ECpE

IOWA STATE UNIVERSITY

Connections

The ELECTRICAL and COMPUTER ENGINEERING Alumni Newsletter

Vol. 21, No. 2 Spring 2005

Jolly Triska passes

Emeritus Professor **Clarence James Triska**, better known to generations of students and colleagues as "Jolly," died on January 17, 2005.

"Jolly will be missed greatly," says **Rollie Knight**, a retired mechanical engineering professor and long-time friend of Triska. "The department really depended on him. I don't think he ever missed being in his office at 6:30 in the morning, even after he retired."

Instead of spending countless hours on the golf course after retiring, Triska helped out at the university whenever he could. One of his favorite projects, according to friends, was assisting students who were working on senior design projects.

"Jolly was always there to help," said **Morris Mericle**, who shared an office with Triska. "He was a superb teacher and he had a real empathy with the students. Plus,

. . . continued on p. 10

No mystery: Plant metabolic networks lead Dickerson's interdisciplinary focus

If **Julie Dickerson**'s research is "mysterious" to others, it's often mysterious to her as well. In fact, that's the appeal to Dickerson of plant metabolic networks: they're singularly resistant to the logic and mathematical precision typically valued by engineers.

"I work in pattern recognition in systems biology and metabolic networks," Dickerson says. "There's a lot of signal processing—we pull signals out of very 'noisy' data and figure out if anything consistent is happening. Then we put the information together to reconstruct the 'black box.' It's unpredictable and the problem domain is very different."

Yet Dickerson doesn't want to overstate the "otherness" of plants and the bioinformatics she uses to understand them. Indeed, she draws analogies to her more traditional interests—wireless communications, for instance, and computer security, a field she considers "strangely related" to her research in plant networks.

"A lot of the modeling techniques are similar," Dickerson notes. "Unfortunately, plant networks follow no discernible rules, whereas computer networks are better behaved."

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Letter from the Chair

Welcome to another issue of *Connections*! Everyone at Iowa State is looking forward to spring and warmer weather. In the meantime, developments in ECpE anticipate the rebirth of nature we'll witness in the weeks to come.

As I mentioned in our fall issue, many changes are taking place. Our new dean, **Mark Kushner**, has joined us in the college. Mark has brought his research group in plasma physics with him (you can read about his work on page 4), and there is the possibility he will occasionally offer seminars in his field. So we have reason to be even more excited than our colleagues in other departments, as Mark will actively participate in the intellectual life of ECpE as well as fulfilling his responsibilities as dean.

But plasma physics is only one of a number of exciting directions research is taking in ECpE. I would like especially to bring your attention to the work in bioinformatics being done by a number of people in the department, not the least of them **Julie Dickerson**, whose work is profiled on page 1. Julie's interest in bio-based applications is reflected in the work of several other members of our ECpE family, from newer adjunct faculty such as **Viren Amin** to veteran researchers such as **Murti Salapaka**, **Srini Aluru**, and **Bob Weber**.

The work profiled in the article on **Zhengdao Wang** (page 5) represents another growing area of collaboration here in the department. Besides his work in wireless applications, Zhengdao is also part of an Information Infrastructure Institute ("iCube") team I'm leading in an NSF-funded project to study the use of sensors in power system applications. We're joined in this work by **Manimaran Govindarasu, Murti Salapaka, Jim McCalley**, and **Vijay Vittal** (Arizona State University).

As exciting as all of these areas are, though, we're looking to expand further and ask for your help once again. Currently we are interviewing a large number of excellent candidates to fill at least four faculty positions, as well as identifying a senior scholar to fill the Palmer Chair. If you know of promising candidates in power, controls, VLSI, and software engineering, or if you have any recommendations, please don't hesitate to get in touch with me. We're especially interested in seeing women and minority candidates for these positions—as the nation's demographics change, theirs will be the future faces of engineering in the United States.

What can we offer these people? As the article on page 7 makes clear, work on our new facilities in Coover Hall is on schedule: the programming is complete, the design phase has begun, and we're looking at completion of Phase 1 sometime in 2007. In addition to great facilities, they'll find colleagues already rich in accomplishments, a stable population of gifted graduate and undergraduate students, and a welcoming environment in which everything possible will be done to facilitate their research—not to mention a successful and supportive alumni family.

So, as always, thanks for everything you do for ECpE. Please drop us a line and let us know how *you* are doing!

Arun Somani

ECpE Connections

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2215 Coover Hall . . . Iowa State University . . . Ames, IA 50011-3060

(Voice) 515 294-2664 . . . (Fax) 515 294-3637

(E-mail) ece@ee.iastate.edu . . . (Web) www.ece.iastate.edu

Prepared for the department by Engineering Communications and Marketing, College of Engineering 05318

Troubleshooting with ECpE computer support group

Hit the wrong key and send your report into a cyber-graveyard? Having trouble with your e-mail attachments? For those and other problems, the ECpE Computer Support Group is here to help.

From setting up your system to installing software to troubleshooting hardware failures, Manager **Steven Kovarik** and his staff can do it all. “We’re basically a one-stop shop,” he says. “We take care of everything.”

Along with three part-time student assistants, Kovarik, **Joe Mesterhazy**, and **Mark Shamblin** make up the group responsible for all computer and electronic equipment in Coover, as well as areas hosting ECpE faculty in Durham and Howe Halls. The part-time student assistants primarily address problems that tend to have quicker solutions, while the full-time staff is there for jobs that take more time and in-depth knowledge.

Kovarik manages with a focus on customer service and wants to keep everyone happy—which sometimes puts his public relations skills to the test. “When somebody needs something,” he says, “they need it right away, if not sooner. When you’re dealing with high-end professors, it’s important that problems get fixed quickly. Sometimes I have to help them see that the information they’re looking for can’t be handed over right away.”

Kovarik and his staff have learned to handle the pressure of managing so many computer labs. The key to keeping faculty, staff, and students happy, Kovarik says, is staying ahead of the curve and keeping lines of communication open. So the group makes sure to contact faculty to appraise their needs before a semester begins. That way, he adds, if a faculty member needs new software or changes to a lab, there are no last-minute surprises.

Because group members are on call 24 hours a day, 365 days a year, holidays can be stressful. If problems crop up on Christmas Day, the Fourth of July, or at three in the morning, somebody from the Computer Support Group will get to campus to fix whatever is slowing things down. But with so many tools at their disposal, Kovarik and his staff are able to stay in tune with what’s going on in ECpE, whether or not they’re on campus. “We know if a server is working correctly, or even if a door is ajar,” he says. “We keep a pretty close eye on things.”

> ”Group members are on call 24 hours a day, 365 days a year . . . We know if a server is working correctly, or even if a door is ajar . . . We keep a pretty close eye on things.”

Kovarik has to keep up to date on the latest hardware and software on the market, and he admits that can be daunting. The group has recently moved from a single-tape backup to a new system that gives them the ability to perform faster backups on all servers and quickly restore data. So if a student or faculty member accidentally deletes an entire folder from the system, Kovarik or one of his staff members can recover it in a flash.

And it’s not just computer-related equipment that the Computer Support Group in ECpE handles: they also help with audio/video equipment, projectors for PowerPoint presentations, and even DVD production. “We can help with pretty much everything,” Kovarik says. ■

Left to right: Joe Mesterhazy, Mark Shamblin, and Steven Kovarik

Outside boxes, off walls, Kushner's team takes plasma places it's never been

If thinking "outside the box" transformed yesterday's bulky TVs into elegant plasma panels thin enough to hang on walls, it stands to reason that "off the wall" creativity might take plasma research even further toward technologies that will change the way we live.

Consider Dean of the College of Engineering **Mark J. Kushner** and his Computational Optical and Discharge Physics Group (CODPG): they've been bouncing ideas off the walls and into creative new plasma applications for years.

Kushner's path to plasma research was, admittedly, indirect. He earned his PhD from Cal Tech studying lasers under a mentor who, he says, advised him to expand his interests as broadly as he could. It was sound advice: at Kushner's first job with Sandia National Lab in the early '80s, his manager informed him there was little future for anyone in high-level gas laser research. Kushner balked at first, but ultimately acknowledged market realities and moved on.

"So Sandia moved me to a project using partially ionized gases—plasmas—for materials fabrication in microelectronics," Kushner recalls. "Because my adviser instilled breadth into me, I could make connections between that technology and pulse power, toxic gas processing, lighting, and other areas to improve people's lives."

Today Kushner's work includes applications ranging from common street lighting technologies to exotic aerospace projects. However, the CODPG's core research is still in microelectronics fabrication, where the group develops computational capabilities for designing reactors for fabricating devices down to the nanoscale.

"One of the challenges in this area," Kushner observes, "is that subtle variations in the aspect ratio of reactors or small changes in pressure alter the characteristics of what you make on the nanoscale. That's one reason these systems are so expensive: a tremendous amount of trial and error goes into optimizing reactors to get precise device characteristics."By developing efficient computational platforms", he continues, "optimizing the large dynamic ranges in space and time across which plasmas and processes for fabricating microelectronic elements operate can be reduced to manageable levels—ideally, with a single computation."

Although you can find codes from Kushner's group being used to design plasma TVs, an even more critical lighting application drawing the group's attention has been the high-intensity discharge lamps common on city streets. Given the hundreds of thousands of hours scientists have already devoted to commercial lighting technologies, Kushner says, vast improvements in energy efficiency using empirical approaches are unlikely. "But if we can increase their efficiency by as little as 10%," he adds, "that translates into tankers-full of oil a day that we're not importing."

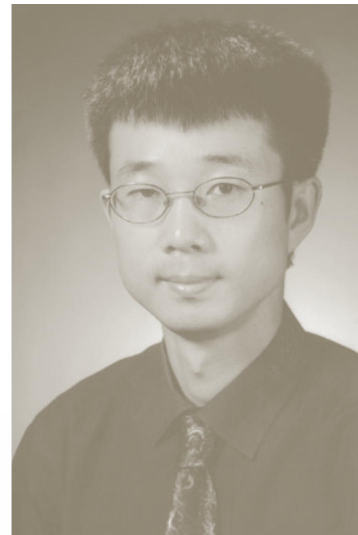
Today the CODPG is partnering with a private firm on an Air Force contract to develop 100-micron-sized plasmas to use as thrusters for spacecraft too small for standard chemical thrusters. In addition to outfitting arrays of tiny satellites precisely positioned vis-à-vis one another, Kushner says, the technology could be applied to the covering of a military or civilian jet's wings, enabling pilots to change the flight characteristics of their aircraft instantaneously.

"Electrical sources of thrust using plasmas scale very well to tiny sizes," Kushner says. "Imagine the entire surface of these micro-spacecraft covered with what looks like a mesh of tiny thrusters. Instead of three discrete axes of thrust, you'd have almost an infinite variety of ways you could orient the spacecraft."

Ironically, this breadth of exposure has helped Kushner come full circle in his career: the CODPG is currently involved in another Air Force project to develop plasmas for generating gas-phase species to run airborne lasers electrically, instruments that today can be produced only by mixtures of highly caustic chemicals.

Bounce far enough and hard enough off that wall, it seems, and one day you might bounce back to where you started.

Working wireless wonders: ECpE's Wang on quest for greater bandwidth



If nearly all communications today are driven by the need for increased bandwidth, nowhere is this need more pronounced than in wireless communications. ECpE Assistant Professor **Zhengdao Wang**, who came to Iowa State in 2002 after earning his PhD from the University of Minnesota, seeks to answer that challenge.

"I've always been interested in communications," Wang says, "particularly signal processing and information theory in wireless, but also in DSL." In fact, he notes, although it employs a different technology to overcome them, the "digital subscriber line" that connects to the Internet via phone lines shares some of the bandwidth challenges of wireless applications.

"DSL uses a kind of modulation scheme called OFDM—orthogonal frequency division multiplexing," Wang explains. "OFDM divides bandwidth into smaller pieces to convey information so the full potential of the phone line can be realized for a traditional modem whose speed is limited." But if DSL inevitably bumps up against its own limitations, you can just imagine the constraints facing wireless communications. Wang has.

"Bandwidth has always been the issue for wireless," Wang says. "Wireless has limited resources, including power and complexity. For example, because the receiver in cell phones is very small, we cannot use the complicated computation we use in DSL."

Wang is currently working under a National Science Foundation grant that seeks to bypass these constraints by using multiple antennas to increase the rate at which information can be delivered. The project, "Space-time Transmitter and Receiver Design with Delay Constraints," looks past short- and long-frame code designs to consider instead the potential of medium-length frames for wireless applications. Besides the code itself, Wang also seeks to develop low-complex detectors for deciphering codes from multiple antennas.

"If we use two antennas at the transmitter and two at the receiver," Wang explains, "the transmission rate can theoretically be doubled. But if we design transmission to exploit multiple antennas, at the receiver we still have problems such as equalization, channel estimation, and decoding the information."

Currently, says Wang, there are no means to keep data streams from multiple antennas from interfering with each other once they reach the receiver. "Receiver antenna one not only receives information from transmitter antenna one, it also receives information from antenna two," Wang observes. "We need to separate them to decode the information."

And because signals traveling along the same frequency will interfere with one another at the receiver, Wang adds, the time or code division multiple access technologies (TDMA and CDMA) used in cell phones need to separate the signals from multiple antennas. On the other hand, sending signals along different bandwidths, as in FDMA, is not as efficient.

"At the receiver," Wang continues, "we want to look at the signals received from all antennas and try to process them together to figure out what has been sent by the different antennas."

Wang's work has attracted the notice of colleagues at Iowa State and in the broader engineering community. "Wang has several interesting projects combining signal processing and communication theory, particularly in multi-carrier communication," says ECpE Associate Professor **Sang Kim**. "His work in developing unified linear precoding in space-time codes will help reduce power consumption on wireless terminals while increasing the reliability of data transmission."

Barely three years out of the PhD, Wang is an associate editor for *IEEE Transactions on Vehicular Technology* and has served as chair, committee member, or reviewer for numerous IEEE conferences and publications. He was co-recipient of the *IEEE Signal Processing Magazine* Best Paper Award in 2003 and the IEEE Communications Society Marconi Paper Prize award in 2004.

Adds Kim, "Wang is a talented young scholar; his achievements are truly outstanding."

Your gifts support endowed chairs and professorships

Money donated to the Department of Electrical and Computer Engineering by alumni and industrial partners is being used for important causes: namely, helping professors and students further their research. Thanks to the generosity of ECpE's friends, five members of the ECpE faculty were named to endowed chairs and professorships in 2004.

ECpE has received more than $12 million in donations through the ISU Foundation, funding:

- Eight endowed faculty chair and professorship accounts ($6,092,319)
- Sixteen general support accounts ($3,298,902)
- Ten fellowship accounts for graduate students ($1,166,559)
- Eighteen undergraduate/graduate scholarship accounts ($876,034)
- Six faculty and staff support accounts ($574,080)
- Three construction/building projects ($137,412)
- Equipment support ($3,636)

Assistant professors **Chris Chu** and **Nicola Elia** were named Harpole-Pentair Developing Faculty professors for the 2004–2005 academic year. (A profile of Elia's work can be found on page 8 of this issue.) **Manimarin Govindarasu** was named Litton Assistant Professor.

Govindarasu works primarily on QoS, fault-tolerance, and infrastructure security aspects of Trusted Internet, focusing on routing, multicasting, and denial of service issues, with additional interests in real-time systems. He has co-authored about 100 peer-reviewed publications in international conferences and journals and given tutorials on Internet Infrastructure Security at leading conferences, offerings that are now part of the IEEE Communications Society's Tutorials Now on-line program. The Litton Professorship also supports PhD student **Al-Duwairi Basheer**, who expects to graduate this spring.

Chu was appointed to support his research on VLSI physical design automation, which focuses on circuit placement and routing topology generation. He published five conference papers and four journal articles last year, one of which won the Best Paper Award at the ACM International Symposium on Physical Design. These funds also support two of Chu's graduate students—PhD candidates **Natarajan Viswanathan** and **Min Pan**—working on VLSI research.

Professor **Vikram Dalal** has held the Thomas M. Whitney Professorship, a five-year appointment, since 2002. Dalal and PhD student **Puneet Sharma**, supported as a Whitney Fellow, are attempting to enhance the performance of nanocrystalline silicon solar cells. A recent paper by Dalal on this work was accepted for publication by *Applied Physics Letters*, a prestigious physics journal.

2002 also saw Professor **Robert Weber** named to the David C. Nicholas Professorship, another five-year term. The Nicholas Professorship has funded additional graduate students and provided a fellowship for **Mike Reid**, a microwave VLSI research assistant. Weber is leading a group of graduate students researching RF, microwave, and optical integrated circuits that include VLSI, electro-optical interfaces, and MEMs, including system-on-a-chip (SOC) design and MEMs-based sensors. ■

ECpE would like to hear from you!

Write to us at 2215 Coover Hall, ISU, Ames, IA 50011-3060; call us at 515 294-2664; e-mail to ece@ee.iastate.edu; or fax to 515 294-3637.

We want to hear about your personal news and career moves for alumni notes in future newsletters. You're welcome to enclose photos; however, we can't return them. We need
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CoE's 'top priority' on track: The new Coover Hall takes shape

Keith Fortmann knows: Engineering programs built on a foundation of great academic offerings and quality facilities attract the best faculty and students in the country.

"That's why Coover Hall remains the College of Engineering's top funding priority, and will continue to be until it is fully funded," says Fortmann, the college's executive director of development. The expansion, he says, will bring ECpE's facilities up to the high standards of its research and teaching activities, ensuring the department's prominence for decades to come.

Construction of Phase 1 is scheduled to begin in March 2006. The project will take about 18 months, with completion anticipated for fall 2007. When finished, the new addition to Coover will increase lab, office, and classroom space from its current 45,000 square feet to about 65,000 square feet. Phase 2, which will also take about two years, will include a modernization of the existing Coover structure.

Beyond the sheer force of numbers—ECpE enrolls more students than any department on campus, Fortmann notes, including two of the university's colleges—the push behind this project comes from recognition by college and university leaders of the department's contribution to the college's national reputation and to economic development in the state of Iowa: put simply, ECpE generates more business startups than any other area on campus.

Associate Professor **Doug Jacobson**, chair of the ECpE Building Committee, has spent the past year working with architects and other committee members on the expansion. The group recently completed one stage of the project, in which they proposed how space should be earmarked for labs and classrooms, while at the same time ensuring that current cost estimates satisfied budget requirements.

"A lot of what the department does is interdisciplinary," Jacobson explains, "and there was a lengthy process of working through plans so everybody got what they needed. In some cases, it just made sense to share labs."

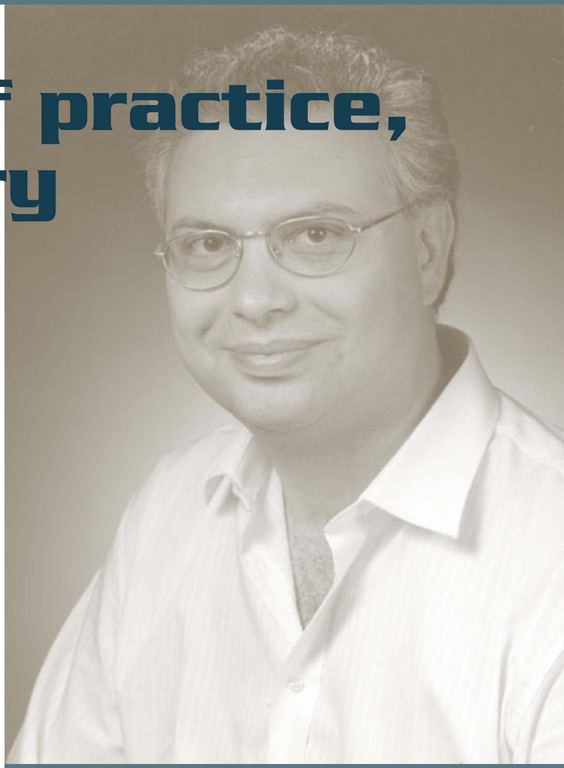
When finished, Jacobson adds, renovations will allow ECpE to enhance both its teaching and research activities through the use of teamwork rooms and modern, flexible learning environments that can be adapted to meet the changing needs of the department. The biggest difference faculty and students will see in Coover, he says, will be the clustering of new labs, creating a greatly enhanced environment for research that brings the department's faculty together under one roof.

These efficiencies of space, Fortmann adds, are echoed in the project's financing. "Remodeling Coover will prove far more cost-effective than building a new facility from the ground up," he notes. "We're taking the best the old Coover has to offer and combining that with innovative design concepts that will allow for future growth."

With new leadership for the department and college in place, as well as the re-emergence of the department's industrial supporters following the 2001 economic downturn, fundraising for the project has recently picked up momentum. Phase 1 of the renovation will cost a total of $16.5 million, Fortmann says, half from private donations; Phase 2 is tagged at more than $10 million.

To date, about $5 million has been raised toward Phase 1, according to Fortmann, with the goal of completing Phase 1 fundraising within the next 12 months. The support of alumni and donors continues to be critical, he adds, and the college seeks pledges for the project that can be fulfilled by 2010.

Beneath the power of practice, the elegance of theory

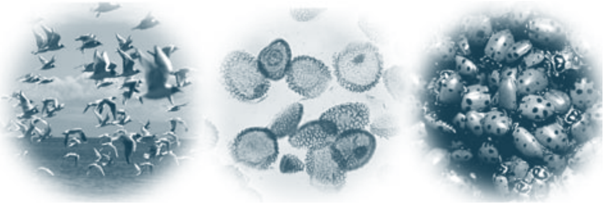


As a young engineer at the Fiat motor works in Italy, **Nicola Elia** worked on applied controls for some of the world's most elegant racing cars. However, pursuing doctoral studies at MIT, he was attracted to the more elusive elegance of theory—specifically, the fundamental phenomena, limitations, and issues underlying systems and controls.

Elia, who earned the Laurea degree in electrical engineering from Politecnico di Torino in 1987 and his PhD in electrical engineering and computer science from MIT in 1996, joined ECpE in 1999. Today, under the sponsorship of an NSF Career Award, titled "Control with Limited Information," he pursues theoretical models for enhancing system design. Elia is especially interested in problems of decision and control with limited information arising from networked control applications and from the design of communication systems with access to feedback.

"You design a controller that will work in the presence of an imprecise model," Elia says, "stuff you perhaps don't know or don't want to model. You leave this as an uncertainty in your model, and you ask the controller, 'Can I still control the model, given this inconsistency?'"

…engineering has not fully understood seemingly random, but in fact highly ordered, systems of autonomous agents such as flocks of birds, swarms of insects, or even epidemiological phenomena.



Elia notes that robust control theory (RTC) has been highly successful in aerospace and other high-tech applications. However, because communication and controls have often been approached as separate disciplines, engineering has not fully understood seemingly random, but in fact highly ordered, systems of autonomous agents such as flocks of birds, swarms of insects, or even epidemiological phenomena.

"Most of the questions arising in the study of systems are motivated by society, by our lack of understanding of systems," Elia continues. "Consider the evolution of a virus in a city: how does the interaction between people and the environment facilitate or obstruct the spread of the virus? The evolution of the virus is a dynamical phenomenon. But it involves so many agents. We'd like to understand the specific properties of its spreading to see what we can do."

Although one might question the possibility of abstracting functional algorithms from disease models while at the same time acknowledging the difficulty of the task, as a theorist Elia makes no distinctions between these and other, more approachable models of engineering. Indeed, he emphasizes, from his viewpoint as a theorist there is little to distinguish mathematical formulas drawn from such relatively esoteric examples and seemingly more accessible systems.

"Mechanical, economic, biological, electrical—the context really doesn't matter," Elia continues. "This is the beauty of theory, which is in a sense independent of context. And being independent, it has a high probability of being useful because it is general for all possible systems. We build these systems, but they're so complicated that we don't fully understand them."

As a consequence, says Elia, researchers can no longer effectively study systems microscopically, but instead must abstract and aggregate their fundamental properties in order to better control them. Such levels of control, he says, rely on crossing the divide between communication theory and control theory.

"New applications are forcing us to talk to each other, to understand each other's terminology, problems, and issues," he says. It's a principle he stresses to his graduate students, and one he hopes will one day make its way into the undergraduate curriculum.

Elia is optimistic about the potential: "I think we have an advantage here in being among the first to try to build a curriculum that has graduate students knowing both controls and communication theory," he says. "That's what I'm trying to build here at Iowa State."

SSOL students launch balloons into space

Iowa State students involved in the Spacecraft Systems and Operations Lab (SSOL) are genuinely engaged in active learning, says **Mani Mina**, ECpE adjunct assistant professor and new director of the SSOL. "This lab empowers students to lead," he says.


Student team members launch balloon as part of SSOL program.

Several times every year, students involved with the lab—sponsored by NASA and part of the Iowa Space Grant Consortium—launch a balloon with an attached satellite that can reach an altitude of 100,000 feet or more. Meanwhile, students and faculty members back at mission control on the second floor of Howe Hall stay in constant communication with the satellite through wireless channels, taking readings that include wind speed, altitude, air conditions, and temperature. According to Mina, some missions track the changes in gravity as the balloon ascends and descends, while others trace exactly how high the balloon ascends and how long it remains at a given altitude.

The satellites have taken hundreds of remarkable pictures and recorded spectacular video since SSOL flew its first mission in 1995. The challenge, though, sometimes lies in retrieving the pictures and video after the balloon comes down. On a few occasions the balloon has landed in the middle of a lake, forcing students to swim to retrieve the data, while at other times the satellite has settled in the top of a tree in a remote area, which also proves difficult to reach.

Students track balloon at mission control in Howe Hall.

Iowa State's lab is unique because missions are managed entirely by students, permitting the SSOL to launch balloons at a much lower cost than NASA and other universities working on similar projects. Most of the approximately 75 students involved in the lab are engineering majors, studying electrical and computer, aerospace, or mechanical engineering. However, working toward an engineering major is not required to work in the SSOL, so any student on campus can be involved.

Iowa State is also part of the University Nanosat Program, and students here work with several other colleges nationwide as well as national labs, including NASA, to expand the research base.

For more information, visit the SSOL Web site at http://cosmos.ssol.iastate.edu/.


A controlled descent helps track landing site.

Triska . . . continued from p. 1

he brought some real-world experience to these young engineers."

Triska enrolled at Iowa State following his service in the U.S. Navy during World War II. But because the college was unable to accommodate all of its students in the fall of 1946, Triska and several hundred other freshmen—many of them electrical engineering majors—were placed off campus at the Camp Dodge Annex, where they spent their first year taking classes.

"We ate in the Army mess hall, attended classes in remodeled officer quarters, and slept in the hospital unit with 30 bunks to a room," Triska recalled in the Spring 2000 issue of *Marston Muses*. "It seemed as if I were still in the Navy, but I made many close and lasting friendships."

Triska graduated with a BS in electrical engineering from Iowa State in 1950. He also earned his MS (1956) and PhD (1961) at the university, then joined the electrical engineering faculty. The popular professor, who earned the Mervin S. Coover Distinguished Service Award in 2002, co-authored two books on microprocessors.

"He was a computer engineer before they had computers," Knight says. "When people had problems with computers, they went to him for help. He took whatever time was necessary to fix the problem."

Triska is survived by two nephews, **Martin Bina** of Spillville, Iowa, and **Michael Bina** of Minneapolis. ECpE extends its deepest sympathies to Jolly's family, colleagues, students, and many friends.

Dickerson . . . continued from p. 1

Things weren't always this strange for Dickerson. The Ames native earned her PhD from USC before coming to Iowa State in 1995, when her research interests fell generally within the mainstream of the discipline. But even then she had begun to explore "fuzzy logic," pioneered in the 1960s to deal with data expressed within general ranges rather than as determinate values.

"There's a growing realization that we have to deal with uncertainty," Dickerson says. "Traditional probability has always asked 'Did something happen?' But with fuzzy logic we're modeling the degree to which an event occurs."

Modeling uncertainty, Dickerson adds, helps to account for the greater variation of biological networks compared to man-made systems. "It's more than whether a given gene was expressed," she says. "Was it highly expressed? Or was it expressed at a lower level? Those ideas must be considered in coming up with realistic models."

Such modeling has assumed increased importance as biologists have moved from studying single genes to analyzing 20,000 to 40,000 genes simultaneously using modern chip technology and parallel computing. The work in bioinformatics and pattern recognition of researchers such as Dickerson has helped them make sense of these larger volumes of data by overthrowing some of their most cherished preconceptions.

"For example, we're getting away from the idea of everything as a pathway," Dickerson offers. "We had a convenient notion of plant metabolism as linear flow charts: something comes in at top and goes out at bottom. But then we learned more about the genes, that there's a lot of feedback and interaction. That makes a big difference."

By abandoning certainty in favor of the fuzzier parameters of probability, says Dickerson, bioinformatics can reduce the vast information locked inside plant genes to manageable proportions. And while this might not produce silver bullets for engineering insect-resistant soybeans or nutrient-rich strains of rice, it can make their development more efficient.

Dickerson's interest in bioinformatics is relatively recent. "Four or five years ago, a colleague from the University of Guelph in Canada told me about his work," she recalls. "They were starting a cross-disciplinary training program in biology. I took the course and some of these problems in biology were very approachable from work I had done in pattern recognition."

Dickerson has been crossing disciplinary boundaries for some time. Her work with ECpE's **Robert Weber** using microwaves to enhance the performance of sensor networks, for example, helped develop several multidisciplinary courses. And she and Weber are currently collaborating on a communication system for transmitting information wirelessly from the internal regions of a jet aircraft engine.

"This successful cross-disciplinary research," Weber observes, "demonstrates Professor Dickerson's ability to interact outside of her area of expertise and fully support a team approach to achieving engineering tasks."

Alumni updates

Ramasubramanian enjoys Arizona sun

Srinivasan Ramasubramanian (PhD'02) is an assistant professor in the Department of Electrical and Computer Engineering at the University of Arizona, where he teaches classes in fault tolerance and optical networking. Ramasubramanian says Arizona is a great place to work and a perfect match for his research in high-speed optical network design. "The university," he says, "is very strong in optics." He and six other researchers at Arizona recently received a grant worth $2.5 million to find a way to reliably transfer data in the event of network failure. Besides teaching and research, Srini enjoys the Arizona weather.

Striegel turns Irish

Aaron Striegel (PhD'02) is an assistant professor in computer science and engineering at the University of Notre Dame, teaching classes in computer security and imbedded systems. He recently received an NSF Career Award for his work on "Transparent Bandwidth Conservation Technique," a project to improve bandwidth efficiency on the Internet. His research seeks deployable solutions for problems that crop up when a content site is hit with an enormous amount of activity at one time. "A good example," he says, "is handling the thousands of fans that want to listen to Irish (or Cyclone) football games on Saturday afternoons."

Straight from the heart

Yi Zheng (MS'85, PhD'87) served as chair of the Department of Electrical and Computer Engineering at St. Cloud State University for seven years, adding a bachelor's degree in computer engineering and a master's program in electrical engineering to the curriculum, at the same time doubling enrollment in the department. Besides teaching, Zheng is working to reduce heart disease. He and other researchers at the Mayo Clinic in Rochester, Minnesota, are using ultrasound waves to vibrate blood vessels, which, in turn, helps determine the vessels' elasticity, a key to measuring early signs of heart disease or hypertension. "If you can detect the stiffness early, you can prevent some heart disease," Zheng says.

New ECpE staff

Charyl Winterink is the department chair's new secretary. She has worked at Iowa State for 17 years, including 15 years with the Ames Laboratory. Charyl's responsibilities include keeping department chair **Arun Somani**'s calendar up to date and assisting with faculty administration, as well as planning special events for the department. Charyl and her husband, **Wes**, are avid ISU sports fans. In her spare time, Charyl enjoys running and traveling.

Honors and awards

Anderson wins Cisco IA scholarship

ECpE graduate student **Benjamin Anderson** received a Cisco Systems information assurance scholarship for the spring 2005 semester. Anderson's application was chosen based on several criteria, including the originality of the ideas posed in an essay, as well as his breadth of knowledge in the information assurance field. Anderson is a student of Assistant Professor **Tom Daniels**.

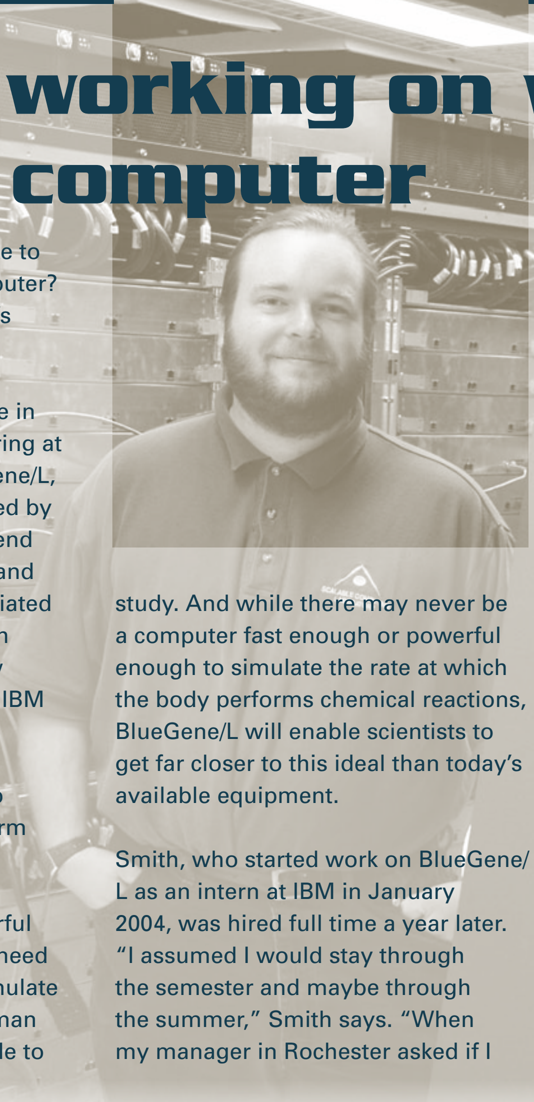
Dogandzic receives IEEE Best Paper nod

Assistant Professor **Aleksandar Dogandzic**'s paper, "Generalized multivariate analysis of variance: A unified framework for signal processing in correlated noise," has received the Best Magazine Paper Award for 2004 from *IEEE Signal Processing Magazine*. The article ran in the magazine's September 2003 issue. Dogandzic was recognized with the award, which includes a cash prize, at the 2005 IEEE International Conference on Acoustics, Speech, and Signal Processing held last month in Philadelphia.

McCalley garners Cornell grant

ECpE Professor **James McCalley** received $25,000 from Cornell University for "Risk-based Maintenance Resource Allocation for Distribution System Reliability Enhancement."

Alum is working on world's fastest computer



Ever wonder what it would be like to work on the world's fastest computer? **Brian Smith** did—and now that's what he's doing.

Smith, who earned an MS degree in electrical and computer engineering at Iowa State, is working on BlueGene/L, a cooperative project spearheaded by IBM to build an innovative high-end computer for scientific research and calculations. The project was initiated in 1999 at IBM's Watson Research Center in Yorktown Heights, New York, and has expanded to other IBM facilities worldwide.

The project's original goal was to build a machine that could perform up to one quadrillion operations per second—about a thousand times faster than the most powerful computer at the time. Scientists need a machine like BlueGene/L to simulate molecular interactions in the human body that are currently impossible to study. And while there may never be a computer fast enough or powerful enough to simulate the rate at which the body performs chemical reactions, BlueGene/L will enable scientists to get far closer to this ideal than today's available equipment.

Smith, who started work on BlueGene/L as an intern at IBM in January 2004, was hired full time a year later. "I assumed I would stay through the semester and maybe through the summer," Smith says. "When my manager in Rochester asked if I wanted to stay and work full time, I said, 'of course.'"

There were fewer than 20 people working on BlueGene/L in Rochester on Smith's first day. That was perfect, he says, because it meant he could work on whatever aspect of the design he chose. His focus, he decided, would be on software.

"With thousands of nodes in the computer working on a single task," Smith explains, "the application must move data between the nodes constantly. I work on the software so any given node can send its data to another node as efficiently as possible."

At first, Smith says, there were fewer than 512 nodes on the computer, but today his team is working on a system with more than 32,000 nodes. "It's been fun to see that progress," he adds.

IOWA STATE UNIVERSITY

Electrical and Computer Engineering
2215 Coover Hall
Iowa State University
Ames, IA 50011-3060