue of Alzheimer's patients
- Paint products
- Groundwater and mine wastewater
- Soil and crops



Students and faculty are currently using the ICP-MS facility to determine if platinum, a potential carcinogen, has been absorbed by plants in the South Bend, Ind., area. The map shown here indicates the location and levels of the platinum found in samples from local roadside soil and plants.



Dr. Jinesh C. Jain, assistant professional specialist, manages the ICP-MS facility. He has more than 10 years experience in trace element analyses and ICP-MS operation. In one of his current projects, Jain is partnering with the School of Medicine at Washington University in St. Louis. Using the ICP-MS facility, he is examining and analyzing brain tissue from Alzheimer's and non-Alzheimer's patients to determine if the trace-element chemistries between the sample groups are different.

Assessing the Damage:

Aftermath of the Duzce Earthquake

On November 12, 1999, an earthquake with a magnitude of 7.2 struck the town of Duzce, 115 miles east of Istanbul. Preliminary reports confirmed 400 deaths, more than 800 people injured, and more than 100 buildings destroyed. It closely followed a quake in August that was the largest and most destructive quake to occur in the country since 1939. The death toll was in excess of 17,000, and more than 50,000 people were injured.

Unfortunately, these were not unusual events. Turkey has a long history of earthquakes. In the last 60 years the country has been hit with 11 major quakes along the North Anatolian Fault, which runs through the northern region of Turkey. Nine of these tremors had magnitudes greater than 7.0 on the Richter Scale, making this one of the most seismically active right-lateral strike-slip fault areas in the world. According to civil engineering and geological sciences graduate student Kenneth T. Farrow, a right-lateral fault is "one that, if an observer was standing on one side of the fault looking towards the other side, the observer would see the ground on the other side of the fault move to the right." The term "strike-slip" describes the motion of the ground on either side of a surface rupture as parallel to the fault direction.

Farrow and Yahya C. Kurama, assistant professor of civil engineering and geological sciences, were part of a reconnaissance team that traveled to Turkey in December 1999. The mission of the team, organized and led by Mete and Canan Sozen of the Civil Engineering Department of Purdue University, was to obtain structural data from buildings damaged in the quakes. A total of 18 researchers participated in the mission. They represented a number of universities and included Farrow and Kurama, from Notre Dame; Antonio Bobet, Yeliz Firat, Santiago Pujol, Julio Ramirez, Ken Ridgeway, Jon Paul Smith, Nihan Tiryaki, and Koray Tureyen from Purdue; Steve McCabe from the University of Kansas; Arturo Schultz from the University of Minnesota; Halil Sezen from the University of California — Berkeley; and Sharon Wood from the University of Texas — Austin. Two representatives from industry were also part of the group; they were Dennis Bates of Bates Construction and Donald Logan of Stresscon Corporation.

The team examined column, wall, and floor dimensions of buildings to determine each structure's Hassan Index. Developed by Ahmed F. Hassan, the Hassan Index is a method of ranking reinforced concrete, low-rise buildings as to their vulnerability during seismic events. By determining a building's probable performance during an earthquake, the team can help Turkish engineers determine how best to rehabilitate structures and prepare them for future quakes.

In fact, another team from Purdue, one including Kurama and Keli Engvall, a recent Notre Dame civil engineering graduate, traveled back to Turkey in June as part of a National Science Foundation project to continue data collection in the Duzce area.

— Article and photos courtesy of Kenneth T. Farrow and Yahya C. Kurama

Graduate student Kenneth T. Farrow stands in front of a house, next to where the steps, also shown in the photo, were before the November quake.

More information pertaining to reinforced concrete structures or the Duzce mission can be obtained by visiting www.nd.edu/~concrete or www.AnatolianQuake.org.

Tech Review Honored

Technical Review has once again received accolades from the Engineering College Magazines Association. For the 1999-2000 academic year, the publication received: a first-place award for *Best Pure Technical Article* — Meghan A. Nagle-Peterson, "Seeing through the Dark"; top honors for *Most Entertaining Feature* — John K. Barry, "Successful Interviewing"; a first-place designation for *Best Continuous Feature* — John K. Barry's humor column; a second-place award for *Best Single Issue* — the February 2000 magazine; a third-place honor for *Best All-Around Magazine*, and an honorable mention for *Best Layout, Single Issue* — the Fall 1999 magazine, designed by Michael LaMora and Ryan Mariotti.

Beginnning its 51st year, *Technical Review* is designed, written, and edited solely by students. Their advisor is John W. Lucey, associate professor of aerospace and mechanical engineering.

IEEE Honors Electrical Engineering Department Faculty

The Institute of Electrical and Electronics Engineers (IEEE) named faculty members Panos J. Antsaklis, Daniel J. Costello Jr., Ruey-Wen Liu, James L. Merz, and Anthony N. Michel as Third Millennium Medal recipients. This honor is bestowed on IEEE members in recognition of contributions in their specific areas of activity.

Golden Jubilee Medals were awarded to Yih-Fang Huang, professor and chair of the electrical engineering department, Liu, Michel, and Michael K. Sain. This medal honors IEEE Circuits and Systems Society members who have distinguished themselves in technical leadership and exceptional contributions toward advancing the goals of the Society during its first 50 years.

In addition to receiving a Golden Jubilee Medal, Huang was also named a Distinguished Lecturer for the Society.

A not-for-profit organization, the IEEE is the world's largest technical professional society. It boasts more than 320,000 participating members from 147 countries. Objectives of the IEEE include advancing the theory and practice of electrical, electronics, and computer engineering and computer science, as well as promoting the development and application of electrotechnology and allied sciences for the benefit of humanity and the advancement of the profession.

Alumni Updates

Kevin G. Connors ('83 EE) of Boston, Mass., is a General Partner with Spray Venture Partners, a venture capital firm that works with engineers to start companies around innovative biomedical technologies.

Brian T. Fitzpatrick ('97 CHEG) was awarded the Joshua Montgomery Sears Jr. Prize by the Harvard Law School. Fitzpatrick is the first Notre Dame graduate to receive this prize. It is given annually to two first-year and two second-year students with the highest grade-point averages. A native of Albuquerque, N.M., Fitzpatrick graduated *summa cum laude* from Notre Dame's Department of Chemical Engineering. During Harvard's commencement ceremonies, Fitzpatrick was also presented with the Fay Diploma for earning the highest combined grade-point average for three years of study at the Law School.

Carl Frushon ('84 AME) was promoted to Lieutenant Colonel in the U.S. Air Force as of July 1, 2000. He works in the Operational Support Office of the National Reconnaissance Office in Chantilly, Va.

William D. Manly ('47 MET, '49 MET), a consultant for the Department of Energy's Oak Ridge National Laboratory in Tenn., received an honorary doctor of engineering degree during Notre Dame's 155th Commencement ceremonies. An international leader in the development of advanced high-temperature materials and associated processing technologies, Manly has also held positions with Union Carbide Corporation and Cabot Corporation.

Editor's Note:

Comments, suggestions, and news about alumni achievements, honors, etc., is always welcome. To submit materials send hard copy or an e-mail to:

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The Real "Cable Guy"

Like Jimmy Stewart's character in "It's a Wonderful Life," the world would look incredibly different without Hubert J. Schlafly Jr. Cable television might not exist. Certainly, many of the network shows and news broadcasts would be more limited than they are today were it not for Schlafly's efforts. That's not just the opinion of a proud alma mater; Schlafly graduated from the electrical engineering department of Notre Dame in 1941. According to the Engineering Emmy Subcommittee of The National Academy of Television Arts and Sciences, "There have been many developments necessary for the success of this technology [television]: adjacent channel transmission, consumer tuning devices for non-broadcast television channels, broadband multichannel transmission trunks, the concept of point-to-multipoint continental networking by satellite, regulatory approvals, and industry acceptance. Remarkably, this subcommittee's research indicates that all of these developments are largely the result of the work of one individual, Hubert J. Schlafly."

He received his first Emmy Award in 1992 for the development of broadband, multichannel cable television technology. On October 11, 1999, Schlafly was presented with a second Emmy, recognizing the design and implementation of the Lens Line Prompting System. Lens Line, created by the TelePrompTer Corporation, allows a performer, speaker, or news anchor to look directly into the camera while delivering a prepared script.

Born in St. Louis, Mo., Schlafly's beginnings were far from the glitz of Hollywood and Emmy Awards. His father was an oil prospector, and the family moved many times. In high school Schlafly gravitated to physics, chemistry, and math. He was later influenced by a cousin to attend Notre Dame and entered the electrical engineering program. Upon his graduation in 1941, Schlafly joined the General Electric Company where he worked on war-time projects such as antiaircraft searchlights and radar-directed gunfire control systems. After the war he joined Twentieth Century Fox as Director of TV Research. He was only 28.

Photo courtesy *Greenwich Magazine*.

Singer Denise Lor, left, and Garry Moore use the TelePrompTer during a live broadcast of Moore's popular TV show.

In 1951 his career took a dramatic turn. He met Fred Barton, a Broadway actor who was stepping into the arena of television drama. Schlafly recalls that Barton found the transition challenging. A stage actor could memorize his lines, repeating them for as long as the play ran. In TV dramas, however, the cast faced a new script for every show. It was Barton's idea to create a prompting device that would display the actors' lines. Twentieth Century Fox wasn't interested, but employees Schlafly and Irving Kahn, nephew of composer Irving Berlin, were. They joined with Barton to form the TelePrompTer Corporation. Once their prompting device became a huge success, Kahn and Schlafly decided to move into other fields.

They were interested in "pay television." That curiosity was the beginning of a cable television explosion. As Schlafly explained, "Broadcast TV signals were transmitted through the air to serve local areas. Channels were assigned by the Federal Communications Commission (FCC) so they would not interfere with one another. This meant a broadcaster had to apply for a license. It also meant that the number of channels was somewhat limited. Cable television, used in Penn. by early cable pioneers, enlarged the reception area of broadcast stations."

Photo courtesy *Greenwich Magazine*.

In 1947 Fred Barton, seated; Schlafly, standing center, and Irving Kahn, standing right, formed the TelePrompTer Corporation. They created a device, shown here, that changed the scope of television. Their product was an immediate hit with television celebrities and political figures.

Schlafly and Kahn developed "Key TV," an early version of a pay system that used a key to permit a subscriber to order special programs delivered by a coaxial cable. These cables were capable of carrying a broad band of TV signals not confined to broadcast frequencies. Although the FCC didn't require companies to get a license, the FCC did control technical standards and set national guidelines, including the requirement of a franchise to serve a specific area.

By the early 1970s TelePrompTer Corporation owned franchises in 140 markets with 1.4 million customers. Schlafly began working with Dr. Hal Rosen at Hughes Aircraft to use satellite technology for national distribution of cable signals. Hughes had designed the first domestic satellite for Canadian TV, Anik I. Schlafly knew that Anik I could carry TV signals, but he needed a way to convince cable operators there was a practical and economical way to receive it as well. This is when he wrote the specifications for a transportable receiver for satellite signals and worked with the Scientific Atlanta Company to build and test the receiver. In June 1973, at a convention of 3,000 cable operators, Schlafly and TelePrompTer sent a program from Washington, D.C., to Anik I and down to the convention floor in Anaheim, Calif. It was the first domestically transmitted national cable program.

Today, Schlafly, who holds 16 patents, is still at work. One of his recent projects involved a handheld battery-operated terminal and display combination designed for ordering goods and services, including emergency assistance. Serving as Chairman Emeritus of Portel Services Network, the company he founded to commercialize this device, Schlafly is still attempting to change the way the world looks.

Hubert J. "Hub" Schlafly Jr. and his wife, Leona, pose with one of his Emmy Awards. He has received two for his work as a pioneer in the television industry.

Engineering Grad and Inventor Dead at 80

George C. Crowley, an engineer and inventor whose work produced 80 U.S. patents, died on January 22, 2000, at the age of 80. A 1942 graduate of the Department of Electrical Engineering, Crowley joined the Navy shortly after graduation and was assigned to the General Electric Company to assist in its wartime efforts. It was Crowley's work on electrically heated flying suits, developed to enable pilots to fly above antiaircraft guns, that led to his invention of the electric blanket. His flair for inventions continued throughout his life. In 1958, he and a partner patented a device for painting golf balls; it used a blower to suspend the balls in the air while they were sprayed and dried. Other Crowley inventions include a tennis-ball bouncer and a device to chase squirrels from bird feeders. When he died, Crowley had a patent pending for a control that would automatically switch off an overheating blanket.

The Order of the Engineer: A Lifelong Obligation

Graduation is a special time. Family members come together to celebrate and honor the efforts of children, brothers, sisters, and grandchildren. For many graduates it is an exciting time as they move from the training and experiences they've had to help them become engineers into the engineering profession. For the College of Engineering it is a time of great pride and responsibility ... a time for graduates to bridge the gap between their education and what is expected of them as practicing engineers. It is a time to welcome each graduate into the Order of the Engineer.

Induction into the Order occurs at graduation when each student is presented with a diploma and a stainless steel ring. Worn on the little finger of the working hand and known as the Engineer's Ring, it is a symbol that the individual wearing the ring has accepted the principles that make up the Obligation of an Engineer. Similar to the Hippocratic oath taken by medical graduates, the Obligation identifies the ethical code by which engineers agree to work. In short, each engineer taking the pledge of Obligation promises to uphold the standards and dignity of the engineering profession and to serve humanity by making the best use of his or her talents and the Earth's resources.

Unlike other groups, the Order of the Engineer is not a membership organization. There are no meetings to attend or dues to pay. Its purpose is to foster a common bond between engineers as they honor their commitment — the Obligation — to put the needs of society ahead of their own. On May 22, 2000, 223 College of Engineering graduates accepted this oath.

The Obligation of an Engineer

By accepting the Obligation of the Engineer pledge and wearing the Engineer's Ring, each graduate affirms the following:

- I am an engineer.
- I have an obligation.
- My obligation has become my desire.
- My desire is to apply the Golden Rule, our code of ethics, to the technical knowledge of the world by persuasion.
- My desire becomes the yardstick of my professionalism.
- And, finally, my professionalism means to me that I will never again ask myself the question, "How much do I get out of it?" But rather that I will ask myself the question, "How much can I give?"

A stainless steel ring like the one shown here is presented to U.S. engineering graduates participating in the Ring Ceremony. The first such ceremony in the U.S. was held on June 4, 1970, at Cleveland State University. But the pledging of engineers dates back to the 1920s when Canada initiated the Ritual of the Calling of an Engineer. The Canadian ceremony, which is protected by copyright laws, uses a wrought iron ring, conducts a secret ceremony, and administers an oath written by Rudyard Kipling.

Engineering insights
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