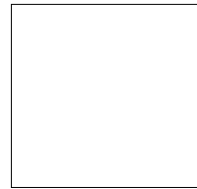




A. JAMES CLARK  
SCHOOL OF ENGINEERING

The Institute for Systems Research  
University of Maryland  
College Park, MD 20742-3311

ADDRESS SERVICE REQUESTED



# SYSTEMSOLUTIONS

THE INSTITUTE FOR SYSTEMS RESEARCH  
A. JAMES CLARK SCHOOL of ENGINEERING

**Maryland Robotics Day is Sept. 21, 2012. Learn more at [robotics.umd.edu](http://robotics.umd.edu)!**

[www.isr.umd.edu](http://www.isr.umd.edu)

A NEWSLETTER FOR COLLEAGUES, RESEARCH PARTNERS, ALUMNI AND FRIENDS OF THE INSTITUTE FOR SYSTEMS RESEARCH, A. JAMES CLARK SCHOOL OF ENGINEERING, UNIVERSITY OF MARYLAND.

## ISR IN THE NEWS

Washington, D.C. television channel 9 (WUSA) was on campus April 27 to do live remotes promoting Maryland Day. Students and faculty from the Maryland Robotics Center were on hand, including Director **S.K. Gupta** and his students with a bio-inspired crocodile robot; **Gil Blankenship** and his students with robotic vehicles that can be controlled with an iPhone app and a flute; **Derek Paley's** student with two robots programmed to self-balance on a see-saw; an anthropomorphic robotic drummer demonstrated by **Nikhil Chopra's** students; and The Robotics@Maryland undergraduate team (advised by **Nuno Martins**) with their autonomous underwater vehicle.

The Maryland Robotics Center now has more than 50 videos on its YouTube Channel. Check them out at [www.youtube.com/user/UMDRobotics](http://www.youtube.com/user/UMDRobotics).

Professor **Cynthia Moss** (Psychology/ISR) was often in the news this year. She was a guest on NPR's *The Diane Rehm Show* for an episode on white-nose syndrome, a skin disease that has killed millions of bats in the past four years.

Her Auditory Neuroethology Lab was featured in "Brain Games," a National Geographic special on the brain's memory, sensory perception and attention. In the segment, Daniel Kish, an echolocating blind man, visits Moss's lab.

A National Science Foundation video features ISR-affiliated Assistant Professor **Derek Paley's** (AE) unmanned aerial vehicles that predict the strength of hurricanes. Paley's Collective Dynamics and Control Laboratory



focuses on collective behavior, specifically on how groups of unmanned vehicles can work together to solve problems.

Associate Professor **Michel Cukier** (ME/ISR) and Assistant Professor **David Maimon** (Criminology) were featured on a SC Magazine podcast about their partnership studying how the social makeup of a computer network correlates with the attacks used against it.

### ISR Collaborators

AccuStrata  
American Air Liquide  
Antenna Research Associates  
AppTek  
AT&T Labs  
BAE Systems  
Canon US Life Sciences, Inc.  
Ceron Networks  
Chemicell  
CoolCAD Electronics, LLC  
Elsevier  
Emerald Sky Technologies  
Energetics Technology Center  
Fujitsu Laboratories of America  
General Dynamics

Intel  
Intelligent Automation, Inc.  
Lockheed Martin  
Lucent-Alcatel  
MARCO  
Metron Aviation  
Northrop Grumman  
OmniSpeech, LLC  
Qualcomm  
Raytheon  
Sikorsky Aircraft  
Smart Information Flow Technologies  
Techno-Sciences, Inc.  
Toshiba

TRX Systems  
Weinberg Medical Physics, LLC

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

2167 A.V. Williams Building, University of Maryland, College Park, MD 20742  
Phone: 301.405.6615 Fax: 301.314.9920  
Web site: [www.isr.umd.edu](http://www.isr.umd.edu)  
Editor: Rebecca Copeland, [rebeccac@umd.edu](mailto:rebeccac@umd.edu)

### IN THIS ISSUE:

- 2 DIRECTOR'S MESSAGE
- 3 \$1M NIST AGREEMENT
- 3 €3.3M EUROPEAN RESEARCH COUNCIL GRANT
- 4 NSF WORKSHOP ON MICRO, NANO, BIOSYSTEMS
- 5 MSSE DEGREE
- 5 MICROROBOTICS REU
- 6 TRENTO AGREEMENT
- 7 ASSOCIATE PARTNERS
- 8 MAJOR GRANTS
- 10 FACULTY AWARDS AND NEWS
- 13 ALUMNI NEWS
- 15 STUDENT NEWS
- 16 ISR IN THE NEWS



Rebecca Copeland

## NEXTOR II aviation operations research: 7 years, up to \$60M

A new seven-year contract with the Federal Aviation Administration (FAA) is extending and expanding the work of the National Center of Excellence for Aviation Operations Research (NEXTOR).

Since NEXTOR's inception in 1996, ISR has been home to the University of Maryland's NEXTOR researchers.

Led by Professor **Michael Ball** (ISR/Robert H. Smith School of Business) and Associate Professor **David Lovell** (ISR/CEE), Maryland is the lead institution in the eight-university NEXTOR II consortium, whose contract could be worth as much as \$60 million in research expenditures.

### The scope of NEXTOR

The original NEXTOR program was one of five Centers of Excellence created by the FAA to lead the aviation community in advancing new ideas and paradigms for

aviation operations, educating and training aviation professionals, and promoting knowledge transfer among industry, government and academic leaders.

NEXTOR carries out a broad research program on topics of vital interest to the FAA and the airline industry. It develops an understanding of how National Airspace System (NAS) service providers and users will respond to alternative system architectures, operational concepts, investment strategies and finance mechanisms. The knowledge and capabilities gained from NEXTOR provide critical information to executives and senior government officials on issues ranging from near-term investment choices to long-term strategies.

NEXTOR research also addresses the development of new system architectures and operational concepts and related decision support models and tools. Some NEXTOR research results have been





REZA GHODSSI

## Entering exciting frontiers

What an exciting third year I've had as ISR director—and things are on track to become even better at the Institute in the coming months.

In this issue of *System Solutions*, you'll read about three large research awards ISR faculty won in this past year. **NEXTOR II** is our cover story. The Federal Aviation Administration has seen fit to extend the important aviation operations research of the original NEXTOR consortium (and our faculty members Mike Ball and David Lovell) for an additional seven years at a funding level that could reach \$60M. ISR's Founding Director John Baras is the principal investigator for a \$1 million cooperative agreement with the National Institute of Standards and Technology to develop and deploy standards, test methods, and measurement tools to support consistently reliable performance of **cyber-physical systems**. And Shihab Shamma has been awarded a €3.3M European Research Council grant to develop a **radically novel view of hearing**, where active hearing emerges from a deep interplay between adaptive sensory processes and goal-directed cognition.

We continue to strengthen our **systems engineering education** leadership here at Maryland. Our ENES 489 systems engineering capstone course for undergraduate seniors has gained a wide following, and our pioneering M.S. Systems Engineering degree, available since 1987 now includes instruction in the latest model-based systems engineering techniques. You can learn more on page 5.

Our faculty never stop thinking about the future. At our faculty retreat in May, close to 60 of our faculty had the chance to think outside the box together, challenging each other with the kinds of **groundbreaking interdisciplinary research ideas** for which we've become known during our history. Since the retreat they have already been working on several new platforms for future research. Stay tuned for what to come from these efforts, which take advantage of our current interdisciplinary strengths while aligning with the historic core expertise of ISR.

We continue to take pride in the accomplishments of our **Maryland Robotics Center**. The number of faculty and labs associated with the center continues to grow and the center's visibility continues to increase. The center's next "Robotics Day" open house is scheduled for Friday, Sept. 21. We hope you'll be able to stop by if you are in the area.

We are doing all these things while continuing to expand our ties to industry and government, both in the U.S. and abroad. We're creating international research partnerships (see our **agreement with Trento, Italy** on page 6). We have started a new **Associate Partners Program** that makes it easier than ever for companies large and small to work with us on research opportunities (page 7). External interactions and outreach have always been an important part of ISR, and I am proud of these new efforts which are moving us even further forward.

On page 4 you can read about some of the external conferences in which ISR was involved in the past year. John Baras was the general chair of the **Conference on Decision and Game Theory for Security** (GameSec 2011) last November, and also organized a **cyber-physical systems executive short course** at the National Institute of Standards and Technology in January. I myself had the pleasure of chairing and leading ISR in organizing an **NSF Workshop on Micro, Nano, Biosystems** in Arlington, Va., at the end of March. The workshop looked at how far micro, nano, and bio systems have come in 30 years, what key challenges remain, and what exciting frontiers are still to be explored. It honored the NSF career of Dr. Rajinder Khosla.

There are many other news items in this issue of *System Solutions* I know you will find of interest. Be sure to read about the awards and honors bestowed on our faculty, the career progress of our outstanding alumni, and the astonishing talent of our current students.

ISR is on the move. Celebrate with us! Join us!

Best regards,

Reza

incorporated into FAA systems and have led to improved NAS performance.

Over the years, NEXTOR research has had a substantial impact on aviation practice, through its use in decision support tools, operational and system concepts, and policy making. Through their long association with the FAA, NEXTOR team members have come to understand the problems of today's air transportation system at a fundamental level and have gained the trust of a broad range of FAA program managers.

In virtually all NEXTOR projects, faculty have played key leadership roles, with their students heavily involved in the work. In this way, NEXTOR has trained the next generation of aviation researchers. These former students have gone on to pursue careers at key government agencies, aviation research and development companies, airlines and universities.

### NEXTOR II consortium partners

In addition to the University of Maryland, core member universities in the original NEXTOR program included George Mason University; the Massachusetts Institute of Technology; the University of California, Berkeley; and the Virginia Polytechnic Institute and State University.

In NEXTOR II, these universities are being joined by the Georgia Institute of Technology, Ohio State University, and Purdue University. These additional schools have developed substantial aviation research programs that substantially enhance the depth and breadth of the existing NEXTOR team.

There are also five affiliate members: Embry Riddle, Morgan State University, San Jose State University, University of South Florida and University of Colorado. These affiliates bring individual talent and facilities to the team and expand involvement to a more diverse group of faculty and students.

### NEXTOR at the University of Maryland

The research focus at Maryland has primarily involved applying operations research and optimization methods to solve problems in air traffic flow management. Maryland has led the NEXTOR

Collaborative Decision Making (CDM) project that develops decision making processes with shared roles for the FAA and airlines in air traffic management and mitigating the impact of congestion, especially due to weather. Maryland also has played a strong role in projects that assess NAS performance, support FAA airport access control policy making, and estimate the economic impact of delays.

Over the years, NEXTOR has drawn on faculty from a broad range of disciplines, including: operations research (Michael Ball and Lawrence Bodin from the Smith School), transportation engineering (David Lovell, Paul Schonfeld and Mark Austin from Civil Engineering), economics (Lawrence Ausubel and Peter Cramton from Economics), transportation economics (Martin Dresner and Robert Windle from

the Smith School), statistics (Wolfgang Jank from the Smith School) and electrical engineering (Leadros Tassiulas from Electrical and Computer Engineering).

Similarly, NEXTOR has funded students from a range of programs including Civil Engineering, Systems Engineering, and Electrical and Computer Engineering in the A. James Clark School of Engineering; the Robert H. Smith School of Business; the Applied Mathematics & Statistics, and Scientific Computation Program; and Computer Science in the College of Computer, Mathematical and Natural Sciences.

Research has been funded by the FAA, NASA and industry partners including Metron Aviation, Raytheon, Maryland Aviation Administration and CSSI.

## Baras, Austin, Yang leading \$1M NIST agreement

Professor **John Baras** (ECE/ISR) is the principal investigator for a \$1 million cooperative agreement with the National Institute of Standards and Technology (NIST). Associate Professor **Mark Austin** (CEE/ISR) and ISR postdoctoral researcher **Shah-An Yang** are co-principal investigators. The researchers will help NIST develop and deploy standards, test methods, and measurement tools to support consistently reliable performance of new smart systems.

These cyber-physical systems (CPS) knit information and physical technologies into interactive, self-optimizing products and infrastructures ranging from smart cars, aircraft and buildings to an intelligent electric power grid. By developing standards, test methods, and measurement tools, the research effort will help U.S. industry accelerate development of innovative products while also protecting these new types of infrastructure from cyber threats.

"Current approaches to engineering CPS are at their infancy at best, and they are too application-specific, too costly, too error prone, and take too long," explains Baras.

"There is a clear need for unifying principles within and across application domains. Investigating and understanding how cyber components can be synergistically interweaved with the diverse physical components pose foundational research challenges in science, engineering and computing, and they will transform science and engineering education. We welcome the opportunity to help meet this need."

Under the agreement, UMD and NIST will evaluate existing technical and theoretical foundations for today's rapidly evolving CPS, identify gaps and obstacles, and ascertain needs for measurement and standards. The research team also will assess existing and anticipated markets and develop a framework to help guide investments in CPS-related research.

The three-year funding also will support efforts to devise a framework that fosters an "open standards platform" approach enabling systems and underlying subsystems and components to work together interoperably. This will unleash creativity in developing innovative new applications. Other research activities will focus on developing modeling and analytic tools for designing, integrating, testing and managing CPS.

## Shamma is PI on €3.3M European Research Council Grant

Professor **Shihab Shamma** (ECE/ISR) is the principal investigator on a five-year project funded by the European Research Council's (ERC) Advanced Grants program. He is working with the Ecole Normale Supérieure and co-PI **Daniel Pressnitzer**, a researcher at the Laboratoire Psychologie de la Perception of the Centre National de la Recherche Scientifique.

"ADAM: The Adaptive Auditory Mind" experimentally investigates a radically novel view of hearing, where active hearing emerges from a deep interplay between adaptive sensory processes and goal-directed cognition.

Listening is an active process that engages perceptual and cognitive faculties, endowing speech with meaning, music with joy, and environmental sounds with emotion and urgency. Through hearing, humans and other animals navigate complex acoustic scenes, separate sound mixtures, disentangle messages, and assess their behavioral relevance. These remarkable feats are currently beyond our understanding and far exceed the capabilities of the most sophisticated audio engineering systems.

This research will experimentally investigate a radically novel view of hearing, where active hearing emerges from a deep interplay between adaptive sensory processes and goal-directed cognition. The research team will integrate cognitive function as an intrinsic part of sensory processing, amenable to neurophysiological investigation. They will explore the postulate that active and versatile perception is mediated by a rapid adaptive process at the neuronal level.

ERC Advanced Grants allow exceptional established research leaders of any nationality and any age to pursue groundbreaking, high-risk projects that open new directions in their respective research fields or other domains. The funding targets researchers who have already established themselves as independent research leaders in their own right.



## ISR faculty involved in important outside activities

### GameSec 2011

Professor **John Baras** (ECE/ISR) was the general chair for the second Conference on Decision and Game Theory for Security (GameSec 2011) in College Park, Md., last November. The conference was sponsored by the Maryland Hybrid Networks Center, ISR, the Maryland Cybersecurity Center, and other technical sponsors. Former ISR Senior Research Scientist **Carl Landwehr** was the keynote speaker at the conference banquet.

GameSec 2011 brought together researchers establishing a theoretical foundation for making resource allocation decisions that balance available capabilities and perceived security risks in a principled manner. The conference focused on analytical models based on game, information, communication, optimization, decision, and control theories applied to diverse security topics. The connection between theoretical models and real world security problems was emphasized. GameSec provides a venue for researchers to develop a deep theoretical understanding of the underlying incentive and resource allocation issues in security.

The third GameSec conference will be held Nov. 5–6 in Budapest. For details, see [www.gamesec-conf.org](http://www.gamesec-conf.org).

### NIST Cyber-Physical Systems Short Course

Professor **John Baras** (ECE/ISR) organized a short course on cyber-physical systems (CPS) for National Institute of Standards and Technology executives this January. The course focused on these systems' timeliness, significance, markets and impact on the U.S. economy and competitiveness.

Participants heard from industry representatives of the automotive, energy and environmental systems, aerospace, power grid, transportation and electrical/electronics machines and instruments sectors. They also were briefed on the challenges CPS presents for computer science, embedded systems, mathematical foundations, hybrid systems modeling, and the metamodels for systems and interfaces needed to consis-

tently and checkably integrate heterogeneous modeling frameworks. A model-based systems engineering perspective and linkages between tradeoff analysis, modeling and requirements management and representation also was presented.

### NSF Workshop on Micro, Nano, Biosystems

ISR administered an important NSF Workshop on Micro, Nano, Biosystems in Arlington, Va., at the end of March. ISR Director **Reza Ghodssi** (ECE/ISR) chaired the organizing committee. The workshop honored the NSF career of Dr. **Rajinder Khosla**.

The last three decades have been marked by new discoveries, innovations and diverse applications of micro- and nanotechnologies, which have come from both top-down and bottom-up approaches. Many of the potentials of nanotechnology, particularly the most innovative ones

involving self assembly and bottom-up approaches are yet to be realized.

The workshop looked at how far micro, nano, and bio systems have come, what key challenges remain, and what exciting frontiers are still to be explored. It included formal talks, poster sessions, panel discussions, and informal meetings.

It featured five plenary speakers, an additional 10 short oral presentations, and a poster session with 32 posters, including work by Clark School faculty **Agis Iliadis** (ECE), **Elisabeth Smela** (ME), **Sarah Bergbreiter** (ME/ISR) and **Reza Ghodssi** (ECE/ISR).



GUEST OF HONOR RAJINDER KHOSLA ADDRESSES FRIENDS AND COLLEAGUES AT THE BANQUET DINNER.

Kazi Minhazur Rahman

### NSF REU PROGRAM IN MICRO-ROBOTICS

Assistant Professor **Sarah Bergbreiter** (ME/ISR) is the principal investigator for a new National Science Foundation Research Experiences for Undergraduates (REU) site, "Research Opportunities in Miniature Robotics." Maryland Robotics Center Director **S.K. Gupta** (ME/ISR) is the co-PI.

The three-year program—underway in Summer 2012—gives undergraduate students exciting 10-week research experiences in miniature robotics. Ten students from across the country develop interdisciplinary research projects, attend technical seminars, visit local government labs, attend professional and academic development seminars, and tour Maryland's top-notch facilities. REU projects involve students in meaningful ways in ongoing research programs, preparing them for graduate school or research careers in industry and labs.



Rebecca Copeland

## ISR's M.S. in Systems Engineering

### Model-based systems engineering in a systems research environment

In our world of increasing technical complexity, systems engineers solve problems and bring complex systems to reality. Their skills give them significant career advantages, including superior opportunities in management and leadership.

ISR is an internationally recognized leader in systems research, with more than a quarter century's experience pioneering the field. Today, ISR emphasizes advanced strategies for high-level synthesis and analysis of complex, multidisciplinary engineering systems, using the latest model-based systems engineering techniques.

ISR's broadly-based, cross-disciplinary Master of Science in Systems Engineering (MSSE) degree exposes students to model-based systems engineering (MBSE) in a systems research environment. Students gain an understanding of essential systems engineering principles, software tools for modeling and optimization, decision and risk analysis, stochastic analysis, and human factors engineering. They also are exposed to financial and management issues associated with complex engineering systems and services. They will gain deep understanding of one particular application area and will employ systems engineering methodologies and sophisticated mathematical, computational and software tools for the end-to-end development of engineering applications and problem solving.

Some of these advanced methodologies and tools include creating models and simulations of complex engineering systems, using algorithms and processes in system architecture development, and assessing systems design through multi-objective trade-off analysis and optimization.

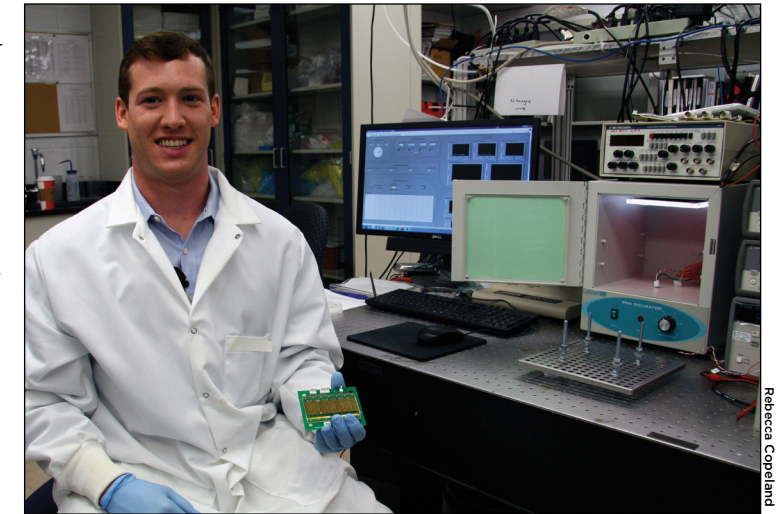
Students bring these advanced skills to bear on real-world problems through case studies and application to specific technology domains that are important to industry and government. ISR places high priority on creating and maintaining a balance of engineering, business and management processes, human and other constraining factors, public policy and law.

The program draws on the engineer-

ing, computer science, and management experience of University of Maryland faculty, and makes optimum use of the university's advanced facilities, including commercial and open-source software tools for MBSE. In addition, the University of Maryland's location close to Washington, D.C., offers advantages and convenience for those seeking employment in,

or those already employed by the federal government and the many private industries supporting it.

To learn more about the MSSE program, contact **Stephen Sutton**, Director,



Rebecca Copeland

"THE MSSE PROGRAM HAS ALLOWED ME TO TAKE THE SKILL SET I GAINED AS AN UNDERGRADUATE ENGINEERING STUDENT AND EFFECTIVELY APPLY IT TO THE KINDS OF REAL-WORLD PROBLEMS I EXPECT TO SEE IN MY CAREER. THE EMPHASIS ON HANDS-ON CLASSROOM EXPERIENCES AND RESEARCH HAS BEEN INVALUABLE IN TEACHING ME HOW TO APPROACH MY OWN WORK."  
—MATT MOSTELLER, 2012 MSSE STUDENT

Systems Engineering Program, at 301-405-4419, [ssutton@umd.edu](mailto:ssutton@umd.edu). Admission requirements and additional details are online at [www.isr.umd.edu/MSSE](http://www.isr.umd.edu/MSSE).

## ISR and INCOSE

In this past year ISR has allied more closely with and increased its participation in the International Council on Systems Engineering (INCOSE), the premier professional society for systems engineering. INCOSE provides ISR with an additional platform to promote our systems research and MSSE program.

INCOSE President John Thomas spoke to ISR faculty and students on INCOSE and the issues facing systems engineering. He also met with the ISR student organization and answered their questions on working in the real world and the .

ISR became an INCOSE Corporate Advisory Board member and member of the INCOSE Academic Council. We are represented by Professor John Baras (ECE/ISR) and Associate Professor Mark Austin (CEE/ISR). In addition, ISR is a sponsor of the regional INCOSE Chesapeake Chapter, which represents systems engineering in industry and government in central Maryland. This forum gives us another place to promote the MSSE program and make technical presentations.

ISR was an exhibitor at the INCOSE Symposium 2012 in early July in Rome, showcasing our MSSE program's emphasis on model-based systems engineering in a systems research environment. MSSE students Matt Mosteller and Parastoo Delgoshaei presented papers at the symposium. Mosteller's paper, "Applying Systems Engineering to Biomedical Applications Platforms for Engineering Experimental Biomedical Systems" received a Best Paper Award.



## Agreement with Trento, Italy yields international research collaborations

A recently signed international framework program agreement between the Autonomous Province of Trento, Italy, and the University of Maryland has already led to collaborative international research projects in solar power, cell-based systems, and ultra-low power systems.

These collaborations, funded by the Autonomous Province of Trento, are part of an effort to conduct joint projects in bioengineering/biomedical devices/bio-microsystems; renewable energy and storage/nanomaterials; and microsystems.

"I'm sure this is the first important step for strengthening the cooperation between the University of Maryland and the Trentino System for High Education and Research," said **Mariano Anderle**, the Autonomous Province of Trento's director of international relations.

"We are excited to begin this new operational phase of our partnership with the Autonomous Province of Trento," said ISR Director **Reza Ghodssi**. "The research projects promise to break new ground and will serve as the catalysts for new relationships among faculty, postdoctoral researchers and students in both Maryland and Trento."

Management and implementation of the agreement is provided by a permanent joint management group with two representatives from the Autonomous Province of Trento—**Mariano Anderle** and **Alberto Lui**, deputy director of international relations for the province; and two from the University of Maryland—**Reza Ghodssi** and **Jeff Coriale**, ISR's director of external relations.

The memorandum of understanding was signed in Maryland on Nov. 3, 2011 by University of Trento Rector **Davide Bassi** and



RECTOR BASSI AND PRESIDENT LOH SIGN THE MEMORANDUM OF UNDERSTANDING. (L-R) ISR DIRECTOR REZA GHODSSI, UNIVERSITY OF TRENTO RECTOR DAVIDE BASSI, ISR DIRECTOR OF EXTERNAL RELATIONS JEFF CORIALE, UNIVERSITY OF MARYLAND PRESIDENT WALLACE LOH, UNIVERSITY OF MARYLAND OFFICE OF INTERNATIONAL PROGRAMS ASSOCIATE DIRECTOR JOSEPH SCHOLTEN.

University of Maryland President **Wallace Loh**.

The memorandum covers research and educational exchanges between the two universities and is part of a broader partnership that also includes the University System of Maryland, the State of Maryland, the Autonomous Province of Trento, the Consiglio Nazionale delle Ricerche, and Fondazione Bruno Kessler.

More details are available online at: [www.isr.umd.edu/news/news\\_story.php?id=6102](http://www.isr.umd.edu/news/news_story.php?id=6102).

### INAUGURAL COLLABORATIONS: SOLAR POWER, CELL-BASED SYSTEMS, ULTRA-LOW POWER SYSTEMS

#### Solar dish applications: solar cooling and photovoltaic cells in dense array

Roberto Brusa, Sebastiano Turrini, Department of Physics, University of Trento. Reinhard Radermacher and Yunho Hwang, Department of Mechanical Engineering; and Mario Dagenais, Department of Electrical and Computer Engineering, University of Maryland.

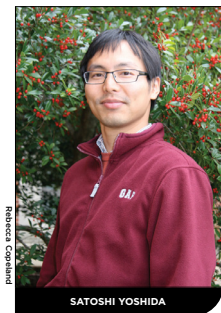
#### Control of living cells through communication with artificial cells

Sheref Mansy, Center for Integrative Biology, University of Trento. William Bentley, Fischell Department of Bioengineering, University of Maryland.

#### Energy-Autonomous Ultra-Low Power Vision Systems (EnerVis)

Dario Petri, Roberto Passerone and Davide Brunelli, Information Engineering and Computer Science, University of Trento. Massimo Gottardi and Pierluigi Bellutti, Center for Materials and Microsystems; Jacopo Iannacci, MEMS research unit, Fondazione Bruno Kessler. Pamela Abshire, Reza Ghodssi, Gang Qu (all Department of Electrical and Computer Engineering/Institute for Systems Research, University of Maryland); and Martin Peckerar, Department of Electrical and Computer Engineering, University of Maryland.

Researchers will be exchanged between the province and ISR for portions of the projects. This is in keeping with the research internationalization goals of the province and the University of Maryland. Initial funding for each project is for one year; it is anticipated that the projects will continue beyond this time.



### Yoshida is Toshiba's 16th Visiting Scientist

Mr. Satoshi Yoshida, an engineer in Toshiba's Global Manufacturing Engineering Center, within its Corporate Manufacturing Engineering Center in Japan, is here for one

year as a Visiting Scientist. He is working on a joint project with Associate Professor **Jeffrey Herrmann** (ME/ISR) to develop optimization models for strategically locating facilities that maximize supply chain profitability.

Mr. Yoshida is the 16th Visiting Scientist ISR has hosted from Toshiba CMC. The program started in 2001. Learn more about ISR's Visiting Scientist program at [www.isr.umd.edu/industry/VSP.htm](http://www.isr.umd.edu/industry/VSP.htm).

## ISR's Associate Partners Program

Aviation, microsystems, robotics and green communication foci available

ISR's Associate Partners Program grants members a level of preferred access to our faculty and students. Associate partners receive priority for research and recruiting opportunities. Partners receive up-to-date information on ISR activities, and ISR actively facilitates direct relationships among associate partners, faculty and students. We also seek out and guide associate partners toward mutually beneficial opportunities for research collaborations with our faculty.

### Benefits

- Priority access to the services of our external relations director, who:
  - » Provides one-stop access to the ISR research community
  - » Establishes ISR knowledge of the partner's organization and research interests
  - » Rapidly identifies collaboration and teaming opportunities
  - » Quickly facilitates connections with best-match ISR faculty and catalyzes discussions to provide assessments of opportunities
  - » Arranges in-person and virtual collaboration development meetings
  - » Guides the associate partner through University of Maryland processes and procedures
- Organization name included in Associate Partners list in ISR print and electronic literature
- Partners receive faculty's priority con-

- sideration for research teaming opportunities
- Bidirectional, short-term researcher exchanges
- Priority and timely access to students for internships and permanent hiring
- Annual ISR-sponsored associate and strategic partners-only workshop
- Distribution of pre-publication research results
- Associate and strategic partners-only website
- Networking opportunities among associate partners

### A path to research collaborations

While valuable in themselves, Associate Partner benefits also provide a natural path to specific collaborations in ISR. These are made possible through additional partnership opportunities, including:

- Membership in ISR's Strategic Partners Program ([www.isr.umd.edu/industry/strategic\\_partners\\_program.htm](http://www.isr.umd.edu/industry/strategic_partners_program.htm)) Benefits:
  - » A specific percentage of dues is allocated to ISR research and education programs of high interest to the partner.
  - » The "Visiting Scientist" benefit allows strategic partner employees to work on campus, conducting research with ISR faculty for extended periods of time.

- Any of the following partnership vehicles:
  - » Research collaborations, including industry-sponsored research
  - » Teaming to win agency-sponsored programs including Maryland Industrial Partnerships for local, small, and start-up companies
  - » Intellectual property licensing
  - » Systems engineering courses, workshops and events
  - » International research agreements
  - » Sponsorship of graduate student fellowships and postdoctoral researchers
  - » Gifts to ISR, including chair endowments, scholarships, gifts of cash, hardware and software, and lab sponsorships

### Dues

Dues to become an Associate Partner are \$10,000 per year. Small companies may qualify for reduced dues. A portion of the dues may be tax deductible.

### For more information

To learn more, contact: **Jeff Coriale**, ISR's Director of External Relations, at 301-405-6604, [coriale@umd.edu](mailto:coriale@umd.edu). Or visit [www.isr.umd.edu/industry/APP](http://www.isr.umd.edu/industry/APP).

## IAI continues colloquia series sponsorship

Intelligent Automation, Inc. (IAI) is again providing financial sponsorship for ISR's colloquia series in 2012. **Vikram Manikonda** (ECE Ph.D. 1997) is IAI's president and a member of the ISR Strategic Advisory Council. He was advised by Professor **P. S. Krishnaprasad** (ECE/ISR).

ISR thanks Manikonda and IAI for their generous sponsorship of the "Intelligent Automation, Inc. Colloquia Series at the Institute for Systems Research." Their support makes the continuation of this community-building colloquia series possible. Learn more about the series and view colloquia videos at [www.isr.umd.edu/events/ISR\\_Colloquia\\_Series/index.htm](http://www.isr.umd.edu/events/ISR_Colloquia_Series/index.htm).



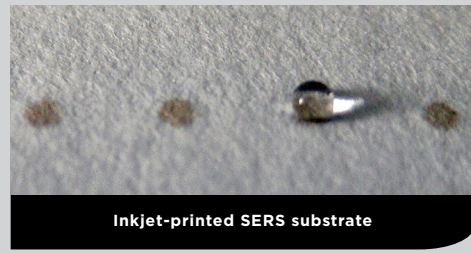
IN FEBRUARY, ISR ORGANIZED THE UNIVERSITY OF MARYLAND'S HOSTING OF A DELEGATION OF UNIVERSITY PRESIDENTS, EDUCATION OFFICIALS AND DIPLOMATS FROM IRAQ. THERE WAS A WIDE-RANGING DISCUSSION WITH MARYLAND OFFICIALS ABOUT FUTURE PARTNERSHIPS, AND THE DELEGATES GATHERED INFORMATION ABOUT HOW MAJOR AMERICAN UNIVERSITIES ARE STRUCTURED AND OPERATE. THEY ALSO TOURED CLARK SCHOOL FACILITIES. HERE, THE DELEGATION VISITS PROFESSOR SHIHAB SHAMMA'S NEURAL SYSTEMS LABORATORY. SHAMMA IS AT CENTER, DRESSED IN RED.



## White: CAREER Award for inkjet-printed biosensors

ISR-affiliated Assistant Professor **Ian White** (BioE) received a 2012 National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award for “Paper-based surface enhanced Raman spectroscopy (P-SERS) for biosensing using inkjet-fabricated devices.” The five-year award is worth \$400,000.

White will develop a method to print sensitive, portable and inexpensive biosensors using ordinary inkjet printers. White has previously created SERS substrates by



Inkjet-printed SERS substrate

fabricating silver nanoparticle-based chemical sensors on sheets of pure cellulose paper using a modified, \$60 inkjet printer. Once the system is set up, no expertise is needed to manufacture it. In the CAREER Award research, White and his team will extend the technique to create paper biosensors with probes made of peptides and nucleic acids embedded in the cellulose paper matrix. The devices will take advantage of the paper's natural fluidic properties to flow biological samples past the probes.

## Shapiro, White receive CERSI awards

Associate Professor **Benjamin Shapiro** (BioE/ISR) and ISR-affiliated Assistant professor **Ian White** (BioE) have received inaugural University of Maryland Center of Excellence in Regulatory Science and Innovation (UM-CERSI) Innovation Awards. These one-year grants support collaborative research projects fostering regulatory science development in medicinal and/or medical devices.

Shapiro's award is for “FDA Safety and Performance Assessment of Emerging Autonomous Neonatal Ventilators by State-of-the-Art Robust Analysis Methods.” He is applying and developing use-control verification techniques such as robust analysis to

initiate best safety practices in autonomous ventilators for preterm neonatal patients.

White's research is “Collaborative Evaluation of Emerging Plasmonic Technologies for Point-of-Care Diagnostics in Low-Resource Settings.” The project focuses on the development of paper-based, surface enhanced Raman scattering (SERS) assay for viral diagnostics.

## Desai studying underlying cancer mechanisms

ISR-affiliated Associate Professor **Jaydev Desai**, (ME) and David J. Foran, Director of the Center for Biomedical Imaging & Informatics at the Cancer Institute of New Jersey (CINJ), are the principal investigators of a 5-year, \$1.6M project to develop new research approaches and technologies for the underlying mechanisms associated with disease onset and progression in breast cancer. The research team will focus on the design, development and evaluation of computational and imaging tools, providing improved detection and tracking of the mechanical and morphological changes that occur with the onset of malignancy.

## Kedem co-investigator on food safety metrics project

ISR-affiliated Professor **Benjamin Kedem** (Math) is a co-investigator on a four-year, \$5.4 million U.S. Department of Agriculture/National Institute of Food and Agriculture grant, “Developing Scientifically-Based Consensus Food Safety Metrics for Leafy Greens and Tomatoes.”



The principal investigator is Professor **Robert L. Buchanan**, director of the University of Maryland's Center for Food Safety and Security Systems.

Ever since 2006, when a deadly batch of spinach killed three people and sickened hundreds, U.S. farm producers, packers

and others along the distribution line have argued over how best to protect consumers and assure them that leafy greens and tomatoes are safe. This research is a major, national initiative to help settle the fight, increase safety and deliver more trustworthy produce. It promises to be one of the most comprehensive studies of fresh produce safety ever conducted.

## Martins developing wearable sensors for wildlife

Associate Professor **Nuno Martins** (ECE/ISR) is developing a data-gathering system that includes devices animals can wear to capture video, sound and geo-location data. He is working with researchers from the National Geographic Society and Princeton University. “Remote Imaging of Community Ecology via Animal-borne Wireless Networks” is an NSF grant worth \$1.8 million over four years, establishing the Clark School's first formal cooperation with the National Geographic Society.

The researchers will construct a wireless network of animal-borne embedded devices. The devices will communicate with one another to resolve their relative positions and provide information about behavior such as predation. They will record audio and high-definition video footage that would normally require high bandwidth and power. Computer algorithms will allow the devices to selectively film at times of interest, greatly extending battery life.

The project will build a foundation of knowledge about designing and optimizing algorithms that control devices for monitoring behavior and social interaction, and provide scientists with valuable information to help protect endangered species.

## Ulukus is PI for cognitive radio networks grant

Professor **Sennur Ulukus** (ECE/ISR) is the principal investigator for an NSF collaborative research grant, “Robust and Secure Cognitive Radio Networks.” The grant is part of a new U.S.-Finnish collaboration program. Maryland's \$160,000 portion of the grant is for two years. The research is a collaboration among the University of Maryland; Northwestern University; the University of Oulu in Oulu,

Finland; and Aalto University in Espoo and Helsinki, Finland. The investigators are developing theoretical bounds for radio resource management schemes and designing low-overhead distributed algorithms.

## Ephremides wins NSF green communications grant

Professor **Tony Ephremides** (ECE/ISR) is the principal investigator for an NSF collaborative research grant, “Energy-Efficient Cognitive Networking.” The two-year, \$172,860 grant is part of a new NSF Finnish-US collaboration program, and is a joint effort between the University of Maryland; Rensselaer Polytechnic Institute; and the Center for Wireless Communications at the University of Oulu in Oulu, Finland.

The project addresses green wireless communication systems and spectrum efficiency. It considers energy efficiency for cognitive radio networks and introduces a novel optimization-based methodology, building on existing results to establish a new focus on green cognitive networking. Energy consumption in cognitive networks provides unique opportunities for exploiting the cognitive process to save energy and use energy reduction techniques to modify and improve cognitive network performance.

## Narayan builds efficient computation algorithms

Professor **Prakash Narayan** (ECE/ISR) is the principal investigator for a three-year NSF grant, “Distributed Function Computation and Multiterminal Data Compression.” Ideas were developed jointly with his Ph.D. student **Himanshu Tyagi**.

The research addresses the theory and design of algorithms for an efficient local computation by multiple network terminals through shared functions of all their observed correlated data. Efficient communication among the terminals facilitates efficient computation. Applications include computing the average, variance, maximum, minimum and parity of observed data in a co-located network of wireless sensors that make correlated measurements. This objective is connected closely to the design of algorithms for the efficient compression of data for storage and transmission purposes,

as well as of algorithms for assuring data security. A main goal of the project is to explicitly characterize these connections, leading to the development of new and efficient algorithms for data compression, function computation and network security.

## Shamma, Kanold, Krishnaprasad win DURIPs

Three ISR faculty have won Defense University Research Instrumentation Program (DURIP) funding.

Professor **Shihab Shamma** (ECE/ISR) received an award from the Office of Naval Research (ONR) for “Research in audio-visual saliency and attention.” Professor **P. S. Krishnaprasad** (ECE/ISR) won an Air Force Office of Scientific Research (AFOSR) award for “Testbed for synthesis of collective behavior from fundamental building blocks.” ISR-affiliated Assistant Professor **Patrick Kanold** (Biology) received an AFOSR award for “Optical stimulation to probe function and structure of microcircuits in auditory cortex of the brain.”

The DURIP program supports the purchase of state-of-the-art equipment to augment or develop university capabilities to perform cutting-edge defense research.

## Shapiro developing control methods for nanoparticle ensembles

Associate Professor **Benjamin Shapiro** (BioE/ISR) is principal investigator on an NSF grant to develop tools that could one day mass-produce revolutionary materials for future technologies such as optical computing, energy harvesting, sub-diffraction limit imaging and invisibility cloaking.

“First-Principles Based Control of Multi-Scale Metamaterial Assembly Processes,” is a four-year, \$1.6M Collaborative Research Cyber-Enabled Discovery and Innovation (CDI) Type II grant that focuses on precisely controlling ensembles of nanoparticles to create defect-free crystals for optoelectronic metamaterials, in a way that has the potential to scale up to fabrication.

The research combines Shapiro's lab capabilities in micro/nano feedback con-

trol with the work of three other principal investigators. Michael Bevan at Johns Hopkins University conducts real-time colloids imaging and experiments; David Ford at the University of Massachusetts Amherst performs statistical mechanics modeling of energy surfaces and arrested states; and Martha Grover, Georgia Institute of Technology, creates control and model reduction methods for statistical ensembles.

They will develop a new approach to the meta-material assembly problem by combining expertise from scientific fields that traditionally have had minimal interaction. Such a development could have a similar revolutionary effect as the creation of single-crystal silicon, which enabled integrated circuits and modern computing.

## Srivastava, Yeung research multi-core and many-core concerns

Associate Professor **Ankur Srivastava** (ECE/ISR) and Associate Professor **Donald Yeung** (ECE) have won a three-year, \$500K NSF grant for “Developing and Applying Reuse Distance Analysis Techniques for Large-Scale Multi-Core Processors.” It is funded through NSF's Software and Hardware Foundations program within the Division of Computing and Communication Foundations. Yeung is the principal investigator.

The research will address concerns in multi-core and many-core architecture by exploring research directions related to multi-core reuse distance analysis for loop-based parallel programs.

## Fritz explores neural basis for working memory

ISR Associate Research Scientist **Jonathan Fritz** has received a \$150K ONR seed grant for a one-year study to lay the groundwork for exploring the neural basis for working memory. Working memory is essential for cognitive processing as we hold one image, sound or idea in mind despite the presence of other competing or distracting stimuli.



Fellows

Professor **Ray Adomaitis** (ChBE/ISR) has been elected a Fellow of the American Institute of Chemical Engineers. Adomaitis' research group focuses on simulation-based design, optimization, and experimental evaluation of advanced materials manufacturing processes.

ISR-affiliated Professor **Ben Shneiderman** (CS/UMIACS) has been elected a Fellow of the Institute of Electrical and Electronics Engineers. Shneiderman was recognized for his "contributions to human-computer interaction and information visualization." Shneiderman is the founding director of the Human-Computer Interaction Laboratory and also a Fellow of the ACM, AAAS, and the National Academy of Engineering.

Outstanding paper awards

Assistant Professor **Ian White** (BioE/ISR) received the 2012 Best Paper Award from the journal *Sensors*. "Aptamer Based Microsphere Biosensor for Thrombin Detection" was co-authored with **Hongying Zhu, Jonathan D. Suter** and **Xudong Fan**. The article describes the development of an optical microsphere resonator biosensor using an aptamer (an oligonucleic acid or peptide that binds to a target molecule) as a receptor for the measurement of the biomolecule thrombin.

Professor **S.K. Gupta** (ME/ISR), his postdoctoral researcher and former Ph.D. student **Atul Thakur** (ME Ph.D. 2011) and his former Ph.D. student **Ashis Banerjee** (ME Ph.D. 2009) have won the Elsevier 2012 Most Cited Paper Award. "A survey of CAD model simplification techniques for physics-based simulation applications," appeared in the journal *Computer-Aided Design*.

"A survey of snake-inspired robot designs," published in the June 2009 *Bioinspiration & Biomimetics*, has been named one of the journal's most-cited papers in the past two years. Written by Professor **S.K. Gupta** (ME/ISR) and his Ph.D. students **James K. Hopkins** and **Brent W. Spranklin**, the article categorizes different types of snake-inspired robot designs based on their main characteristics.

University of Maryland awards

Cynthia Kim Eminent Professor of Information Technology **Anthony Ephremides** (ECE/ISR) has been named a Distinguished University Professor at the University of Maryland. This official title is the highest academic honor the university confers upon a faculty member. It is reserved for a small number of exceptionally distinguished scholars.

Distinguished University Professors are selected from faculty who have been recognized nationally and internationally for the importance of their scholarly or creative achievements and who have demonstrated the breadth of interest characteristically encompassed by the traditional role of scholar, teacher and public servant. Ephremides has been recognized for founding the field of ad hoc wireless networks, and as a leading international scholar in communication.

Professor **Carol Espy-Wilson** (ECE/ISR) has been selected as a 2012-2013 Distinguished Scholar-Teacher by the University of Maryland. She joins Professor **Avis Cohen** (Biology/ISR) 2011-2012, Professor **K.J. Ray Liu** (ECE) 2007-2008, Professor **Michael Fu** (Robert H. Smith School of Business/ISR), 2004-2005; Professor **Steven Marcus** (ECE/ISR), 2000-2001; and Professor Emeritus **Thomas McAvoy** (ChBE/BioE/ISR), 1997-1998; as ISR winners of the award.



TONY EPHREMIDES



CAROL ESPY-WILSON

ISR-affiliated Professor **Min Wu** (ECE/UMIACS), her Ph.D. student **Ravi Garg** and her former advisee **Avinash L. Varna** (ECE Ph.D. 2011) won the 2012 University of Maryland Invention of the Year Award in the Information Science Category for "Environmental Signatures for Forensic Analysis and Alignment of Media Recordings."

The awards are presented annually by the University of Maryland Office of Technology Commercialization to honor outstanding inventions and inventors.

The researchers created a novel natural timestamp for audio and visual recordings. The natural timestamp invention detects natural interference caused by the 50/60 Hz electrical network frequency to authenticate a recording's time and location. The system also allows users to determine if a recording has been tampered with or edited. In addition, it will enable new alignment and stitching methods in professional A/V editing software, creating an easy way to synchronize various recordings.

Associate Professor **Pamela Abshire** (ECE/ISR) and her Ph.D. student **David Sander** were finalists in the Information Science category for "Next-Generation Image Sensors."

Focal plane arrays are part of infrared photon, radiation, and positron emission tomography detectors. The recent trend of giving specialized detectors the ability to set predetermined voltage and/or current points has led to difficulty in fabricating them. Abshire and Sander's approach allows arbitrary programming characteristics of the biasing configuration on a pixel-by-pixel basis via a proprietary optimization technique within the sensors. This vastly improves performance metrics such as signal-to-noise ratio, bit-energy, and minimized thermally generated dark current.

ISR-affiliated Professor **Christopher Davis** (ECE) received the A. James Clark School of Engineering's 2012 Poole and Kent Senior Faculty Teaching Award. The award is given to a senior faculty member for excellence in teaching.

Associate Professor **Pamela Abshire** (ECE/ISR) won the Clark School's 2011 Robert E. Kent Teaching Award for Junior

Faculty. Abshire was chosen for her engaged teaching methodology, sustained commitment and development of the ECE capstone design curriculum, and extensive involvement in advising and mentoring undergrad and graduate research projects.

Other awards

Associate Professor **David Lovell** (CEE/ISR), advisor to the Clark School's Engineers Without Borders (EWB) chapter,

has been named the 2012 recipient of the organization's "Peter J. Bosscher Faculty Advisor Award for Outstanding Leadership."

The award recognizes EWB faculty advisors who provide outstanding leadership and mentorship to their student chapter. Lovell has been working with EWB at UMD since 2004, leading students on sustainable engineering project trips to Burkina Faso, Ethiopia, and the Pine Ridge Indian Reservation in South Dakota.

facultyNEWS

Publications of note

Professor **Shihab Shamma** (ECE/ISR), former ISR postdoctoral researcher **Stephen David**, and alumnus **Nima Mesgarani** (ECE Ph.D. 2008) are three of the authors of a study on how the human auditory system processes speech, published in the Jan. 31, 2012 edition of *PLoS Biology*.

David is an assistant professor at Oregon Health & Science University, where he heads the Laboratory of Brain, Hearing, and Behavior in the Oregon Hearing Research Center. Mesgarani is a postdoctoral researcher in the Neurological Surgery Department of the University of California, San Francisco School of Medicine.

"Reconstructing Speech from Human Auditory Cortex" details recent progress made in understanding the human brain's computational mechanisms for decoding speech. The results provide insights into higher-order neural speech processing and suggest it may be possible to read out intended speech directly from brain activity. Potential applications include devices for those who have lost the ability to speak through illness or injury.

Brian N. Pasley of the Helen Wills Neuroscience Institute, University of California, Berkeley is the paper's lead author. In addition to the University of Maryland co-authors, additional co-authors include Robert Knight, University of California San Francisco and University of California Berkeley; Adeen Flinker, University of California Berkeley; Edward Chang, University of California San Francisco; and Nathan Crone, Johns Hopkins University.

**Stephen David, Shihab Shamma** and ISR Associate Research Scientist **Jonathan Fritz** published an article in the Dec. 21, 2011 edition of *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*.

"Task reward structure shapes rapid receptive field plasticity in auditory cortex" suggests that top-down control of sensory processing can be shaped by task reward structure in addition to required sensory discrimination.

The study predicts that it should be possible to suppress visual responses with an appropriate approach behavior paradigm. The study also suggests that the form of learning influences how information is actively processed, stored, and recalled in the brain.

Developing a deeper understanding of how learned reward and motor contingencies control sensory processing may lead to more effective approaches to behavioral training and a more complete picture of how sensory information from diverse behavioral contexts is integrated into a unified representation.

New research by Professor **Cynthia Moss** (Psychology/ISR) and her colleagues **Yossi Yovel, Ben Falk** and **Nachum Ulanovsky** appeared in the Sept. 13 edition of *PLoS Biology*.

"Active Control of Acoustic Field-of-View in a Biosonar System" uncovers systematic "active-sensing" strategies used by echolocating bats to scan their environment. The researchers trained Egyptian fruit bats to land on a target under conditions of varying levels of environmental complexity, and measured their echolocation and flight behavior. The bats modulated the intensity

of their biosonar emissions, and the spatial region they sampled, in a task-dependent manner. The findings suggest that mammals' acoustic scanning of space is highly flexible and modulated much more selectively than previously recognized. This research also was featured in a *New York Times* story.

ISR-affiliated Assistant Professor **Patrick Kanold** (Biology) and his colleagues have published "Electrical synapses formed by connexin36 regulate inhibition- and experience-dependent plasticity" in the *Proceedings of the National Academy of Sciences of the United States of America (PNAS)*.

The research shows that elimination of electrical synapses formed by connexin36 altered inhibitory efficacy and caused frequency facilitation of inhibition consistent with a decreased GABA release in the inhibitory network. The altered inhibitory efficacy was paralleled by a failure of theta-burst long-term potentiation induction and by impaired ocular dominance plasticity in the visual cortex. Together, these data suggest a unique mechanism for regulating plasticity in the visual cortex involving synchronization of inhibitory networks via electrical synapses.

Associate Professor **Ben Shapiro** (BioE/ISR) is co-editor along with Jason Gorman of the National Institute of Standards and Technology of *Feedback Control of MEMS to Atoms*, a new book published by Springer. The book illustrates the use of control and control systems as an essential part of functioning integrated miniaturized systems.

Books

continued on page 12...





**Patents**

Professor Emeritus **Thomas McAvoy** (ChBE/ISR) and his colleagues received U.S. Patent 8,042,209 for “Techniques for Compensating Movement of a Treatment Target in a Patient.” The invention improves radiological treatment of tumors in cancer patients via a real-time tumor motion compensation system. The system is used with a treatment couch that ensures accurate delivery of radiation without increasing patient discomfort, treatment time and cost, or decreasing biological effectiveness. The patent is a result of National Institutes of Health research conducted by McAvoy, Professor **Warren D’Souza** (Department of Radiation Oncology, University of Maryland Medical School), and ECE Professor **K. J. Ray Liu**. In addition to McAvoy, the patent is shared by D’Souza, **X. Cedric Yu**, **William Regine**, and **Mohan Suntharalingam**.

ISR-affiliated Professor **Christopher Davis** (ECE), former ECE Research Scientist **Igor Smolyaninov**, and alumnus **Yu-Ju Hung** were awarded U.S. Patent 7,943,908 for “Sensor system with surface-plasmon-polariton enhanced selective fluorescence excitation and method.” They developed a sensor system with surface-plasmon-polariton enhanced selected fluorescence excitation. The system can be used in genomic, proteomic, chemical and biological applications, permitting a precise determination of presence of fluorescent genes, cells, DNA oligonucleotides, c-DNA, RNA, antibodies, antigens and proteins.

**Lectures**

Professor **Tony Ephremides** (ECE/ISR) delivered a plenary keynote address in October 2011 at National Taiwan University during the first International Workshop on Machine to Machine Technology. Ephremides spoke on “A Broader View of Cooperation in Wireless Networks.” The talk reviewed the significant potential of cooperative communications to improve the performance of wireless communications through MIMO transceivers.

He also was the 2011 UMIC Distinguished Lecturer at RWTH Aachen University in Aachen, Germany, speaking at the Ultra High-Speed Mobile Information

and Communication Cluster of Excellence on “Stable Throughput, Rate Control, and Delay in Multi-Access Channels.”

In addition, Ephremides was the general chair of the 2011 International Symposium on Information Theory in St. Petersburg, Russia, in August 2011.

Professor **John Baras** (ECE/ISR) gave several invited lectures in the past year. In June 2011, he spoke on “Challenges and Opportunities for Future Broadband Networks: From Physical to Services to Social,” at INRIA, Rennes Bretagne Atlantique, at the opening of Labex Comin Labs, a new center of excellence.

He also gave the invited plenary lecture at the 19th Mediterranean Conference on Control and Automation in Corfu, Greece, on “Cooperative Networked Systems: Multiple Graphs, Coalitional Games, New Probabilistic Models.”

In September, Baras visited General Electric Central Research Laboratories, speaking on “Control Science and Engineering: Providing Foundations for the Emerging Model-Based Systems Engineering Discipline.”

In October, he gave an invited three-hour tutorial at the 14th International Symposium on Wireless Personal Multimedia Communications, in Brest, Bretagne, France. Baras spoke on “Wireless Information Infrastructures and the Future Internet: Protocol Components, System Architectures, Security and Privacy.”

Associate Professor **Ankur Srivastava** (ECE/ISR) has been appointed to the Association for Computing Machinery Distinguished Speaker Panel. In recognition of his research and experience, Srivastava will be speaking most often in the broad subject fields of design automation and computer systems.

Professor **P. S. Krishnaprasad** (ECE/ISR) was awarded the 2012 Baetjer Colloquium Lectureship of Princeton University’s Mechanical and Aerospace Engineering Department. He was recognized for his contributions to the fields of geometric control, filtering theory, robotics and bio-inspired design, and lectured on “Structure and Dynamics in Collectives” at Princeton on April 20.

ISR Director **Reza Ghodssi** (ECE/ISR) was an invited speaker at the Third International Winter School on Nano and Biotechnology. His lecture, “Integration of Biomaterials in Micro/Nano Systems for Biological and Chemical Sensing,” explained research using virus-nanotemplated surfaces for enhancing biochemical recognition in sensors, and in patterning electrically responsive biomaterials for biosensor functionalization.

Ghodssi also spoke on “Biofabrication using the Tobacco mosaic virus for next-generation micro/nano devices and systems” at the Bio-Inspired Engineering International Symposium 2012. He demonstrated how Tobacco mosaic virus particles can be integrated with microfabrication processes, and how their nanoscale architecture can advance the performance of microbatteries and microsensors.

**NAKFI conference**

ISR-affiliated Associate Professor **Jonathan Simon** (ECE/Biology) has been selected to attend the 10th Annual National Academies Keck Futures Initiative (NAKFI) conference, “The Informed Brain in a Digital World” at the Academies’ Arnold and Mabel Beckman Center in Irvine, Calif., in November. The conference will focus the discipline of neuroscience on the challenges and opportunities presented by the digitally connected world.

Participants are selected through a competitive application process. At the conference they present posters on their latest research and participate in interdisciplinary research teams that develop a possible scientific plan to solve an outstanding challenge. The goals of the research teams are to spur new thinking, have people from different disciplines interact, and forge new scientific contacts across disciplines.

NAKFI is a 15-year effort of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine to catalyze interdisciplinary inquiry and enhance communication among researchers, funding organizations, universities, and the general public. The objective is to support the climate for conducting interdisciplinary research, and to break down related institutional and systemic barriers.

**Joint appointments**



John T. Conwell

ELISABETH SMELA

**Elisabeth Smela** is a professor in Mechanical Engineering and a former ISR affiliate faculty member. Her research interests are in Microelectromechanical systems (MEMS), particularly polymer MEMS and bioMEMS.

She focuses on the use of organic materials (from polymers to cells) in microsystems to realize microactuators, cell-based sensors, and CMOS/MEMS integrated systems. Smela directs the Laboratory for Microtechnologies.



ALIREZA KHALIGH

**Alireza Khaligh** is an assistant professor in the Electrical and Computer Engineering Department with research interests in power electronics, renewable energy systems, energy harvesting, plug-in hybrid electric vehicles, electric vehicles and smart grid technologies. He directs the Power Electronics, Energy Harvesting and Renewable Energies Laboratory.



DEREK PALEY

**Derek Paley** is an Assistant Professor in the Department of Aerospace Engineering and a former affiliate faculty member of ISR. He has research interests in dynamics and control, including cooperative control of autonomous

vehicles, adaptive sampling with mobile networks, and spatial modeling of biological groups. Paley is the director of the Collective Dynamics and Control Laboratory.



MICHAEL ROTKOWITZ

**Michael Rotkowitz** is an assistant professor in the Electrical and Computer Engineering Department with research interests in decentralized control, optimization, and sparse estimation.

His awards include the IEEE Control Systems Society’s 2007 George S. Axelby Outstanding Paper Award and the 2011 SIAM Control and Systems Theory Prize.

**Affiliates**



STEVEN GABRIEL

**Steven Gabriel** is an associate professor in the Civil and Environmental Engineering Department, with additional appointments in the Applied Mathematics & Statistics, and Scientific Computation program.

He is group coordinator for the Civil Systems program and also is a co-director of the Master of Engineering and Public Policy Program, a joint degree program between the Clark School and the School of Public Policy.



IAN WHITE

**Ian White** is an assistant professor in the Fischell Department of Bioengineering with research interests in disease detection, optical biosensors, ring resonators, SERS, and lab-on-a-chip. His research group develops integrated microsystems that enable new applications for the study of cancer metastasis, the diagnosis of infectious disease, and low-cost, portable chemical and biomolecular detection. White uses a systems approach to apply the fundamentals of physics, chemistry, and engineering to problems relevant to critical biomedical applications. He organizes ISR’s Microsystems Seminar series.



ALISON FLATAU

**Alison Flatau** is Associate Dean of Research for the Clark School and a professor in the Aerospace Engineering Department. Her research interests are in magnetostrictive materials & transduction, nanotechnology sensors, synthetic jet actuators, active flow control, and biosensors and bioactuation.



**Mingyan Liu** (MSSE 1997; ECE Ph.D. 2000) has been promoted to full professor in the Electrical Engineering and Computer Science Department at the University

of Michigan. She was advised by Professor John Baras (ECE/ISR) for both her Maryland degrees. Liu’s current research interests are in resource allocation, performance analysis, and energy-efficient design of wireless, mobile ad hoc, and sensor networks.

She also received a best paper award this spring for “In-Situ Soil Moisture Sensing: Measurement Scheduling and Estimation using Compressive Sensing” at the 11th ACM/IEEE Conference on Information Processing in Sensor Networks. Liu wrote the paper with visiting student Xiaopei Wu. The research considered the problem of monitoring soil moisture over time using a wireless network of underground sensors.



**Sean Andersson** (ECE Ph.D. 2003) has been promoted to associate professor with tenure at Boston University. He is a faculty member of the departments of Mechanical and Systems

Engineering. His research interests include systems and control theory with applications in scanning probe microscopy, dynamics in molecular systems, and robotics. Andersson received an NSF CAREER Award for “Nonlinear Control for Single Molecule Tracking” in 2009. He was advised by Professor P. S. Krishnaprasad (ECE/ISR).

*continued on page 14...*



**Mounya Elhilali** (ECE Ph.D. 2004) has received an ONR Young Investigators Award for “Active Listening: Closing the loop between sensation, perception and behavior.” She will address the unsolved neuroscience problem of how brains effortlessly recognize sounds. Elhilali was advised by Professor Shihab Shamma (ECE/ISR), was an ISR postdoctoral researcher from 2005–2007, and is an assistant professor in the ECE Department at Johns Hopkins University. In 2009 she won an NSF CAREER Award for “Cognitive Auditory Systems for Processing of Complex Acoustic Scenes.”

**Xiaobo Tan** (ECE Ph.D. 2002), an associate professor at Michigan State University, recently had his work on robotic fish featured as a Highlight on NSF’s “SEE Innovation” website. Tan has developed energy-efficient robotic fish which could revolutionize the way aquatic environments, drinking water reservoirs and aquafarms are monitored. Tan was advised by Professor John Baras (ECE/ISR) and Professor P.S. Krishnaprasad (ECE/ISR).

**Enlu Zhou** (ECE Ph.D. 2009) won a 2012 Young Investigator award from the Air Force Office of Scientific Research. She is investigating “Dynamic Decision Making under Uncertainty and Partial Information.” Zhou is an assistant professor in the Industrial & Enterprise Systems Engineering Department at the University of Illinois Urbana-Champaign. She has research interests in stochastic control, Markov decision processes, simulation optimization. At Maryland she was advised by Professor Steve Marcus (ECE/ISR) and Professor Michael Fu (BGMT/ISR).

**Ravi Tandon** (ECE Ph.D. 2010) received the best paper award in the Communication Theory Symposium at the IEEE Globecom conference for his paper, “Discriminatory Lossy Source Coding: Side Information Privacy.” Tandon was advised by Professor Sennur Ulukus (ECE/ISR).

**Ermin Wei** (Math, Finance, Computer Engineering B.S. 2008) is a fourth-year Ph.D. student in Electrical and Computer Engineering at MIT, working in the Laboratory for Information and Decisions

Systems. Her current research interests are in convex optimization and analysis, game theory, network optimization and control, distributed optimization methods, social and logistic networks. At Maryland, Wei was part of the Intelligent Servosystems Lab with Professor P. S. Krishnaprasad (ECE/ISR). She won the ISR Outstanding Systems Engineering Undergraduate Student award in 2008.

**Parag Banerjee** (MSE Ph.D. 2011) has joined the faculty of the Department of Mechanical Engineering & Materials Science at Washington University in St. Louis. He is focusing on the synthesis of nanomaterials with tunable properties that can be integrated into devices such as biomedical sensors and energy storage and harvesting devices. Banerjee was advised by Professor Gary Rubloff (MSE/ISR). Along with Rubloff, he won the university’s Invention of the Year Award for electrostatic nanocapacitors.

**Matteo Mischiati** (ECE Ph.D. 2011) is a postdoctoral fellow in the research group of Anthony Leonardo at Janelia Farm Research Campus, part of the Howard Hughes Medical Institute. The Leonardo Lab conducts research in neuroethology, studying how behaviors emerge from computations distributed across many neural circuits. Mischiati is working on studies of dragonfly flight behavior. At Maryland, Mischiati was advised by Professor P. S. Krishnaprasad (ECE/ISR).

**Mustafa Beyaz** (ECE Ph.D. 2011) is an assistant professor in the Electrical and Electronics Engineering Department at Antalya International University, Antalya, Turkey. As a graduate student, Beyaz worked in the MEMS Sensors and Actuators Lab and was advised by ISR Director Reza Ghodssi (ECE/ISR). His dissertation focused on the development of an integrated electromagnetic micro-turbo-generator supported on microball bearings. Such power sources can replace batteries in portable electronic systems used mainly in military applications.

**Kevin Galloway** (ECE Ph.D. 2011) is a postdoctoral research fellow in the Department of Electrical Engineering and

Computer Science at the University of Michigan. He is developing feedback controls for stabilizing walking and running gaits for bipedal robots, a project which incorporates nonlinear control theory as well as experimental implementation with a novel bipedal robot known as MABEL. At Maryland, Galloway was one of the lab managers for the Intelligent Servosystems Lab and was advised by Professor P.S. Krishnaprasad (ECE/ISR).

**Serban Sabau** (ECE Ph.D. 2011) is a postdoctoral researcher in the Department of Electrical and Systems Engineering at the University of Pennsylvania. He is working with Professor Ali Jadbabaie in the General Robotics Automation, Sensing and Perception Laboratory on projects related to the Office of Naval Research MURI, “Next Generation Network Science.” Sabau was advised by Associate Professor Nuno Martins (ECE/ISR).

**Vicky Zhao** (ECE Ph.D. 2004) has been promoted to Associate Professor with tenure in the ECE Department at the University of Alberta, Canada. At Maryland, she was advised by former ISR faculty member K. J. Ray Liu (ECE). Her research interests include media-sharing social networks, information forensics and security and digital signal processing and communications.

**Rick Stamper** (ME Ph.D. 1997) is interim dean of faculty at Rose-Hulman Institute of Technology. He also served as the associate dean of professional experiences and head of the Department of Engineering Management. He earned the E. Russell Johnston Jr. Outstanding New Mechanics Educator Award in 2001 from the American Society for Engineering Education. Recently, he was among nine engineering professors featured in the Princeton Review’s *The 300 Best Professors*. Rick was advised by the late Professor Lung-Wen Tsai (ME/ISR).

**ISR alumni, do you have career news?** We’d love to share it with our readers, both in print and online. Send your news to Rebecca Copeland at [rebecacac@umd.edu](mailto:rebecacac@umd.edu).

In March, three students from the MEMS Sensors and Actuators Laboratory (MSAL) won the Best Student Poster Award at the 2012 Mid Atlantic Micro/Nano Alliance Symposium in Annapolis, Md. Materials Science and Engineering Ph.D. student **Brendan Hanrahan** and undergraduate researchers **Jeremy Feldman** (ECE) and **Saswat Misra** (ECE) won for their research, “Off-the-Shelf MEMS for Rotary MEMS.” This same team earlier presented their work at the IEEE MEMS 2012 Conference in Paris. The research was well received by colleagues in the international MEMS community. ISR Director Reza Ghodssi (ECE/ISR) directs the MSAL lab.

Mechanical Engineering junior **Carlos Casarez** won a Goldwater Scholarship, the premier national award granted to undergraduate students majoring in mathematics, natural sciences and engineering who are interested in research careers. Casarez is advised by Assistant Professor Sarah Bergbreiter (ME/ISR) and plans to pursue a Ph.D. in mechanical engineering, working on robotic technology.

Materials Science and Engineering graduate student **Marshall Schroeder** has been named a John and Maureen Hendricks Energy Research Fellow. He is advised by Professor Gary Rubloff (MSE/ISR). Schroeder received the award for his research to design and construct a novel three-dimensional, high-aspect ratio, all-solid-state, lithium-O<sub>2</sub> battery. The battery is a proposed successor to lithium-ion batteries, which Schroeder believes are approaching the material limits of further improvements.

Six students mentored by ISR faculty are among those selected for the A. James Clark School of Engineering’s 2012 Future Faculty program, which prepares students for academic careers in top-50 engineering schools. ISR students are:

- **Alexander Kozen** (MSE) and **Jordan Betz** (BIOE), advised by Professor Gary Rubloff (MSE/ISR)
- **Omur Ozel** (ECE), advised by Professor Sennur Ulukus (ECE/ISR)
- **Ravi Garg** (ECE), advised by Professor Min Wu (ECE/UMIACS)
- **Ivan Penskiy** (ME), advised by

Assistant Professor Sarah Bergbreiter (ME/ISR)

- **Timir Baran Datta-Chaudhuri** (ECE), advised by Associate Professor Pamela Abshire (ECE/ISR) and Professor Elisabeth Smela (ME).

ECE graduate student **Ravi Garg** and alumnus **Avinash L. Varna** (ECE Ph.D. 2011) received a Best Student Paper Award at the ACM Multimedia 2011 Conference. “Seeing ENF: Natural Time Stamp for Digital Video via Optical Sensing and Signal Processing” examines a novel technique for forensic analysis of digital video using ubiquitous environment fingerprints from power lines that are naturally embedded in video signals at the time of recordings. The paper is co-authored with ISR-affiliated Professor Min Wu (ECE/UMIACS), advisor to both Garg and Varna.

Computer Science graduate student **Alexandros Tzannes** won the ACM Student Research Competition for “Improving Run-Time Scheduling for General-Purpose Parallel Code.” The award was given at the 20th International Conference on Parallel Architectures and Compilation Techniques. Maryland students in computing and interdisciplinary areas related to computing have placed highly in several of these ACM competitions in the past; this is the first time that a Maryland student has won first prize. Tzannes is co-advised by Associate Professor Rajeew Barua (ECE/ISR) and Professor Uzi Vishkin (ECE/UMIACS).

Assistant Professor Sarah Bergbreiter (ME/ISR) and her students **Wayne A. Churaman** and **Aaron P. Gerratt** received the New Technology Foundation (NTF) Award for Entertainment Robots and Systems at the 2011 IEEE/RSJ International Conference on Intelligent Robots and Systems. The award was given for the paper, “First Leaps Toward Jumping Microrobots.” The paper presents the first results for jumping robots at millimeter-size scales.

Two graduate students associated with the National Center of Excellence in Aviation Operations Research (NEXTOR) received Federal Aviation Administration graduate

research awards for 2011–2012. **Kleoniki Vlachou** received the grant for “Equitable Resource Allocation Mechanisms During Reduced Airspace Capacity,” while **Prem Swaroop** is researching “Service Expectations Setting in Air Traffic Flow Management: A Consensus-Building Mechanism.” Vlachou is a Civil and Environmental Engineering Ph.D. student advised by Associate Professor David Lovell (CEE/ISR). Swaroop is a Robert H. Smith School of Business Ph.D. student advised by Professor Michael Ball (BMGT/ISR).

Materials Science and Engineering graduate student **Keith Gregorczyk**, advised by Professor Gary Rubloff (MSE/ISR), has been awarded his second L-3 Graduate Fellowship by L-3 Communications. Gregorczyk’s research focuses on using atomic layer deposition (ALD) for the fabrication of heterostructured nanomaterials. His goal is to show that this technique, and the materials that can be made using it, will offer significant improvements in the way batteries store and distribute energy.

**Timothy Creech**, a graduate student advised by Rajeew Barua (ECE/ISR), is one of six Clark School students in NASA’s inaugural class of Space Technology Research Fellowships. Only MIT and Georgia Tech had more fellows with seven per school. The fellowships provide fellows with on-site NASA center/research and development lab experience.

Director of Computing **Jeff McKinney** received a 2011 Board of Regents University System of Maryland Staff Award in the “Effectiveness and Efficiency—Administrative Transformation” category. This is the highest honor the Board bestows to recognize distinguished performance and achievements of exempt and nonexempt staff from institutions within the University System of Maryland. McKinney was honored for results of seven years working to improve the technological resources and performance of ISR, ECE, Physics and Math.