



# SYSTEMS SOLUTIONS

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Research

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## Moss, Horiuchi win \$1.6 million NIH grant

Professor **Cynthia Moss** (Psychology/ISR) and Assistant Professor **Timothy Horiuchi** (ECE/ISR) have received a five-year, \$1.6 million grant from the National Institutes of Health (NIH).

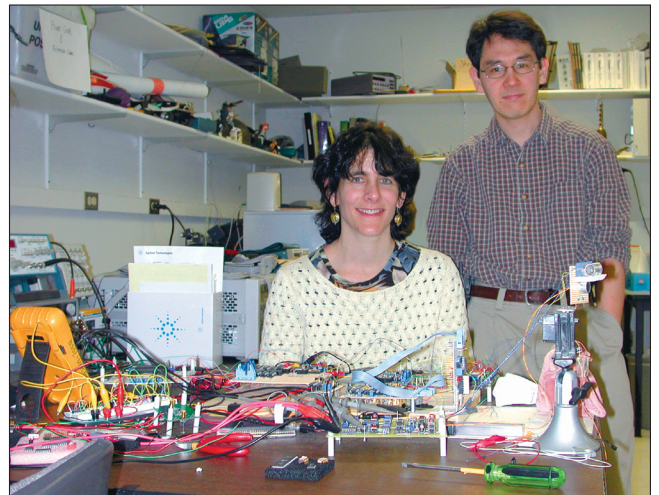
The grant, for their work in "Dynamic Sensorimotor Control for Spatial Orientation," was issued by NIH's Division of Neuroscience and Basic Behavioral Science, part of the National Institute of Mental Health.

Moss and Horiuchi's work will help to expand understanding of how mammals process and integrate auditory information with their motor programs, adapting as they move spatially in their environments.

Being able to navigate within the environment is central to healthy human functioning. An enhanced understanding of sensorimotor integration may lead to better treatment and rehabilitation for people in whom this fails to develop normally or for whom it has broken down through disease.

For example, individuals with impaired vision depend largely on auditory cues to direct their movements, and yet surprisingly, blind individuals may show impaired audiomotor integration, perhaps because they lack the visual input normally used to calibrate this sensorimotor feedback system.

Moss and Horiuchi's research will combine behavioral and neurophysiological experi-



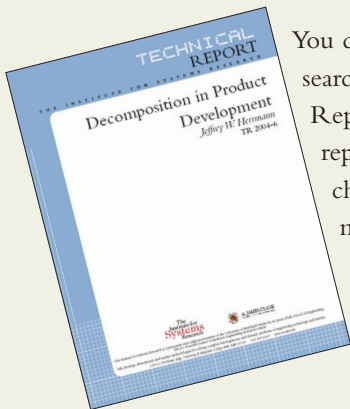
ments using the acoustic imaging system of the echolocating bat, an animal that relies on spatial analysis of dynamic auditory scenes to guide its behavior.

They will study spatial localization, tracking and obstacle avoidance; examine how the bat's sonar signal production shapes auditory responses to echoes; and study how patio-temporal activity patterns in the nervous system can depend on behavioral state, task and context.

This research will have wide ranging impact for neuroscience, biological research techniques, robotics design, control theory and the development of assistive medical devices. [ES](#)

## Online services at ISR

ISR is now making available an online streaming library of lecture and colloquium videos featuring faculty, distinguished lecturers and other special guests. View these presentations from the cutting edge of systems-related research in streaming QuickTime format at [www.isr.umd.edu/VideoReports/](http://www.isr.umd.edu/VideoReports/).



You can search, view and download thousands of Technical Reports spanning nearly 20 years of ISR history. The reports are in PDF format and are available free of charge. Search by keywords, author, title, year and more. M.S. theses and Ph.D. dissertations are included. <http://techreports.isr.umd.edu/ARCHIVE/>

The latest news about ISR is always available online at [www.isr.umd.edu](http://www.isr.umd.edu). [S](#)

## Four new patents

Former ISR Associate Research Scientist **M. Scott Corson**, along with **Vincent Park** of the Naval Research Laboratory, have been issued two patents for technology invented during Corson's tenure with ISR.

US Patent #6,628,643, "A method for eliminating the requirement for synchronized clocks in distributed routing approaches that are dependent on the temporal ordering of events," features the TORA (Temporally Ordered Routing Algorithm) algorithm, well-suited for operation in a dynamic or bandwidth-constrained networking environment such as mobile wireless networking.

US Patent #6,667,957, "Adaptive routing method for a dynamic network" is a highly-adaptive, loop-free, distributed routing algorithm for dynamic networks. The protocol's reaction is structured as a sequence of diffusing computations, each of which consists of a sequence of directed link reversals.

ISR-affiliated Professor **Christopher Davis** (ECE), ECE Assistant Research Scientist **Igor I. Smolyaninov**, former post-docs **Saeed Pilevar** and **Klaus Edinger**, and former Ph.D. student **Walid Atia** have been issued US Patent #6,633,711 for "Focused ion-beam fabrication of fiber probes for use in near field scanning optical microscopy." This is a method of forming a fiber probe with an aperture for use in near-field scanning optical microscopy.

Former ISR faculty members **Don DeVoe** and the late **Lung-Wen Tsai** were issued US Patent #6,664,126 for "A process for 3-dimensional micro mechanisms." This invention provides a fabrication process for manufacturing truly 3-dimensional micromechanisms which takes advantages of SOI (silicon-on-insulator) wafers. [S](#)

## Michel Cukier wins NSF CAREER award for computer network security



ISR-affiliated Assistant Professor **Michel Cukier** (ME), has won a National Science Foundation Faculty Early Career Development (CAREER) Award for "Probabilistic Evaluation of Computer Security Based on Experimental Data." The project will evaluate the security of a computer network based on experimental data such as vulnerability and attacker data collections.

Because current computer networks are so complex, any network contains vulnerabilities that might be exploited by an attacker. Once a vulnerability is discovered, for security concerns, the vulnerability should be immediately removed. However, this removal may impact other components of the network. For example, some applications no longer run when "patches" are applied to the operating system.

To resolve these trade-offs, Cukier will introduce a measure of computer security and probabilistically quantify it based on experimental data. Applying this approach, the vulnerabilities most prone to attacks can be identified. The security community will benefit from this probabilistically quantified measure based on previous data collections of system, network and application vulnerabilities and attacks.

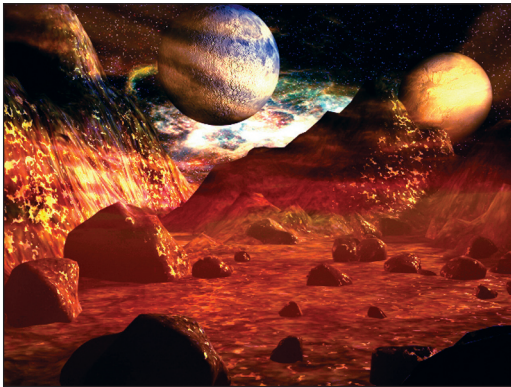
NSF CAREER awards foster the development of outstanding junior faculty, combining the support of broad and high-quality research and education. [S](#)

## Akin is PI for new NASA astrobiology award

ISR-affiliated Associate Professor **Dave Akin** (AE/ISR) is the principal investigator for a three-year NASA Astrobiology Science and Technology for Exploring the Planets (ASTEP) award valued at \$3,075,094.

NASA's ASTEP program brings the science and technology communities together to enable future space missions to determine whether life exists or has existed outside Earth. Through a detailed, collaborative analysis of the Earth's own extreme environments, NASA believes it can better prepare to understand analogous systems elsewhere. The focus of ASTEP projects is to validate and improve existing technology, preparing it for future flight missions to test for life in the solar system and beyond.

Considerable scientific and public interest was generated by the discovery, almost two decades ago, of deep volcanic vents in the mid-Pacific and mid-Atlantic ocean rifts, which support rich biological environments that do not rely on sunlight. Recently, volcanic vents were also discovered under the ice cap in the Arctic. However, technology does not currently exist to sample the life forms around these vents. This project will be the first to obtain biological samples from the



Arctic, which will tell scientists how much commonality in evolution exists between hydrothermal ecosystems in widely separated areas.

In the project, Akin's Space Systems Laboratory will adapt its space robotics technology to build a dexterous robot arm for deep submergence activities. It will integrate this manipulator with the Woods Hole Oceanographic Institute's SeaBed autonomous underwater vehicle and send it under the Arctic ice cap to sample marine life around hydrothermal vents at a depth of 4,000 meters.

NASA will use this Earth-based investigation to gain understanding as to how to best conduct biological investigations of other bodies (most directly Mars and the Jupiter moon Europa).

Akin will be joined on the project by Assistant Professor Ella Atkins (AE), who will develop technologies for autonomous perception and planning to identify, target and capture specific biological specimens. [ES](#)

## \$1.2 million NSF grant for optical wireless sensor networks

ISR Senior Research Scientist **Stuart Milner** is the principal investigator of "SENSORS: Optical Wireless Sensor Networks for Critical Infrastructure Surveillance," a new three-year, \$1.2 million National Science Foundation award.

Co-PIs are ISR-affiliated Professor **Christopher Davis** (ECE); Uzi Vishkin (ECE/UMIACS); Professor Gregory B. Baecher, chair of the Civil and Environmental Engineering Department; and Philip J. Tarnoff, director of the Center for Advanced Transportation Technology.



An agile transceiver with a high-performance motor.

There is a growing need, especially in light of homeland security, for surveillance of critical infrastructure, including road, water, electrical, and rail systems. There is an equally compelling concern for a high level of effectiveness among first responders to terrorist, weather and hazardous spill incidents. In both cases, there is an urgent need for high-quality, video-based surveillance, advanced specialized sensors and high-bandwidth communications, which are portable, secure, reconfigurable and offer high availability.

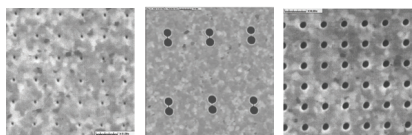
This project will extend research in optical wireless and other technologies to provide a robust, advanced sensor-communication network. This will include developing autonomous, solar-powered optical wireless transceivers that can point and track, handle continuous or bursty data, and function in a dynamic, self-configuring network environment.

The goal is to advance the development of portable, secure, reconfigurable and high availability networks for surveilling roads, water, electrical, rail and other infrastructure systems as well as for first responders in various kinds of incidents. These networks will be rapidly deployable and provide an instant communications infrastructure. [ES](#)



## \$1.2 million NSF award for nanofabricated all-optical devices

ISR-affiliated Professor **Christopher Davis** (ECE) is the principal investigator for a new National Science Foundation award, “NIRT: Nanofabricated All-Optical Computing, Switching, and Signal Processing Devices Based on Single Photon Tunneling.” This is a four-year, \$1.2 million award. Co-PIs are ECE Professor John Melngailis; ECE Assistant Research Scientist Igor Smolyaninov; Alexei A. Maradudin from the University of California, Irvine; and Andrei V. Stanishvsky from the University of Alabama at Birmingham.



Focused ion-beam milled nanochannels in thick gold membranes

A new and important phenomenon involving single photon tunneling was recently discovered by members of this team. Transmission of light through nanometer-scale pinholes in a gold film covered by a nonlinear dielectric saturates at a few thousand photons per second. The transmittance

of such a nanometer-scale hole is nonlinear with light intensity, and at the single photon level corresponds to each photon in the process of being transmitted through the hole controlling the transmittance of successive photons.

This result is analogous to the Coulomb blockade observed in single electron tunneling experiments. The phenomenon was initially observed only for random nanoscale pinholes that occur naturally in thin evaporated gold films. Further work has demonstrated that the transmittance of both individual nanofabricated holes (nanopores), and arrays of nanopores, both made by focused ion-beam nanofabrication techniques, shows not only the simple photon-blockade effects, but also controlled photon transmission. For example, the transmittance of a nanopore or nanopore array at one wavelength can be controlled by illumination with a second, different, wavelength.

In this project a multidisciplinary team of optical scientists, theorists and nanofabricators will study this new phenomenon and explore potential applications based on fabricated nanopores or arrays of nanopores in metal films. They expect that a detailed study of optical properties of such well-controlled nanopores and other nanostructures will reveal novel quantum phenomena in nonlinear optical transmission.

In addition, novel and potentially important applications of nonlinear nanopore materials may also be expected in optical communications and all-optical signal processing. Optical signal processing relies on nonlinear interactions of light, which usually happen at very high optical intensities. Preliminary results indicate that the local optical field in a nanopore is enhanced by at least six or eight orders of magnitude, enabling nonlinear optical interactions to occur at much lower illuminating light intensities. This opens the door to devices where light is used to gate light, which the researchers have already demonstrated at a fundamental level. Thus, a great number of optical communication and optical signal processing devices, such as all-optical switches, and signal and image processing devices, may be realized on a microscopic scale, and at much smaller operating optical powers than macro devices. [ES](#)

## NSF grant for PRAM On-Chip

Assistant Professor **Rajeev Barua** (ECE/ISR) is a co-principal investigator for a new NSF Information Technology Research grant. Parallel Random-Access Model (PRAM) On-Chip is a five year, \$700K grant addressing the open problem, “Can a breakthrough high-end parallel computer be built through designing a machine that truly can look to a programmer like a PRAM?”

Professor **Uzi Vishkin** (ECE) is the principal investigator. Other co-PIs along with Barua are Bruce Jacob, Manoj Franklin and Gang Qu (all ECE).

The magnitude of the algorithmic knowledge base that has been developed for the PRAM algorithmic model makes it a serious alternative to serial algorithmic theory. The problem of building a general-purpose parallel computer that is significantly faster than its serial counterpart has been a major open problem for computer science since the inception of the field. It has eluded a solution for several decades.

This research will provide the backbone in the development of a holistic computation framework, called Explicit Multi-Threading (XMT) that seeks to resolve this long-standing problem. [ES](#)

## Espy-Wilson given Honda Initiation Grant

Associate Professor **Carol Espy-Wilson** (ECE/ISR) has received a one-year, \$50,000 Honda Initiation Grant for “Probabilistic Framework for Acoustic-Phonetic Knowledge Based Continuous Speech Recognition.” The program “discovers and engages Honda’s future research partners in academia.” [ES](#)





## Abed co-PI for NSF SGER grant

ISR Director **Eyad Abed** (ECE/ISR) is the co-PI of a new National Science Foundation SGER grant, “Optimal Stochastic Unit Response Subject to Ramp and Network Constraints.” This one-year grant will address the optimal response of a power utility’s thermal plant to price and network uncertainties. The principal investigator is Professor Chung-Li Tseng of the Civil and Environmental Engineering Department.

Dr. Abed’s continuing research projects include an ONR effort, “Nonlinear Dynamics and Control of Supercavitating Bodies,” joint with co-PI Professor Balakumar Balachandran of the Mechanical Engineering Department; an NSF grant, “Nonlinear Dynamics-Based Robust Congestion Control,” in which ISR Post-Doctoral Research Associate Priya Ranjan is playing a major role; and an ARO grant, “Dynamics and Control of Biologically Inspired Mobile Networks,” pursued jointly with co-PI Professor **John S. Baras** (ECE/ISR) [ES](#)

# Six ISR faculty win MIPS contracts

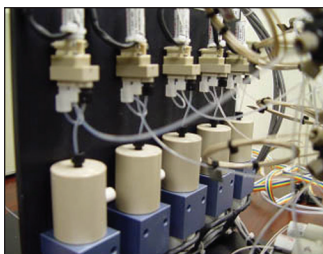
ISR faculty are associated with six new Maryland Industrial Partnerships (MIPS) contract awards. The MIPS program provides matching funding for university-based research projects that help companies develop new products. Any company with operations in Maryland is eligible, as are faculty from any of the University System of Maryland’s 13 institutions. Projects must deal with innovative technological or scientific concepts and have direct commercial applications.

Professor **K.J. Ray Liu** (ECE/ISR) is working with InTank, Inc., of Laurel, Md., on the new MIPS project, “Ultrasonic Nondestructive Inspection of Tanks.” This project will develop an effective and efficient ultrasonic testing system for use in robots that inspect commercial storage tanks such as gasoline, fuel oil, and chemicals.

ISR Senior Research Scientist **Stuart Milner** is working on a MIPS communications project with LumenLink, Inc., of Rockville, Md. The project will develop actively tracked optical wireless links for “bursty,” high-data-rate communications between moving platforms.

Professor **John Baras** (ECE/ISR) is working on a Phase II MIPS project with Hughes Network Systems on “Broadband Internet Applications over Satellite,” which will develop new and innovative Internet applications exploiting the increased bandwidth of forthcoming high-data-rate satellite constellations for HNS’s DIRECWAY product.

Associate Professor **S.K. Gupta** (ME/ISR) is working with Automated Precision, Inc., of Rockville, Md., developing mathematical models, algorithms, and prototype software to facilitate the inspection of automobile body panels using a novel, digital micro-mirror device-based inspection hardware system being developed by API. The new auto body inspection sensor system would significantly reduce the time it takes to inspect automobile body panels, and enable near 100 percent accuracy.



Pumping station of the Protovis VeriScan 3000

Assistant Professor **Benjamin Shapiro** (AE/ISR) is working with Protovis of Rockville, Md., on biodec-tor fluidic delivery optimization. This project will model, develop and optimize a micro fluidic sample delivery system for Protovis’ VeriScan 3000 instrument, an advanced biological or chemical detector combining Micro-Electro-Mechanical (MEMS) and micro-fluidic technologies.

ISR-affiliated Professor **Neil Goldman** (ECE/AE) is working with TRX Systems, Inc., Lanham, Md. on indoor location and emergency alerting technology. He will design and develop technology to wirelessly track the location of firefighters, police, and other public personnel inside buildings and structures. [ES](#)



InTank robot inspects a commercial storage tank

## Toshiba scientists discuss future research collaborations



Toshiba representatives meet with ISR faculty in January. Representatives from Toshiba's CMC Microelectronics Packaging Research Center visited ISR in January to discuss future research collaborations. [ES](#)

## Two new Toshiba visiting scientists

ISR currently has two Toshiba scientists in residence, working with faculty on projects of mutual interest.



**Mr. Taizo Tomioka** is a Toshiba research scientist from Yokohama, Japan. For the next six months he will be working with Assistant Professor Reza Ghodssi (ECE/ISR) and Professor Gottlieb Oehrlein (MSE) on microelectronics process technology for advanced small optical modules using 3D silicon interposers and IC stacking technology.

**Mr. Hideo Mizusawa** is a research scientist at Toshiba. During his stay here he is continuing the research of previous Toshiba visitors with Professor Michael Ball (Robert H. Smith School of Business/ISR) on the production loading project. [ES](#)



## Honda R&D representatives visit ISR

Four representatives from Honda R&D visited ISR Nov. 14 for a review of the Visiting Scientists Program. In the photo below, the representatives are meeting with Clark School of Engineering Dean **Nariman Farvardin**. The visitors were: **Mr. Taku Kitayama**, Chief Engineer & VSP Manager, Honda R&D Co. Ltd.-Japan; **Mr. Ryoji Minami**, Senior Coordinator, Corporate Services; **Ms. Sakurako Kurano**, Administrative Assistant, General Administration; and **Ms. Noriko Mills**, Administrative Assistant, General Administration; all from Honda R & D Americas, Inc.-Ohio Center. They were joined by the current Honda Visiting Scientist, **Mr. Morimichi Nishigaki**.



Since 1999, the ISR-Honda Visiting Scientist Program has brought early-career engineers from Honda Research and Development in Japan to ISR for a 14-month immersion in English language and American culture. During their time here, the engineers work with ISR faculty on projects suited to their mutual interests.

The flexible program has been designed to meet Honda's strategic needs. The research conducted is strongly oriented towards Honda's practical and strategic problems, and has strengthened the technical interaction between ISR and Honda.

**Mr. Naritomo Higuchi**, one of the first Honda engineers to participate, says, "Thanks to the Visiting Scientist Program, I developed strong relationships with U.S. researchers. I learned about American universities, industries and their close cooperation through the program. These experiences brought lots of benefits for my current work at Honda. I believe this program will offer really valuable opportunities to every young engineer."



Mr. Yuichi Kato, another of the engineers who took part in the program, says, “Of course, I developed my English communication skills. However, the biggest benefit of this program was to learn the American way of thinking and doing research work. I strongly recommend for young engineers to experience this program.”

Jeff Coriale, ISR’s Assistant Director for External Affairs, says, “This is a win-win situation for both Honda R&D and ISR. The Honda engineers have gained and demonstrated significant expertise while here. The ISR and faculty hosts’ research programs have benefitted through the industrial expertise and insights provided by the Visiting Scientists.”

Mr. Masanori Satake, Honda’s Visiting Scientist Program Manager, says, “This program is unique because it gives challenging experiences to our young engineers. We hope they will become great engineers in the future because of these experiences.” [↗](#)

## Honeywell Labs visitors learn about ISR research

The Clark School of Engineering and ISR hosted a delegation from Honeywell Labs on Nov. 21. The Honeywell representatives learned about some of the research of Professor John Baras (ECE/ISR), Assistant Professor Pamela Abshire (ECE/ISR), Assistant Professor Reza Ghodssi (ECE/ISR), ISR Assistant Research Scientist Eric Justh, and Professor P.S. Krishnaprasad (ECE/ISR). [↗](#)

## Ephremides named Cynthia Kim Eminent Professor; gives invited talks

Last fall, a committee appointed by Clark School Dean Nariman Farvardin named Professor Tony Ephremides to the Cynthia H. Kim Eminent Professorship in Information Technology. This new professorship is endowed by Jeong H. Kim and his family. Dr. Kim is the founder of Yurie Systems and currently a professor of the practice in the Electrical and Computer Engineering and Mechanical Engineering Departments.

In his announcement, Dean Farvardin noted that Ephremides is one of the pioneers in studying wireless communication networks.

“He was the first to propose and study ad hoc multihop wireless networks in 1979 and continuously has made sustained major contributions in that field since then,” the dean said. “He was also the first to identify the role of higher layer protocols in conserving energy and the need to exploit the coupling between layers in the design of wireless networks. His work has literally initiated new tracks of research that by now have become standard components of all journals and conferences in wireless networking.

Farvardin also noted that Ephremides is considered the father of self-organizing algorithm research for mobile ad hoc networks and has performed pioneering research in most aspects of that field.

Ephremides has impressed upon the networking community the importance of the physical layer link and has promoted within the information theory community the extension of that powerful and elegant theory to the field of networking. In addition, Ephremides has made seminal contributions in a variety of focused topics in classical communication theory, stochastic systems, and in several application areas.

Farvardin said that Ephremides has shown leadership in education by pioneering innovative industry-academic cooperation programs and mentoring many graduate students who are now distinguished researchers and professors around the world. Ephremides is a Fellow of the IEEE, past chair of the International Symposium on Information Theory and past chair of Infocom.

### Invited talks

Ephremides gave invited talks at Yale University in October and at the University of Pennsylvania in November. He was also a recent participant in two NSF workshops in Chicago for the definition of future research directions. The first was on future research on information theory and computer science. The second was on future research and challenges in the use of so-called ultra wide band (wireless) transmission at multiple gigabytes per second. Ephremides says, “This is an emerging technology that holds a great deal of interest to vendors and service providers in addition to the research community.” [↗](#)





## Fu named Distinguished Scholar-Teacher

Congratulations to Professor **Michael Fu** (BGMT/ISR), who has been named a 2004-2005 Distinguished Scholar-Teacher by the University



of Maryland. The honor includes public presentations, activities for the university and funds to support professional activities. The program honors a small number of faculty members who have demonstrated notable success in both scholarship and teaching. It is sponsored by the Office of Academic Affairs and administered by the Associate Provost for Faculty Affairs.

## Brubaker earns Outstanding Teaching Award

Congratulations to ISR-affiliated Associate Professor **Kaye Brubaker** (CEE), the recipient of the 2003 E. Robert Kent Outstanding Teaching Award for Junior Faculty. This award is given to a junior faculty member for excellence in teaching.

## New visiting scientist

ISR welcomes new visiting scientist **Inn Ho Jee**, an Associate Professor of Electrical and Computer Engineering at Hongik University in Korea. He is working in signal processing and communication with Professor **K.J. Ray Liu** (ECE/ISR) and his research group.

## New postdoctoral researchers

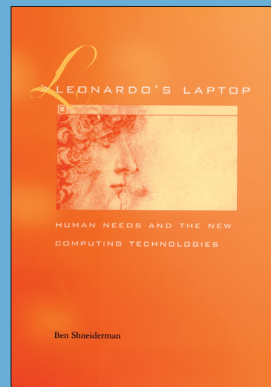
ISR welcomes five new postdoctoral researchers. **Zhu Han** has been working with **K.J. Ray Liu** on signal processing since December. **Munther Hasouneh** recently began working with ISR Director

**Eyad H. Abed** on dynamic system modeling analysis and simulation. **Svetlana Lachinova** will be arriving soon to work with **Mikhail Vorontsov** in the CSHCN Intelligent Optical Lab. She will be conducting research on the analysis of laser tracking systems operating in atmospheric turbulence conditions for laser communication applications, and the development of numerical simulation tools for characterization of atmospheric laser beam propagation parameters in laser tracking systems. **Masoud Olfat** began research on wireless communications with **K.J. Ray Liu** in December. **Xiaodong Yao** is working with **Michael Fu** and **Steve Marcus** on preventive maintenance for semiconductor manufacturing and modeling/analysis of Markov decision processes.

## Landwehr joins ISR

ISR welcomes **Carl Landwehr** to our faculty as a Senior Research Scientist. Dr. Landwehr is an expert in trusted computing.

## Shneiderman wins IEEE Book Award



(MIT Press), won the award for distinguished literary contributions furthering public understanding of the profession. Ben notes that *Leonardo's Laptop* was written for general readers to help them envision the future of information technologies, and for professionals to encourage a more human-centered approach to

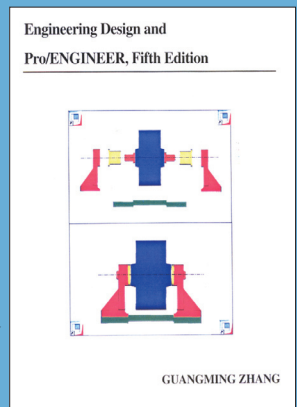
innovation.

Shneiderman also had a hand in the federal government's new guide to developing web sites that are as citizen-centric and user-friendly as possible. Shneiderman wrote, "Design is difficult, but these new research-based guidelines are an important step forward in providing assistance to those who are dedicated to quality."

## Zhang book now in fifth edition

*Engineering Design and Pro/ENGINEER*, written by Associate Professor

**Guangming Zhang** (ME/ISR) is now in its fifth edition. Dr. Zhang's book presents a comprehensive treatment of



engineering design with a focus on solutions based on information technology. It is an introductory text for undergraduate students in all engineering specialty areas and is also useful for professionals engaged in product design.

## Liu elected member-at-large

Congratulations to Professor **K.J. Ray Liu** (ECE/ISR), who has been elected a Member-at-Large of the IEEE Signal Processing Society Board of Governors for 2004-2006.

## Faculty-staff effort wins best paper award

ISR faculty and staff are among the authors of "A New Pedagogy in Electrical and Computer Engineering: An Experimental and Conceptual Approach," which won the Benjamin J. Dasher Best Paper Award at the IEEE "Frontiers in Education" conference the first week of

November. The paper's authors are ISR-affiliated Professor **Neil Goldsman** (ECE); ISR Coordinator of Education Programs **Lee Harper**; ECE Ph.D. student **Zeynep Dili**; Janet Schmidt, the university's director of Engineering Student Research; and ECE Department Chair **Steve Marcus** (ECE/ISR).

## Raghavan winner in junior faculty paper competition

ISR-affiliated professor **S. (Raghu) Raghavan** (Robert H. Smith School of Business) has won second place in the 2003 INFORMS Junior Faculty paper competition. The paper, "Long-Distance Access Network Design," was co-written

with Rosemary Berger, assistant professor of Industrial and Systems Engineering at Lehigh University. Raghavan reports the paper also has been accepted for publication in *Management Science*, the flagship journal for the Institute for Operations Research and Management Science (INFORMS). **SS**

## studentNEWS

ISR Ph.D. student **Soon Cho** received a Student Paper Award for "Real-Time, In-Situ Metrology to Drive Real-Time Advanced Process Control" at Sematech's Advanced Equipment Control/Advanced Process Control Symposium. His advisor, Professor **Gary Rubloff** (MNE/ISR), writes, "Soon's work has been pivotal in developing and demonstrating a viable option for the expansion of the semiconductor industry's current emphasis in advanced process control (APC) into the domain of real-time APC, where real-time, in-situ sensors provide the metrology for virtually instant feedback to the equipment and process. This goal has been central in my group's research for the past several years."

**Marcel Pruessner**, a graduate student in the MEMS Sensors and Actuators Laboratory, received a \$15,000 ARCS Scholarship in a ceremony at the U.S. Supreme Court last fall. He joined two other Clark School students, 15 others winners, University of Maryland President **Dan Mote** and Clark School professors in meeting Justice Anthony Kennedy, their host for the evening.

Pruessner's research focuses on optical switching and III-V MEMS. He is advised by Assistant Professor **Reza Ghodssi** (ECE/ISR), who also attended. **SS**

## High school senior in year-long practicum at Intelligent Servosystems Lab

When high schooler **Mikala Streeter** visited the University of Maryland campus in April 2003 for "Maryland Day," she came back with something valuable—an internship for her senior year.

The Maryland Day event gives prospective students and their families a taste of what the university offers. Streeter, who attends Charles Herbert Flowers High School in Springdale, Md., took in the demonstrations and exhibits, visiting classrooms and laboratories.

At the A.V. Williams Building, Streeter toured ISR's Intelligent Servosystems Laboratory (ISL) and was impressed by the demonstrations of robots that can see and hear. When she returned home, she wrote a letter to Professor **P.S. Krishnaprasad** (ECE/ISR), who directs the lab, and asked if he would be her mentor for her Research Practicum, an all-year internship for seniors in her program. Krishnaprasad agreed.

The practicum is required for Streeter's senior Science and Tech class. "We have to find a mentor, define a project, work on it and meet with them," Streeter explains. "At the end of the year we are expected to write a five-chapter, 20–40 page paper, make a research poster and speak at a symposium."

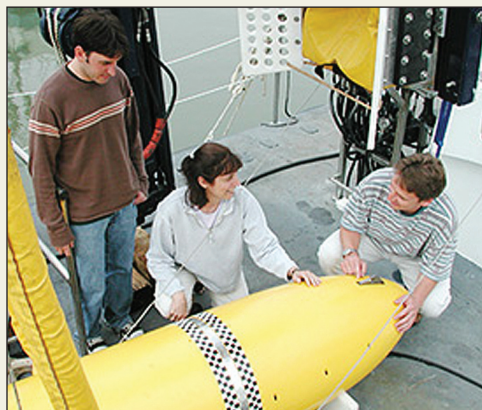
Streeter has come to campus each week since the fall to meet with Krishnaprasad and work on her project. "I have been learning background information, such as the fundamentals of computer programming languages like MDLE and MATLAB," she says. "In my remaining time here I want to design a fantasy robot on the computer and program it to do certain things. I'm especially interested in auditory responses."

When her programming is complete, Streeter will be able to test her results using ISL Lab robots.

Streeter has been accepted into the electrical engineering program at MIT for fall 2004, where she hopes to earn a master's degree in five years. Her research interests are robotics and renewable energy. Someday she hopes to travel to western Africa to set up renewable energy projects. **SS**



## ISR alum Naomi Leonard makes waves in Monterey Bay



ISR alum Naomi Leonard (center in photo at left), a professor in Princeton University's Mechanical and Aerospace Engineering Department, is making waves with underwater robotics research.


Last summer her team launched fleets of autonomous underwater vehicles into the Pacific Ocean at Monterey Bay to test the vehicles' ability to move in formation through the water while mapping ocean currents and tracking marine microorganisms.

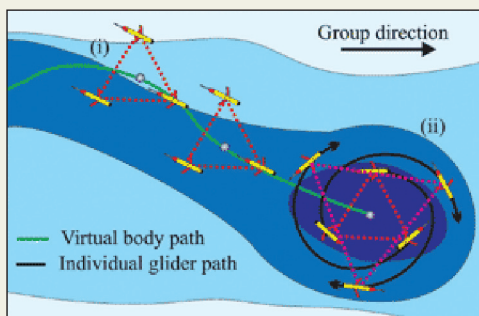
The work was sponsored by the Office of Naval Research. It could yield benefits for a wide range of fields from climate and ecological research to military surveillance.

Leonard says, "It was really exciting. We ran experiments with groups of gliders including rigid and deforming (contracting) formations, and with gliders coordinated with other sensor platforms (towed sensor array from ship and propeller-driven AUV) for evaluating our ability to estimate gradients in temperature, salinity, etc.

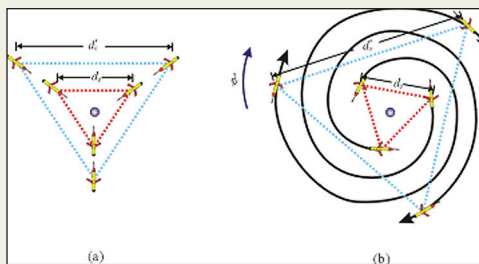
"The gliders themselves were truly remarkable; they were almost perfectly reliable and they stayed in the water for weeks at a time. It was an amazing demonstration of the power of feedback control to see the really autonomous behavior of the gliders as compared to the demands on person time to keep the airplanes flying, the towed arrays moving, even the propeller-driven AUV going—it needed to be launched and recovered frequently."



Leonard is a 1994 ISR-affiliated Electrical Engineering Ph.D. Her advisor was Professor P.S. Krishnaprasad (ECE/ISR). 



**Adaptive sampling.** Gradient climbing (i) by the vehicle group on the sampled field and data-driven group rotations, expansions and contractions focus the mobile sensor array on sub-regions of greatest scientific interest.



**Group expansions.** The red triangle denotes the initial configuration, the light blue triangle denotes resulting formation after expansion. (a) is group expansion; (b) is group expansion with simultaneous rotation.

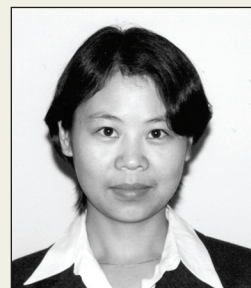
## Sarkar, Liu receive NSF CAREER awards


Saswati Sarkar, an ISR graduate who is now an assistant professor in the University of Pennsylvania's Electrical and Systems Engineering Department, has won a National



Science Foundation Faculty Early Career Development (CAREER) Award for "Realizing the Potential of Wireless Ad-Hoc Networks through Holistic Resource Allocation." Sarkar will design an optimal distributed control framework that uses local observations and partial information of the resource requirements and availabilities at other nodes to attain efficiency. Sarkar's Ph.D. advisor was Leandros Tassioulas.

ISR alum Mingyan Liu, an assistant professor in the University of Michigan's Electrical and Computer Engineering Department, won a CAREER Award for



"Capacity-Driven Design of Large-Scale Wireless Sensor Networks." She will develop a design methodology for large-scale data-gathering wireless sensor networks using fundamental capacity limit studies. Her Ph.D. advisor, Professor John S. Baras (ECE/ISR), says, "Mingyan is special because she started in the ISR MSSE program, where she excelled. Then she became a Ph.D. student in our ECE Department, where she also excelled. She is the first MSSE graduate I know of who has gone into an academic career—and she is succeeding in it." 



## events

Professor **Michael Ball** (Robert H. Smith School of Business/ ISR) hosted the Collaborative Decision Making (CDM) project review at ISR on Sept. 25. CDM is one of the research areas of NEXTOR, the National Center of Excellence for Aviation Operations Research.

An interim-use Engineering College Clean Room opened this fall, meeting an urgent need for enhanced campus-wide fabrication capabilities. The room provides facilities to serve MEMS device fabrication as well as general micro/nano fabrication. This temporary facility is located in the Energy Research Building within the Institute for Research in Electronics and Applied Physics (IREAP). The steering committee includes Assistant Professor **Reza Ghodssi** (ECE/ISR), Associate Professor **Don DeVoe** (ME), Assistant Professor **Elisabeth Smela** (ME) and Professor **John Melngailis** (ECE/IREAP).

ISR welcomed engineers from three African nations on Nov. 12. Left to right, Dr. I.E. Davidson, South Africa; Prof. Ebenezer Jackson, Ghana; Prof. P.A. Kuale, Nigeria; ISR Director Eyad Abed; Dr. Joseph Ekeh, Nigeria; and Engineer J.O. Ayodele, Nigeria.



Bioscience Research and Technology Review Day, Nov. 5, featured a Neuroscience Symposium presented by Professor **Cynthia Moss** (Psychology/ISR) and Assistant Professor **Timothy Horiuchi** (ECE/ISR). In addition, "The Dynamic Brain: Linking Neural Activity and Behavior," was presented by Horiuchi and Professor **Shihab Shamma** (ECE/ISR) and representatives from NIH and MIT. [ES](#)

## Distinguished Lecturer Series features Smith, Chua, Glass and Robertson

Douglas Smith of the Kestrel Institute spoke about high-performance planners and schedulers on Oct. 20 as the first ISR Distinguished Lecturer of the fall. He was followed on Dec. 18 by Professor Leon Chua from the University of California, Berkeley, who gave a "New Perspective on Wolfram's 'New Kind of Science.'"

Leon Glass, FRSC; the Isadore Rosenfeld Chair in Cardiology and Professor of Physiology at McGill University in Montreal, spoke on "Dynamics in Genetic Networks" on Feb. 20. He described a mathematical framework that can be used to relate the structure and dynamics of genetic networks.

The second lecture of the spring 2004 semester, on April 16, will feature George G. Robertson, ACM Fellow and Senior Researcher at Microsoft Research. He will speak on "From Hierarchies to Polyarchies: Visualizing Multiple Relationships." Robertson will review what we know about hierarchy visualization, illustrate the broader polyarchy visualization problem with some examples, describe some polyarchy visualization techniques and talk about user studies that evaluate them. [ES](#)

## mediaNOTES

ISR-affiliated Assistant Professor **Min Wu** (ECE/UMIACS) was featured in the December 2003 issue of MIT's *Technology Review* magazine. The story spotlights her work in digital watermarking for black and white text documents, which someday could be used in commercial document-verification systems.



The December 2003 issue of *Esquire* magazine features a story on the Defense Advanced Research Projects Agency (DARPA) and the work of its program managers, key to the agency's research. ISR Senior Research Scientist **Stu Milner**, a DARPA program manager, is in the group photo that opens the story.

Professor **G. Anandalingam** (Robert H. Smith School of Business/ISR) was a guest on CBS's "The Morning Show" in a segment about the spread of Global Positioning System (GPS) technology to consumer use, in particular, General Motors' On-Star system.

National Public Radio's "All Things Considered" ran a segment featuring Professor **Cynthia Moss** (Psychology/ISR) and other researchers at the First Conference on Acoustic Communication by Animals, held the last week of July at the University of Maryland. In the segment, Moss speaks about her work with echolocating bats.

WMAL news radio interviewed Professor **Armand Makowski** (ECE/ISR) and Clark School Adjunct Eugene Keating about the telecommunications impact and causes of the August 14 power outage that

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## Media notes

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affected much of the Northeast U.S. and eastern Canada.

Professor **James Hendler** (CS/ISR) was quoted in an internetnews.com story about the development of the Semantic Web. Hendler is co-chair of the Web Ontology Working Group, part of W3C, the World Wide Web Consortium. He also commented on developments in robotics on WTOP Radio, Dec. 20.

Professor **Ben Shneiderman** (CS/ISR) is a consistent newsmaker and commentator. At year's end he was one of the guest commentators in a segment titled "The Best and Worst of 2003 in Technology" on WAMU's The Kojo Nnamdi Show and was featured on *Government Computer News*' web site, speaking about "where IT is or isn't heading in the new year." Ben offered commentary on spam, RFID, and the

relative importance of speech and visual in the future of computing.

Shneiderman's Treemap software, developed in the ISR-affiliated Human-Computer Interaction Laboratory, impressed the British media. *The London Independent* newspaper proclaimed, "Nothing beats it for simplicity and the 'wow!' effect when you first use it."

Treemap also was recognized for its use as a component in software that Sun Microsystems, Inc., is using for visual analysis of its global quality and marketing initiatives. Fraser Arnot, the architect of the first treemaps at Sun said, "We quickly realized Treemap's key attribute was the ability to identify the critical few from the trivial many, which in today's business world is becoming harder and harder to do. In addition, we were surprised that we could use it in so many areas of the business." ☺ S

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**ISR** is a permanent state-supported institute of the University of Maryland, within the A. James Clark School of Engineering. ISR is a National Science Foundation Engineering Research Center.

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