INDUSTRIAL & SYSTEMS ENGINEERING

THE ALUMNI MAGAZINE FOR THE STEWART SCHOOL OF ISyE AT GEORGIA TECH

FALL 2012

Industrial and Systems Engineers:

MAKING A DIFFERENCE IN THE WORLD

How ISyE faculty projects span the globe and fuel the imagination, *page 8*

Georgia Tech

Georgia Tech ISyE H. Milton Stewart School of Industrial & Systems Engineering

The *Industrial & Systems Engineering* alumni magazine is published annually by the H. Milton Stewart School of Industrial & Systems Engineering at the Georgia Institute of Technology.

Vol. 6, No. 1 • Fall 2012

Barbara Christopher
Managing Editor

Ashley Daniel
Assistant Editor

Sarah Collins
Graphic Designer

Aimee Smith
Graphic Design
Student Assistant

H. Milton Stewart School of Industrial & Systems Engineering

Georgia Institute of Technology

755 Ferst Drive
Atlanta, Georgia 30332-0205

PHONE:
404.385.3102

FAX:
404.894.2301

E-MAIL:
communications@isye.gatech.edu

WEB:
www.isye.gatech.edu

SCHOOL CHAIR:
Jane C. Ammons
H. Milton and Carolyn J. Stewart School Chair

ASSOCIATE CHAIRS:
Paul Kvam, PhD
Associate Chair for Graduate Studies and Professor

Chen Zhou, PhD
Associate Chair for Undergraduate Studies and Associate Professor

MIX
Paper from responsible sources
FSC® C014125
FSC www.fsc.org

All sources for paper pulp are Forest Stewardship Council (FSC) certified to support responsible forest management worldwide. This paper includes a minimum of 10 percent post-consumer recovered fiber.

PLEASE RECYCLE THIS PUBLICATION.

Feature Stories

ISyE News & Additional Features

On the front cover: *Feature Story, page 8.*
On the back cover: *Words that describe industrial engineers intermingled with faces of the newest members of ISyE's Advisory Board and current Advisory Board Chair, page 4.*

It continues to be an exciting time at the Stewart School of Industrial Systems & Engineering (ISyE), as we forge ahead in pushing theoretical frontiers and solving real-world societal problems. A little more than a year has passed since I was appointed to the position of chair, and observing the progress within ISyE from this perspective has made me immensely proud and has certainly served to keep me inspired.

As the stories on the pages of this fall issue will illustrate, ISyE faculty, alumni, and students can be found around the globe literally making a difference in the world—and that is, indeed, awe-inspiring. As leaders in the field of industrial and systems engineering, we have been paving the way in productivity and efficiency, innovating and making any product—from manufacturing to delivery—more cost-effective, more pragmatic, more valuable. Whether dealing with issues of healthcare, sustainability, or a host of other pervasive life essentials, we can be found working with and leading a wide variety of organizations to greater heights for the greater good of our communities, the environment, and the world.

Apart from coming up with solutions to some of the crucial engineering grand challenges in energy, sustainability, manufacturing, logistics, and healthcare, we are working on projects that assess vulnerability in the food supply chain and are also exploring ways to help our country regain its natural competitiveness and improve global trade initiatives. In addition to all of that, we are working on the foundational disciplines in optimization, simulation, stochastics, and statistics to further our fundamental understandings.

We are extremely proud of our faculty, students, and alumni and the significant contributions they are making in the world. I hope you enjoy this issue. Please stay in touch.

Jane Chumley Ammons, PhD, PE
H. Milton and Carolyn J. Stewart School Chair
H. Milton Stewart School of Industrial & Systems Engineering
Georgia Institute of Technology

2013 U.S. News & World Report: **ISyE Maintains Top Rankings**

The Stewart School of Industrial & Systems Engineering (ISyE) has once again ranked as the top industrial engineering program in the nation, according to *U.S. News & World Report* (*USNWR*) rankings.

The publication's 2013 Best Graduate Schools edition ranked the graduate program in ISyE No. 1 for the twenty-second consecutive year, an achievement that is, from the Institute's checks, unmatched by any other academic program in any other Georgia college or university.

USNWR first ranked ISyE No. 1 in 1990 with its inaugural rankings issue, and then for twenty-two consecutive years beginning in 1992; only in 1991 was ISyE ranked No. 2.

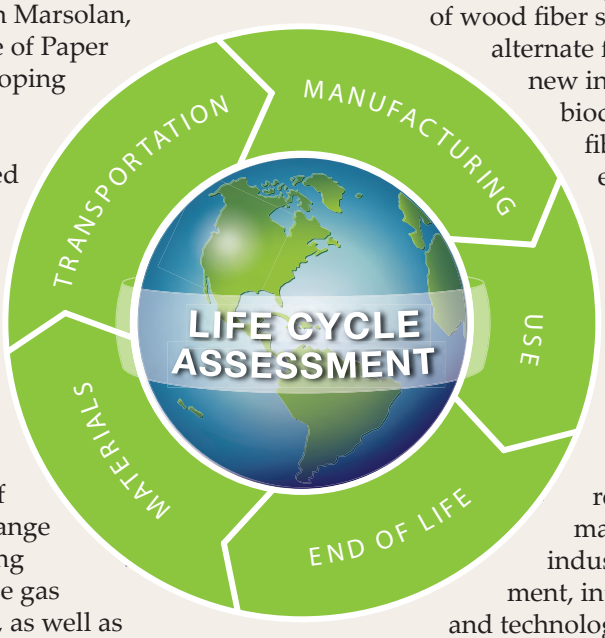
Also maintaining its graduate ranking, the College of Engineering (COE) ranked No. 4 for the eighth consecutive year, and its programs again ranked in the top ten.

The ISyE undergraduate program maintained its top undergraduate ranking in the 2013 edition of Best Colleges by *USNWR*. This issue marks the eighteenth consecutive year that ISyE has ranked as the foremost program of its kind in the nation at the undergraduate level.

COE also maintained its 5th place ranking for undergraduate engineering programs at universities where the highest degree is a PhD and its programs ranked in the top ten.

Life Cycle Sustainability Assessment to Influence Use of Alternative Fibers

Valerie Thomas, Anderson Interface Associate Professor of Natural Systems in the Stewart School of Industrial & Systems Engineering, and Norman Marsolan, director of Georgia Tech's Institute of Paper Science and Technology, are developing an assessment for Kimberly-Clark (K-C) on the environmental and broader sustainability issues related to using non-forest alternative fibers. K-C, the world's largest tissue manufacturer, has partnered with Georgia Tech on this project to more fully understand and responsibly manage the impact of its decisions on fiber.



Thomas is working with Wenman Liu, a PhD student in the School of Public Policy, to evaluate a wide range of environmental impacts, including water use, biodiversity, greenhouse gas emissions, and ecosystem impacts, as well as broader issues regarding land use and sustainability.

In addition to its efforts to reduce its forest fiber footprint, K-C has announced its plan to transition at least 50 percent of wood fiber sourced from natural forests to alternate fiber sources by 2025. This broad, new initiative is expected to help protect biodiversity and reduce the impacts of fiber that the company uses, while ensuring the fiber is sourced in an environmentally and socially responsible way. Equally important, the initiative will also help insulate the company from continuing volatile price fluctuations in the world fiber market.

With a joint appointment in the School of Public Policy, Thomas' research interests include energy and materials efficiency, sustainability, industrial ecology, technology assessment, international security, and science and technology policy. Thomas is a fellow of the American Association for the Advancement of Science and of the American Physical Society.

Agroterrorism Defense: ISyE Develops Model to Assess Vulnerabilities in the Food Supply Chain

By Abby Robinson

While many people may think of high-profile terrorist targets to be sites such as skyscrapers, bridges, or nuclear power plants, the nation's food supply is also a vulnerable target. Called "agroterrorism," these attacks involve deliberate contamination of the food supply.

To address the agroterrorism threat, researchers at ISyE are developing a model of food supply chains that federal agencies and corporations can use to determine how best to protect the nation's food supply from intentional acts of biological, chemical, physical, or radioactive contamination.

"Our goal is to help make sure food products are safe from farm to fork by identifying food supply chain designs that ensure a high level of system productivity, while mitigating the risk posed by intentional attacks on the food supply chain by intelligent adversaries," said Associate Professor Alan Erera.

Erera leads the six-year, $1 million research project that began in 2010. The project is funded by the U.S. Department of Homeland Security's National Center for Food Protection and Defense. Erera and Professor Chip White are using an optimization-based methodology to predict the probability of terrorist attacks at specific points in food supply chains and prioritize interventions and countermeasures based on their capability to mitigate risk and economic utility.

"We're trying to help the government and industry understand how the structure of a food supply chain impacts the vulnerability of a food product against a contaminant such as botulinum toxin," said White, who is also the Schneider National Chair in Transportation and Logistics at Georgia Tech. "With agroterrorism, the food is the weapon and the supply chain is the weapon delivery platform; our model assumes that the terrorists want to keep the supply chain intact and move the contaminated food product to the consumer as quickly and quietly as possible."

The researchers are currently using the model to identify the vulnerabilities in the food supply chain for liquid eggs. Of the estimated 215 million cases of eggs produced in 2009, 30 percent were removed from their shells and turned into liquid, frozen, and dried egg products used by the food service industry and as ingredients in other foods, such as bread, mayonnaise, and ice cream.

Preliminary results from the model have shown how the liquid egg supply chain could be better protected from an attack through investments and adaptability in the production process.

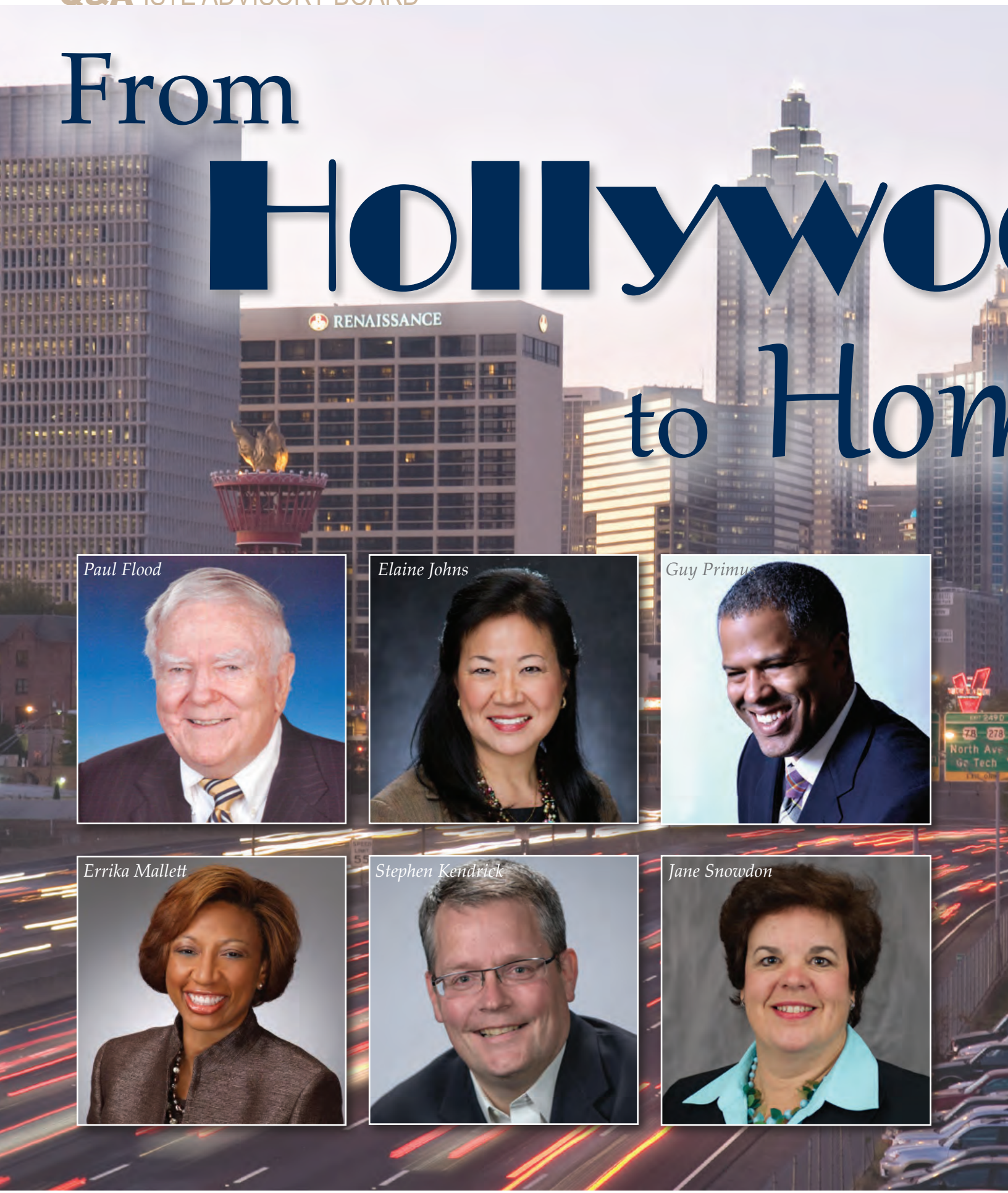
Adaptability scenarios tested with the model included strategies such as reducing the amount of liquid egg in each tank, housing the liquid egg product in several facilities instead of just one, increasing the frequency of tank cleanings, changing the timing of certain activities, and increasing security.

Each of these potential changes to the production process had advantages and disadvantages that were also considered in the model. Reducing the amount of liquid egg in each tank might decrease the amount of product that could become contaminated, but it could increase production costs. While having a few smaller facilities instead of one large facility might decrease the amount of product that could become contaminated, and decrease distribution costs if the facilities were strategically geographically distributed, the change could increase production costs and the cost to protect the facilities against a threat.

"Corporations want a safer supply chain, but they also want to know how different supply chain designs and risk mitigation strategies impact cost, productivity, and vulnerability," said Erera. "Using our model, we are beginning to identify ways that a small investment can significantly mitigate risk in the food supply chain."

During the remaining years of the project, the researchers plan to expand the utility and authenticity of their model by conducting additional case studies using other food products. The researchers believe the case studies may lead to overarching recommendations for how different food industries can best protect their products against a terrorist attack.

From Hollywo to Hom



od netown

Advisory Board Chair & New Members Comment on Industrial Engineering

Five new faces have joined the advisory board of the Stewart School of Industrial & Systems Engineering (ISyE) for the 2012 - 2016 term. **Paul Flood**, IE 1958; **Elaine Johns**, IE 1985; **Stephen Kendrick**, IE 1988; **Errika Mallett**, IE 1996; and **Guy Primus**, IE 1992, were inducted during the annual spring meeting in April 2012. ISyE's advisory board serves as a sounding board for the school chair and assists with devising the school's strategic initiatives and development goals. **Jane Snowdon**, PhD IE 1994, currently serves as the board's chair. This summer, these distinguished members offered their perspectives on industrial engineering (IE) and ISyE.

Why does the world need industrial engineers?

Kendrick: Industrial engineers provide a great service by addressing the best use of limited resources to achieve an organization's objectives. IEs are problem solvers, addressing real-world issues such as the improvement of manufacturing effectiveness and efficiency, how products should be moved on a global basis in a fast and efficient manner, and, in general, how we should do things better. The elimination of waste is a key outcome, something we should be focused on in the resource-constrained world we live in.

Snowdon: Industrial engineers devise ways to make processes, systems, and people work more effectively and efficiently together. Improvements can take various forms including reduced cost, improved quality, higher productivity, less time, and lower energy.

Primus: The world is changing so rapidly that someone needs to make order of the chaos. Whether it is the logistics issues of an increasingly global economy, the increased focus on healthcare, or the disintermediation of the supply chain brought about by e-commerce, the world works a lot better when industrial engineers are developing systems to help things flow more smoothly.

What are some skills that you learned at ISyE that have proven to be most beneficial to you in your career today?

Mallett: The knowledge I received as an IE to analyze processes, identify the deficiencies within those processes, then cultivate new programs and/or processes that would create improvements, greater efficiencies and/or a positive impact to the bottom line, gave me the ability to be a successful account executive for IBM in the oil and gas industry; an impactful program marketing director for BMC Software; an effective managing partner for my own business, which focused on marketing logistics for nonprofits and small businesses; and as an HR Manager who helped identify and initiate new programs to help recruit, acquire, and retain talent for Southwire Company. Although all these positions are different, the common thread is my IE training and development. My IE degree prepared me for success in all of these scenarios by teaching me to look at a situation, analyze it, and be pragmatic in my approach to it.

Primus: I'd say that the most important skill that I acquired was the ability to work on teams. I had been on teams, but never had to rely on others for success. My ability to work in and manage teams is a critical part of my success. Modeling was also another skill that I acquired. The program pricing model that I built for NPR helped reshape the public radio landscape. Even today, I use complex models to ensure that I have the answers before the questions are asked.

Flood: The ability to think in an analytical manner and understand the time value of money when applied to capital investments. Having a broad engineering background has given me the ability to develop practical, cost-effective solutions—often in emotional environments among participants with diverse backgrounds and interests.

Was your degree versatile and flexible enough for today's world?

Kendrick: Absolutely. The versatility of the degree is why I consider it one of the best majors available. You are prepared to address issues in manufacturing, supply chain management, and general business, with a mind's eye on how to make things better. You are not limited to a specific industry; not limited to a specific role. Industrial engineers are hired to do many different things and, ultimately, are well positioned to be leaders in whatever business they choose.

Johns: Absolutely. The ability to analyze and solve problems, to think logically, and to communicate very technical topics at the 50,000-foot level are extremely valuable.

Snowdon: Industrial engineers play many different roles such as manufacturing engineers, cost engineers, consultants, analysts, research scientists, sales and marketing managers, and chief executives.

Flood: Yes, very much so. Learning to apply the seven "magic steps" in the IE classes prepares students for all types of engineering, management, consulting, and executive careers. The magic steps are: identify the problem; analyze the problem and gather the facts; determine alternative solutions; evaluate the alternatives; draw conclusions and determine the solution and course of action; sell the solution and course of action to interested personnel and those impacted by the solution; and successfully implement the solution and course of action.

Meet the Board

Paul Flood is chairman and CEO of Chattahoochee Health Resources. His clients include hospitals, state hospital associations, and large physician practice groups. He is involved in strategic and tactical planning, establishing CEO and executive goals and measurable objectives, executive compensation, and succession and retirement planning. He has over 45 years of experience as a consultant, working in over 300 client organizations worldwide. His primary areas of expertise are strategic planning, organization and governance, executive performance compensation and supplemental executive retirement programs, corporate restructuring, integrated healthcare networks, managed care, and arbitration of managed care provider/payer disputes.

Elaine Johns is president and CEO of EnerVision, Inc., a management and technical consulting firm working in the electric utility industry. She leads the company's nationwide consulting efforts, as she builds relationships and pursues new business for the firm. She specializes in the development of comprehensive power supply strategies, provides expertise with contract negotiations, and is responsible for the overall leadership and direction of the company's Power Supply Practice Area. She is also one of the firm's strategic planning facilitators, working with boards of directors and executive management in defining strategic and business planning goals and objectives, organizational designs, and efficiencies. She has over 27 years of consulting experience in areas including strategic planning, power supply planning, utility rates, marketing, and economic analysis.

Stephen Kendrick is chief systems officer at 3DM Systems, a provider of noninvasive 3D ear scanning technology, where he leads business and solution development. Prior to joining 3DM, he was managing director of IronPlanet Motors, responsible for extending IronPlanet's service model to the automotive and power sports industries. He also served as a partner at Accenture, where he successfully launched Accenture's supply chain outsourcing business. He has more than 25 years of international business experience in driving revenue growth and improving operational capabilities for Fortune 1000 companies, including a group vice president position with JDA, a leading supply chain management software company.

What is one of your fondest memories of your time as an ISyE student?

Primus: I really enjoyed playing intramural basketball with the professors—especially Professors Goldsman and Hackman. In the classroom, I remember being in total amazement when Professor Ratliff demonstrated CAPS Logistics routing software—that was before Google Maps. I also remember working with Donovan Young on a project to design a system for what was to become the DVR, which was before broadband and high-capacity storage, so I thought that the DVR was a crazy idea back then. Plus, why would anybody want to skip forward thirty seconds at a time?

Mallett: Senior Design. The opportunity to apply our skills and knowledge in a real environment by adding value to a small business's bottom line is one of my greatest memories within ISyE. What's exciting is to see how the Senior Design program has truly evolved over the past 16 years.

Kendrick: My fondest memories include my time as a co-op student, applying what I learned real-time and further enhancing my overall learning experience. In addition, working on my Senior Design project was great, allowing me the real opportunity to bring it all together. Also, I really enjoyed the faculty. The depth and breadth of skills I came across was amazing and ultimately deserving of our No. 1 ranking.

Thank you all for serving a term on the ISyE Advisory Board. Why do you think it's important to stay connected to your alma mater?

Snowdon: It is a great honor and privilege to serve a term and chair the ISyE Advisory Board. Staying connected to your alma mater is important for providing advice on and support for academic and financial matters, maintaining and expanding your professional network, and mentoring the future leaders in industrial engineering.

Johns: We all have a lot for which we are thankful. For me, giving back to Georgia Tech, which is a huge contributor to who I am today, is the least I can do.

Flood: ISyE at Georgia Tech put its "print" on me and helped mold me into who I am today. It is, therefore, important for me to give back to the school to help ensure that it continues to do the great job it has done in the past—even in the more complex world that the student will enter when he or she graduates.

Errika Mallett is a marketing communications manager for Southwire, providing marketing strategy and support for the Retail Sales organization. Previously, she served as an HR manager to support Southwire's collegiate recruitment, retention, and partnership opportunities. She is a member of the Alumni Association Board of Trustees; the past president for one of the Alumni Association's Affinity Groups, the Black Alumni Organization; and a mentor in the Mentor Jacket program. She also serves on the Student Center Governance Board, serves on the Women Alumni Network Executive Board, and served as vice chair of Georgia Tech's Fiftieth Anniversary Steering Committee for the Matriculation of Black Students. As a result of her service to Georgia Tech, she has been recognized as a Legend by AASU, a Mentor of the Year by OMED, and an Outstanding Young Alumna by the Alumni Association.

Guy Primus is chief operating officer (COO) at Overbrook Entertainment, the film, TV, and transmedia production company founded by producer James Lassiter and actor/producer Will Smith. As COO, Primus oversees Overbrook's operations and manages the company's staff. He also heads Overbrook's strategic ventures group, an organization dedicated to expanding and optimizing Overbrook's business portfolio. He serves on the board of directors of Starling.tv, the social TV platform that allows viewers to chat, play, and interact with one another while watching TV. He is also a member of the advisory boards of JibJab Media, a leading provider of digital greetings and online entertainment; MoviePass, a monthly movie subscription service; Fusion TV, a media company that produces and distributes high-definition video content; and bLife, a company committed to creating science-based mobile experiences that help people live happier and healthier lives.

Jane Snowdon is coleader of IBM's Global Technology Outlook at the IBM T. J. Watson Research Center in Yorktown Heights, New York. Prior to this role, Snowdon was a senior manager and research staff member in the Industry Solutions and Emerging Business Department at IBM Research, where she developed strategies and drove research efforts worldwide to create innovative solutions for smarter buildings. Her area of research was modeling, analytics, simulation, and optimization of buildings to identify energy and cost savings. Snowdon is a senior member of IEEE and IIE, and a member of INFORMS, the New York Academy of Sciences, and was elected to the Connecticut Academy of Science and Engineering. She is also a member of the College of Engineering Advisory Board.

Industrial and Systems Engineers: **Making a Difference in the World**

How ISyE faculty projects span the globe and fuel the imagination

By Faye Goolrick

It's an ordinary Monday morning, and traffic snarls its way through the city as another workweek begins.

From a distribution center near the airport, truckers load up and head for grocery and big-box stores, carrying cargo from near and far: Georgia peaches, Chilean wines, Costa Rican flowers, Japanese auto parts, cotton T-shirts sewn in Guatemala, hand-crafted furniture from Milan.

In an office in Midtown, a dedicated public health worker contemplates her organization's next international challenge: getting humanitarian aid to the globe's newest natural disaster area as quickly, efficiently, and economically as possible.

A few blocks away, oblivious to the world outside, a retired teacher waits nervously in the outpatient wing of a local hospital. Today, she has her first radiation treatment—a five-minute insertion of removable irradiated seeds—meant to shrink her tumor and give her back her life.

Meanwhile, crowded together on a busy street corner on the Georgia Tech campus, ten new freshmen wait anxiously until, right on time, the next electric/hybrid campus shuttle bus arrives to take them to class.

It's a typical day in a modern American city, with typical challenges and success stories for industrial and systems engineers. Though most people take such stories for granted, a quick look behind the scenes proves that in myriad ways, the work ISyE graduates do day in and day out makes a huge difference to huge numbers of people. It is no exaggeration to say that individual and societal health, world economies, and the daily routines and overall quality of life of millions of people around the globe are immeasurably improved by thoughtful application of basic principles and cutting-edge research unique to the discipline known as ISyE.

Let's take a closer look.

The Global Supply Chain: From the World to Your Door (in 24 hours!)

To contemporary Georgia Tech ISyE faculty members and their students, popular consumer goods like peaches, wine, and fresh-cut flowers are only the tip of the iceberg in a global "cold food" supply chain that grows more complex every year. Today's industrial and systems engineering challenges include traditional engineering concerns such as efficient manufacturing processes, durable packaging, and transportation and distribution logistics—as well as new challenges of food safety and traceability, cultural norms and government regulations in hundreds of sovereign nations, and the pivotal political, economic, and logistical role of the Panama Canal in world trade. *[To learn more about some of ISyE's work in food safety, see "Agroterrorism Defense" on page 3.]*

But let's talk about wine. For the past three years, John J. Bartholdi III, Manhattan Associates Chair in Supply Chain Management, has been part of a project that monitors temperatures inside shipping containers on ships carrying food products all over the world. The monitoring device records internal temperatures every two hours around the clock. Bartholdi's special focus, funded in part by an industry group, involves determining whether temperature variations affect the quality of wines imported into the U.S.

Tasting results are still being assessed, but other important findings have surfaced as well. "The wine tracking made us aware of the lack of standard terminology in the cold supply chain," says Bartholdi. "International logistics are not standardized, and there is no established hierarchy of standards. The cold supply chain also includes a lot of small businesses providing things like fresh produce, making standardization even more of a challenge." He expects these kinds of supply chain inconsistencies to become even more unacceptable in the next few years as international shippers gear up for the capacity increases spurred by the 2014 expansion of the Panama Canal.

The Panama Canal expansion is one big piece of an ever-growing logistics puzzle—a puzzle research engineers like Jaymie Forrest, managing director of the Georgia Tech Supply Chain & Logistics Institute, are uniquely positioned to solve. Working with the Panamanian government, Forrest and her colleagues have established a Panama Logistics Innovation & Research Center to improve the logistics capability of the canal's host nation. The initiative aims to help position Panama as a distribution point for Asian products and—American corporations—as a gateway and trade hub for expanding U.S. markets and imports throughout Latin America. "Right now, our volume of trade is larger with Asia," she observes, "but trade with Latin America is growing at a faster rate."

The button is a recording device that has been programmed to wake up every two hours to record time, date, and temperature. It can continue for as long as three months, which allows us to probe deeply into the supply chain, from winery to retail store and sometimes all the way to the consumer. This enables us to see the speed of various parts of the supply chain as well as the temperature.

In the coming years, the Georgia Tech logistics experts will work with Panama to develop professional-level training in supply chain logistics; help the government and the port authority create a National Logistics Council; and pursue additional research to analyze and improve the country's overall logistics platform. At a minimum, this platform includes the Panama Canal, container ports on two oceans plus a connecting railroad, multiple airports serving passengers and freight, special economic zones providing incentives to logistics operations, and a wide range of supporting logistics services. The cargo flowing through the canal will appear under flags from some 150 nations with crews speaking dozens of languages; the goods arriving in Panama for further shipping—or for offloading and distribution throughout Latin America—will come from thousands, if not millions, of suppliers. The impact of these infrastructure and logistics improvements will be felt worldwide for decades to come.

Challenges and Collaboration

"It used to be that industrial engineers focused mainly on the plant floor and looked for ways to make manufacturing processes more efficient," says Bartholdi. "Then we moved to distribution and worked to make distribution systems more efficient. But since the 1990s, the world's economic system has become more integrated, with everyone sourcing from everyone all over the world. As a result, industrial engineers have to work globally. You can't coordinate things by staying home in your office—not when your supply chains reach around the world."

According to Professor Emeritus Leon McGinnis, engineers traditionally looked at processes that were somewhat self-contained, where one person could see and understand those processes. "But today, the scope and scale of industrial engineering challenges exist at a much larger order

of magnitude. The problems are no longer just industrial engineering problems; they may also be electrical, mechanical, medical, or political. We have to address problems more comprehensively and collaboratively across many different fields," says McGinnis.

Ozlem Ergun, associate professor; Julie Swann, Harold R. and Mary Anne Nash Associate Professor; and Pinar Keskinocak, Joseph C. Mello Professor, are the founders and codirectors of the Center for Health & Humanitarian Logistics. The Center focuses on research and outreach in supply chain strategies and technologies to increase the effectiveness of health and humanitarian aid operations around the world.

One way the Georgia Tech ISyE team is meeting these challenges is by leading in the teaching of a twenty-first-century systems modeling language called SysML, an open-source specification adaptable to a wide range of systems engineering applications. As McGinnis explains, SysML (sysml.org) can be customized for the task at hand, providing application modeling and automated transformation to simulation capability (dramatically reducing the cost) for many different companies, large or small. Georgia Tech, the only academic institution working as a named contributor on the SysML project, offers what many consider to be the world's best-known and most comprehensive graduate and undergraduate curricula in SysML.

Yet for McGinnis and other senior ISyE faculty, the teaching challenges of this era go well beyond computational modeling; the goal is to expand knowledge, not merely capture and repeat it. "I want to get industrial engineers out of the business of building models they already know how to build," McGinnis says. "In the future, IEs will need to move beyond the routine; we need to use our system modeling and analytical tools to build and manage large, multidisciplinary teams seeking transformational change."

In the words of the National Academy of Engineering, the "grand challenges" for engineering in the next century lie squarely within these broad, multidisciplinary arenas—major undertakings such as providing universal access to clean water, advancing health informatics, and reverse-engineering the brain. At a minimum, each of these challenges will require extensive collaboration across multiple disciplines, not to mention cultures and continents. And each challenge has key roles for industrial engineers.

"It's hard study, but if you want to make a difference, industrial engineering is a career that matters," says Jane Ammons, ISyE chair and past president of the Institute of Industrial Engineers. "We have the largest industrial engineering program in the U.S. We graduate 10 percent of the nation's industrial engineers—and the quality and breadth of the talent here will have a major impact on the world of tomorrow."

Engineering for Human Health and Well-Being

Perhaps nowhere is the impact of ISyE revealed more dramatically than in the medical world. From disaster relief, to nanomaterials, to breakthroughs in cancer irradiation techniques, ISyE

"But today, the scope and scale of industrial engineering challenges exist at a much larger order of magnitude. The problems are no longer just industrial engineering problems; they may also be electrical, mechanical, medical, or political. We have to address problems more comprehensively and collaboratively across many different fields."

- Leon McGinnis

faculty are recognized worldwide for creative application of different engineering disciplines in improving human health and well-being.

According to Nash Associate Professor Julie Swann, who also codirects Georgia Tech's Center for Health & Humanitarian Logistics, the tools of industrial and systems engineering can be immensely helpful in analyzing and recommending new and more effective approaches to disaster relief and public health, both in the U.S. and around the world. Currently, she and her students are providing computer modeling as part of a cross-disciplinary project, the Caribbean Hazard Assessment Mitigation and Preparedness initiative (CHAMP), to assess preparedness against another catastrophe such as Hurricane Katrina in 2005 or the massive earthquake that devastated Haiti in 2010. "Vulnerability during a disaster depends on a country's environment and characteristics," she says. "Income levels, governmental structure, the level of involvement by police—all these things can affect levels of mortality and economic damage. Using a statistics-based model, we want to predict which factors are the most critical in determining preparedness."

Funded by a Georgia Tech alumnus, CHAMP evaluates hospitals and healthcare networks, supply and distribution chains to population centers, evacuation route capacity, building construction, and many other factors to help governments and nongovernmental organizations (NGOs), such as the Red Cross, prepare for and understand vulnerabilities in disaster response. To date, the team has worked with governments and NGOs in Belize, Jamaica, Trinidad and Tobago, Puerto Rico, and the Dominican Republic.

Closer to home, Swann and her collaborators have worked with Children's Hospital of Atlanta to track childhood obesity; studied children's distance from specialty pediatric care in many south Georgia counties; and worked with the Centers for Disease Control and Prevention (CDC), and several state health departments, to determine the availability of the H1N1 flu vaccine and vaccination rates in nine southeastern states. A new project under way for the U.S. Department of Veterans Affairs (VA) evaluates the potential of telemedicine.

For Eva Lee, professor at ISyE, mathematical programming and large-scale computational algorithms are tools to help save lives. Using systems

Big Findings in Big Data

Imagine a back-office banking employee hard at work at data analysis. Using a spreadsheet, she pores over the latest extraction from the "big data" of total transactions. Her focus: a tiny subset of seemingly routine banking transactions that may be the latest entries in an elaborate, multicontinent money-laundering scheme. Happily for the bank employee, a complex software program using automated machine learning has already culled through the vast universe of potentially suspicious transactions. What once took dozens of investigators many months to do by hand, the artificial intelligence technology does—with fewer errors—in days.

To Coca-Cola Chair in Engineering Statistics Jeff Wu, this kind of big data mining is only one example of the potential in exploring the vast store of information accumulated by millions of business and consumer transactions in modern life. The banking example is a real one, developed by Wu and colleagues, including a senior vice president with Bank of America, which later commercialized the product and used it to save millions of dollars through better identification of money-laundering fraud.

"We have had big data since the days of the NCR cash register and the automotive assembly line," says Wu. "But in the early years, retailers and manufacturers were not thinking about how to use it." Today, with huge quantities of data collected and stored via the Internet, the challenge is no longer on collecting data, but on figuring out ways to use it for better decision-making in a wide range of fields. "We need the data to make sense," he says. "We have data collected by Google, Amazon, Yahoo, Facebook—what can we do with it? It's not just a computer science challenge; it's a statistical and industrial engineering challenge as well."

Every day, billions of bytes of data are generated from product realization, purchasing transactions, information collected from health centers, and more. (Left to right) Jan Shi, Carolyn J. Stewart Chair; Jeff Wu, Coca-Cola Chair in Engineering Statistics; and Ming Yuan, Coca-Cola Junior Professor, research how to successfully use massive data sets to help transform the way we do business.

modeling, algorithm and software design, and decision theory analysis to aid in healthcare decision-making, she has worked with medical personnel to develop advanced cancer irradiation techniques, consulted frequently with the CDC and the Atlanta Veterans Affairs Medical Center, and even journeyed to Japan for on-the-ground research in the aftermath of the Fukushima nuclear power plant disaster.

Lee's cancer research focuses on using positron emission tomography imaging to locate malignant tumors, then computing algorithms to deliver a precise, escalated dose of radiation directly to the cancerous cells while leaving healthy tissue untouched. The technique has proven especially effective in treating cervical and prostate cancer.

"Cervical cancer is the fifth most common cancer in the world, and it has a 35 percent fatality rate if left untreated," she says. "Our newest research involves using tiny, removable seeds to insert radiation inside the tumor—five minutes today, five minutes tomorrow. It's a very exciting, novel approach that controls the tumor but preserves surrounding organs."

In Japan last year, Lee was the first U.S. scientist to interview people living within fifteen miles of the destroyed Fukushima nuclear plants after the March 2011 earthquake and tsunami that killed more than 19,000 people. Using RealOpt, a real-time public health pandemic, radiological, and biowarfare informatics-analytic system she developed several years ago for use by the CDC and local governments in the U.S., she collected data on evacuation timelines, radiological screening, and other information from the local population, including family members of workers at the nuclear plant. Her work group included not only U.S. colleagues from the CDC and National Science Foundation, but researchers from a local Japanese university as well.

ISyE faculty members Turgay Ayer and Chip White III are using their expertise in supply chain engineering to improve availability of a universally needed medical product: human blood. Their project, currently in the proposal stages, focuses on the routes and capabilities of blood-collection vehicles, familiar to most of us as bloodmobiles.

Every day, thousands of bloodmobiles around the world collect blood to be used for accident victims, surgery patients, and others in medical need. A small fraction of these vehicles carry very expensive, specialized equipment designed to collect blood that will be processed into a fast-clotting cryo blood product used in critical cases in emergency rooms. Unlike most blood collection, the blood to be used for cryo products must be frozen and separated within eight hours. All emergency rooms in a given region must have access to cryo products immediately when needed. The tough logistics question is this: Which bloodmobiles should collect blood for cryo uses, and how should they be routed to optimize the use of the cryo collection bays but also maximize the use of less expensive units?

"Focusing on the Atlanta area, our goal is to model and optimize a supply chain for this specific blood product," explains White. "We'll be looking at the current processes, adjusting routes throughout the week, and developing a better system for collecting this very time-sensitive, critical product."

As White notes, the problem is not unlike the logistics challenges faced by UPS and other entities making stop-and-go pickups and deliveries in congested, high-traffic areas. And while all deliveries are important to their senders and recipients, the timely delivery of a critical cryo blood product can, quite literally, become a matter of life or death.

The Stewart School has built a world-class faculty that features pioneering researchers and distinguished academic leaders. (Left to right) Leon McGinnis, professor emeritus; Jane Ammons, Stewart School Chair; Nagi Gebrael, associate professor; and Ben Wang, Gwaltney Chair in Manufacturing and executive director of the Georgia Tech Manufacturing Institute, discuss ISyE's teaching and research efforts in modern manufacturing systems.

In some cases, an innovative application of industrial engineering in the medical field may be discovered by accident, or perhaps serendipity. At a professional conference a few years ago, Ben Wang, Gwaltney Chair in Manufacturing Systems and executive director of the Georgia Tech Manufacturing Institute (formerly known as the Manufacturing Research Center for Georgia Tech), met a medical specialist working with orthotic prostheses. After learning about Wang and his colleagues' work in advanced composites, she proposed that Wang explore using some of these new materials to create lighter, more comfortable artificial limbs. The collaboration eventually led to an award from the VA to develop carbon nanomaterials as prostheses for amputees who lost limbs in military combat or through diabetes. "The key word is comfort," says Wang. "The advanced materials improve the fit,

Valerie Thomas, the Anderson Interface Associate Professor, studies energy efficiency in transportation, sustainability, and the use and environmental impacts of biofuels. She is also investigating how RFID tags can be used to promote more efficient recycling and reuse. Here Thomas collaborates with Nader Nejad of Recycletronics (right), an Atlanta-based company that specializes in electronics, computer, and cell phone recycling.

the pressure points, humidity, and temperature of the prosthesis, so the patient can wear it longer and more comfortably."

ISyE faculty members have even put their expertise to use to help de-stress Georgia Tech students and staff who depend on campus trolleys to get them to class and work on time. Ideally, the trolleys run on a schedule of one trolley every six minutes as they circulate throughout the campus. But for trolley operators, the challenge is always to avoid "bunching" during delays. Every time one trolley gets one minute behind, more people try to crowd on (causing more delay), and the impact cascades, resulting in a bunched-up row of trolleys going nowhere. By the time the sixth trolley departs from the bunch, it may be running more than six minutes behind. As a result, idle times and fuel consumption increase, students are tardy, and valuable class time is wasted—all at an avoidable cost that grows by the second.

To improve this situation, Bartholdi and a team of students stepped up. "We have collaborated with Georgia Tech's Department of Parking & Transportation to design a system of tablet computers, one per bus, so the buses can self-schedule," explains Bartholdi. The self-equalizing schedule, based on automated GPS and cell phone communications with trolley drivers, was tested on campus in spring 2012 and will be implemented in fall 2012. In addition to helping congestion on the Georgia Tech campus, the team expects this approach to be useful for other transportation systems, such as subway trains and airport shuttles. A report on the project was published in a professional journal in May.

Manufacturing and More

Suppose your military unit is on assignment in Afghanistan, and your vehicle needs a replacement part. Using a computer and software, a laser, and raw material consisting of powdered metal, your unit's mechanics construct the replacement part immediately, on-site, and put your vehicle back in the field in hours—instead of days, or even longer.

This innovative new concept of on-site manufacturing—known in the field as "additive manufacturing"—could eventually "change the face of manufacturing" and revolutionize large segments of traditional industries and associated supply chains, says Wang. He and his ISyE colleagues McGinnis, White, and Jan Shi are working closely with Mechanical Engineering Professors Suman Das and David Rosen, leaders in additive manufacturing, and are hard at work on developing real-world applications of additive manufacturing. With the additive manufacturing approach, a 3-D computer-assisted design (CAD) software programming blueprint for machine parts can be downloaded from the cloud (a storage space on the Internet), and the part can be constructed immediately on-site, using lasers and powdered metals. With an inventory consisting of bags of powdered metal, plus thousands of cloud-based product designs accessible for download anywhere, anytime, a machine shop or work group can produce hundreds of different parts as needed at the point of consumption.

Although this form of manufacturing is still in the beginning stages, the implications are profound, especially for military and time-sensitive applications. While parts made on-site by additive manufacturing might be more expensive individually than similar mass-produced parts, the ability to manufacture one part at a time, on demand, will result in time, opportunity, and energy savings. In military settings especially, making parts locally could greatly improve repair times and enhance surge capability as well. A shift to additive manufacturing would also streamline supply chain logistics from delivering huge, finished pieces to delivering bags of powdered metal.

For Wang, who coordinates Georgia Tech's manufacturing activities, the concept of additive manufacturing holds immense potential at Georgia Tech. It is also very relevant with regard to his roles in assisting Georgia Tech president G.P. "Bud" Peterson, a board member on the Obama Administration's Advanced Manufacturing Partnership to support innovative manufacturing in the U.S., and Georgia Tech Executive Vice President for Research Stephen E. Cross, a member of the Defense Science Board.

Your workday is over, and now it's time to take out the trash. But there's a lot less of it than you expected—because more than half your disposable goods are being reclaimed by recycling companies long before they reach the landfill.

"Smart Trash" may be a few years in the future, but the technology—the ubiquitous barcode—has been around for decades, says ISyE's Valerie Thomas. Thomas is developing a prototype of a recycling bin equipped with a bar-code reader. The reader would capture details about the "trashed" items, store that information in a central database, and make the database available to potential recycling companies who could assess the value of the various components and make arrangements to pick up, purchase, and resell your trash.

The Smart Trash concept is only one of numerous faculty projects devoted to the broad category of sustainability: recycling, decreasing energy use, and even reverse-engineering to lessen products' life cycle impact on the environment. Among other projects, Thomas is also working on energy efficiency in housing with the City of Atlanta Office of Sustainability and on projects related to biofuels, electric vehicles and wind power with several other Georgia Tech colleagues. "Most of my efforts on Smart Trash involve shepherding along concepts," she says. "But we already have the technology for this idea, such as using barcodes for Smart Trash recycling—and at the implementation level, it's just another app; it's really not that hard to do."

Georgia Peaches, Alaskan Salmon, and California Pears: Where does your food come from?

Perhaps someday soon, your smartphone will be able to tell you, based on digital data encoded on every food item in the store.

The federal Food Safety Modernization Act, signed into law by President Obama on January 4, 2011, and currently in the early implementation stages, requires that all food sold on the American marketplace be traceable throughout its lifespan. Producers and vendors must maintain traceability information in digital form so that food products can be traced quickly—and quickly recalled—in the event of an outbreak of foodborne illness. The first major overhaul of the Food and Drug Administration's food safety laws since the 1930s, the 2011 law, as it is implemented, will require extraordinary technological innovation in an age when food travels through dozens of hands in the supply chain. As an illustration of the related challenges, Jaymie Forrest, managing director of the Georgia Tech Supply Chain & Logistics Institute, points to a recent tracking study showing that a fresh food product from Asia changed hands fifty-six times before arriving at its ultimate grocery store destination.

At Georgia Tech, the work on food traceability is concentrated in the Integrated Food Chain Center (IFC), a collaborative initiative bringing together representatives from the food industry, academia, and government to focus on improving the cold chain management of perishable food products. Housed within the Georgia Tech Supply Chain & Logistics Institute, the IFC draws on the combined energies and expertise of ISyE faculty members, graduate students, and undergraduates working in collaboration to identify and develop solutions across this wide-ranging, critically important field.

In addition to food traceability, ISyE faculty members are also working to prevent terrorist attacks on the food chain. With funding from the U.S. Department of Homeland Security, faculty members Alan Erera and Chip White are engaged in an ongoing high-security project to protect the nation's food and water supplies from widespread, catastrophic contamination by potentially deadly biological weapons such as anthrax. *(See page 3 story.)*

From Theoretical to Applied, **ISyE is Research-Active**

The Stewart School of Industrial & Systems Engineering (ISyE) faculty typically conducts $6 million to $7 million in sponsored research annually. Whether pushing theoretical frontiers or applying the power of existing methodologies in domains involving real-world problems of societal and global concern, our faculty is extremely research-active. Here you will find a sampling of some of the recent applied and theoretical research conducted at ISyE.

APPLIED RESEARCH at ISyE provides solutions to practical problems and enriches our understanding of the underlying domain.

Energy and Sustainability

- Arizona State University: paper sector sustainability
- City of Atlanta: Atlanta greenhouse gas emissions and plan
- Coca-Cola: assessment of progress toward sustainability goals
- Operador Nacional do Sistema Elétrico Brazil: scheduling production of hydroelectricity under uncertainty
- Renmatix Inc.: assessment of fossil energy and greenhouse gas emissions for production of biofuel from woody mass

Healthcare and Humanitarian Logistics

- Children's Healthcare of Atlanta: promoting pediatric wellness by targeting obesity interventions through system analysis
- Centers for Disease Control and Prevention: online interoperable capability for RealOpt for large-scale medical countermeasures dispensing operations and planning
- Emory University:
  - pediatric heart network and systems
  - systems biological analyses of innate and adaptive responses to vaccination
  - measurement and evaluation of H1N1 response systems toward driving improvements in effectiveness and efficiency
- Meadows Memorial and Georgia Trauma Center: Leaders in health transformation
- The St. John Group: evaluation of health kits
- U.S. Department of Defense: technology for tactical and operational planning and emergency response

Manufacturing

- OG Technologies:
  - predictive process control and measurement strategy based on the optical caliper
  - supervisory predictive control for slab surface defects detection and control in continuous casting
- NGIMAT: in situ process control and variability reduction for nanopowder production scale-up

Transportation, Supply Chains, and Logistics

- Exxon Mobil Research: very large-scale mathematical programming for maritime logistics inventory routing problems
- Intel Corporation: gaming in the supply chain
- Office of Naval Research: self-organizing logistics systems
- National Center for Food Protection and Defense: risk mitigation and food supply chain design and control
- Samsung: real-time vehicle routing with accurate delivery time estimates
- Union Pacific: Union Pacific disruption management system enhancement

THEORY-DRIVEN OR METHOD RESEARCH at ISyE enhances the development and growth of a discipline by discovering new phenomena and ideas.

Optimization

- Air Force Office of Scientific Research:
  - selective optimization
  - new approaches for very large-scale integer programming
- Exxon Mobil Research:
  - large-scale non-convex MINLP under uncertainty
  - very large-scale and robust discrete optimization
- National Science Foundation:
  - exploiting submodularity in integer programming
  - fundamentals of convex mixed integer nonlinear programming
  - nontraditional cutting-plane algorithms for mixed integer programs
  - service distribution equity using spatio-temporal statistical foundations
- Navy: design and complexity analysis of algorithms for convex optimization
- Office of Naval Research: experimental modules for combinatorial optimization and mixed integer programming

Simulation

- National Science Foundation: a novel framework for simulation selection procedures based on multidimensional drifting Brownian motions hitting ellipsoids

Statistics

- National Science Foundation:
  - metamodel-based measurement, control, and optimization of engineered surfaces
  - multilayer designs, kriging, and beyond
  - multidimensional mixture regression models: estimation and inference
  - risk-conscious design and retrofit of building for low energy
- National Institutes of Health: statistical modeling of receptor/ligand binding kinetics on the T-cell surface

Stochastic Systems

- National Science Foundation:
  - analysis and control of large-scale service systems
  - performance analysis of closed queuing networks with subexponential processing times
  - robust optimization of nanoparticle synthesis in supercritical Co2
  - streaming data analysis in sensor networks

Conference Examines the State of U.S. Manufacturing Competitiveness

Overall, manufacturing in the U.S. is growing stronger; however, maintaining and strengthening America's competitiveness in the global market will require a tremendous measure of planning, effort, and focused financial investment. This was the consensus message delivered at the "U.S. Manufacturing Competitiveness Initiative: Dialogue on Next Generation Supply Networks and Logistics," held at the Georgia Tech Global Learning Center in Atlanta in February 2012. Georgia Tech and the U.S. Council on Competitiveness sponsored the conference.

Conference speakers and panelists included CEOs and senior executives from industry, labor, government, and academia who shared their perspectives on the current state of the U.S. manufacturing industry, the challenges it faces in terms of global competition, and possible solutions to mitigate those obstacles, specifically in terms of supply networks and advanced logistics. Leaders from Fortune 500 companies such as UPS and Coca-Cola, as well as academic experts from Georgia Tech, were among some twenty participants who shared their insight.

"Our challenge is to not only get back to 'made in America' but also 'invented in America,'" said Georgia Tech President G.P. "Bud" Peterson in his opening remarks. "The same spirit of innovation and collaboration that once gave us preeminence in manufacturing can help us regain our competitiveness, thereby creating jobs, increasing exports, and serving as a catalyst for a healthy economy."

The two-day invitation-only forum, coordinated by the Stewart School of Industrial & Systems Engineering (ISyE), opened with welcoming comments from the conference chair Chip White III, Schneider National Chair in Transportation and Logistics in ISyE.

"We are delighted to be partnering with the Council on Competitiveness to address how the supply chain and logistics industry can help provide a competitive advantage for U.S. manufacturing and, in so doing, help strengthen the U.S. economy," said White.

The Council is a nonpartisan, nongovernmental organization composed of CEOs, university presidents, and labor leaders. The Atlanta event was the thirteenth in a series of conferences held around the country addressing various aspects of manufacturing competitiveness.

To view the joint Georgia Tech-Council on Competitiveness Report detailing the forum's findings in full, visit **http://bit.ly/OGPHMP.**

New Predictive Health Track in MS Health Systems

Georgia Tech now offers a new master's degree program track in predictive health—a field of study that focuses on maintaining health rather than treating disease.

The new track will be within the existing Master of Science in Health Systems program, offered by the Stewart School of Industrial & Systems Engineering (ISyE). It consists of thirty semester hours that can be completed in one year.

In the program, students will learn how to analyze and model risk factors in large, complex healthcare databases, as well as how to link clinical observations with medical knowledge to improve healthcare choices and decisions. Upon completion of the program, students will be prepared for leadership positions in the healthcare industry and capable of using quantitative and systems modeling to design, implement, and manage superior healthcare delivery.

The program will also further the work of the Emory-Georgia Tech Predictive Health Institute. The Center for Health Discovery and Well Being, a unit of the Predictive Health Institute, opened in 2007 and has since screened 700 participants, collecting approximately 2,000 data points of health-related information per visit (initial, six-month, one-year, two-year, etc.). So someone who has been with the program for three years, for instance, will have approximately 10,000 data points in their history.

Georgia Tech students and faculty will analyze the collected data to understand the impact of the Center for Health Discovery and Well Being. Such intensive analysis can be used to develop a model or algorithm for software that could potentially advance the understanding and implementation of predictive health programs.

"Over the past decade, we have seen continuously increasing healthcare expenses, which, unfortunately, have not resulted in an overall improvement in people's health status," said Pinar Keskinocak, Joseph C. Mello Professor in ISyE, director of research for the Health Systems Institute, and codirector of the Center for Health & Humanitarian Logistics at Georgia Tech.

"Predictive health focuses on maintaining health rather than on treating disease. This involves using patient data and new tools to identify and measure risks and deviations from health, and to intervene before a disease or health failure occurs. Given the unique features of the data and problems under investigation, there is a tremendous need for educating students and for new research," Keskinocak added.

The Predictive Health Track was made possible by a grant from the George Family Foundation. For more information on the Master of Science in Health Systems program, contact Keskinocak at **pinar@isye.gatech.edu.**

Like Us, Follow Us, **Stay Connected!**

For an inside look at the world of ISyE,
find us on:

facebook.com/GeorgiaTechISyE

twitter.com/GeorgiaTechISyE

youtube.com/GeorgiaTechISyE

ISyE-NEWS **www.isye.gatech.edu/news-events/enews**

Senior Design: Meaningful Education with Real-World Results

Senior Design, the undergraduate capstone course in which students form teams to solve a complex real-world industry challenge, is a win-win collaboration for both students and industry. This comprehensive experience helps students gain confidence and practical professional experience as they make the transition from academic to professional life. Their industry partners gain a team of six to eight exceptionally bright undergraduate students who can provide a variety of innovative and creative solutions to an existing organizational problem. Many of these organizations end up making permanent job offers to students from the project team after spending an intense semester working alongside them.

Senior Design industry clients include large Atlanta-based companies that want to create and maintain a connection to Georgia Tech; however, a wide range of other organizations, including branches of government, international manufacturers and distributors, hospitals, and global aid organizations, have begun to seek out the Senior Design Program to tap into new perspectives on their challenges. The companies range in size from startups with fewer than five employees to top companies in the Fortune rankings.

If you are interested in having a team of bright undergraduate students provide your organization with a variety of innovative and creative solutions to a problem, visit **http://www.isye.gatech.edu/seniordesign.**

The winner of the Spring 2012 Senior Design Competition was the GE Energy Team, with their project entitled "Wind Turbine Offloading Optimization Strategy." (Left to right) Yonatan Dov Mintz, Jacmara Katheryn Ching Sanchez, Oscar Andres Harasic-Yaksic, Mario Solares Nassar, Antonio Elosua Cantu, Professor Donna C. Llewellyn, Santiago Diaz Kieffer.

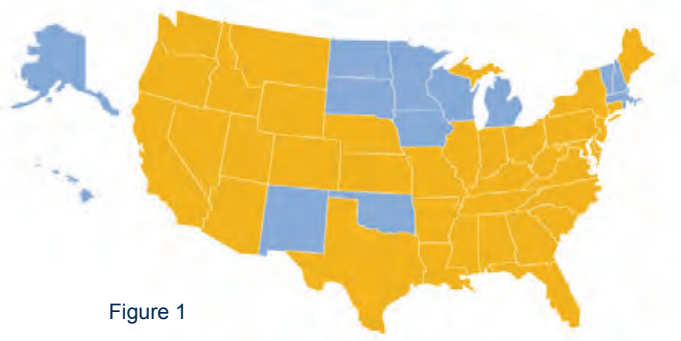


Figure 1

Figure 2

Figures 1: The gold states are places in which at least one ISyE Senior Design project has had a major impact since fall 2005.
Figures 2: The gold countries are places in which at least one ISyE Senior Design project has had a major impact since fall 2005.

The following table lists the Senior Design clients since fall 2005. Clients in bold have sponsored at least one project that has qualified for the Senior Design finals in the end-of-the-semester Senior Design Competition.

FOR-PROFIT

ADEX Machining
AGL Resources
AirTran
American CyberSystems
Anheuser-Busch
AT&T
Atlanta Brewing Company
Atlanta Gas Light
Atlanta Journal-Constitution
Avery Dennison
Bella Cucina
BellSouth
BlueLinx
Burger King
CAB
Canvas Systems
Carrier Europe
Carter's
Caterpillar
Cbeyond
Chick-fil-A
Cisco Systems
Coca-Cola
Coca-Cola Enterprises
Coca-Cola North America
Coca-Cola Refreshments
Comcast
Cooper Industries
CR Bard
Craft-Art
CYI Gifts
Delta
DHL
Dick's Sporting Goods
e^2M
EarthLink
EGO North America
Elesys
Enraf
Exel
Express
F&P Georgia Manufacturing
GE Energy
General Mills
Georgia Power
Goody Products
Grenzebach
Gypsum Management & Supply
H.C. Brill
Home Depot
Honda
Honeywell
House of Cheatham
IKEA
iKobo
Intel
InterContinental Hotels Group
Kimberly Clark
Kubota Tractor
Legacy Property Group
Lockheed Martin
Macy's
Manheim Auto Auctions
Marmi Natural Stone
Mars
Matador Distributing
McKesson
Michelin
Midtown Consulting Group
Newell Rubbermaid
Next Wave
Norfolk Southern
Office Depot
PACCAR Parts
Panasonic
Platt Electric Supply
Porsche
Pratt & Whitney
Predictix
RaceTrac
Radiant
Rainmaker
Reliance Electric
Remington Medical Supply
RMI
Rock-Tenn
Rockwell Collins
Roswell Recycling
Ryder
Saia
Sandoz
Sandvik Mining & Construction
Scientific Atlanta/Cisco
Shaw Industries
Siemens
Southern Company
Starline Associates
Summit Industries
SunTrust
SynQ Solutions
TriVantage
Tyco Healthcare
Tyco Safety Products
United Distributors
UPS
USG
UTI
Vertical Brands
VF
Waffle House
Walmart
Whirlpool
WIKA
Windstream
ZF Industries

HUMANITARIAN

Atlanta Community Food Bank
CARE
Centers for Disease Control and Prevention
Flu-Free Schools
UNICEF
United Nations High Commissioner for Refugees
United Nations World Food Programme
World Health Organization

MEDICAL

Atlanta Gastroenterology Associates
Cardiovascular Associates
Children's Healthcare of Atlanta
DeKalb Medical Center
Emory Crawford Long Hospital
Emory University Healthcare
Emory University Hospital
Northside Hospital
Piedmont Fayette Hospital
Piedmont Heart Institute
Piedmont Hospital
Piedmont Newnan Hospital
WellStar Kennestone Hospital

GOVERNMENT

Atlanta Fulton County Emergency Management Association
Atlanta Regional Commission
City of Atlanta
DeKalb County
DeKalb County Police Department
Fulton County
Georgia Poison Control
Gwinnett County Public Schools
Metro Atlanta Regional Transportation Authority

NONPROFIT

Buckhead Baseball
Georgia Aquarium
Georgia Tech Athletic Association
Georgia Tech Campus Recreation Center
Georgia Tech Capacity Planning and Space Management
Georgia Tech Office of Undergraduate Admissions
High Museum of Art
MedShare International
Project Open Hand
Salvation Army
The Children's School

The winner of the Fall 2011 Senior Design Competition was the RMI Team, with their project entitled "Private Fleet Optimization." (Left to right) Tina Yu, John Kang, Camilo Lotero, Zachary Laguna, Sikander Hajiyani, Professor Xiaoming Huo, Sojeong Lee, and Clara Moon.

18 MONTHS | 5 RESIDENCES 4 CONTINENTS | 1 GLOBAL SUPPLY CHAIN PROJECT

Georgia Tech's Executive Master's in International Logistics & Supply Chain Strategy (EMIL-SCS) is the program of choice for experienced logistics and supply chain professionals looking to expand their scope of responsibilities. Designed for the busy global executive, the eighteen-month program is built around five two-week residences that take place in North America, Europe, Latin America, and Asia. Each international residence is collaboratively designed to meet the particular interests and objectives of each new class—from the cities and countries visited, to the industries and companies explored. Between residences, students are back in the office implementing lessons learned and leading key supply chain improvement initiatives.

Here is a look at the five residences for the EMIL-SCS Class of 2012:

RESIDENCE I | GEORGIA TECH CAMPUS

NORTH AMERICA

Destination: Atlanta, Georgia
Focus: Develop a framework for supply chain strategy and build a clear understanding of how logistics and supply chain activities influence corporate financial performance. Strengthen analytical skills and master techniques for forecasting and managing demand. Select a Global Supply Chain Project and form a team to work with over the next 18 months. Provide an update of the Global Supply Chain Project during each international residence.

RESIDENCE II | EUROPE

EUROPE

Destination: Cologne and Munich, Germany; Krakow, Poland
Focus: Understand sustainability and the differences among labor models around the world, and the ways in which those differences influence supply chain strategy.

Class of 2012 Career Statistics:
44 percent have an MBA
36 percent hold VP- or C-Level positions
22 percent hold Senior Manager or Director positions
83 percent have a minimum of 15 years industry experience

Class of 2012 Sponsoring Companies:
Bumblebee Foods, Dell, DB Schenker, L'Oreál, Tiffany & Co., Tyco Fire Corporation, United Parcel Service, United Technology Corporation, and Waste Management Systems

LATIN AMERICA | RESIDENCE III





LATIN AMERICA

Destination: Panama City, Panama; Lima, Peru; Sao Paulo, Campinas, and Santos, Brazil
Focus: Concentrate on distribution facility design and operations, and understand trade agreements and strategies for navigating complex tax regimes.

ASIA | RESIDENCE IV





ASIA

Destination: Mumbai, India; Bangkok, Thailand; Hong Kong; and Shanghai, China
Focus: Explore the region's aggressive growth strategy to build the world-class rail, highway, port and air cargo facilities necessary to support domestic growth, while meeting with top sourcing executives at Global 500 companies.

NORTH AMERICA | RESIDENCE V




NORTH AMERICA

Destination: Louisville, Kentucky; Atlanta, Georgia; Montreal, Canada
Focus: Learn about manufacturing, NAFTA trade, risk management and supply chain leadership. Present the findings and recommendations from the Global Supply Chain Project.

The program culminates with the final presentations of the Global Supply Chain Projects the teams worked on throughout the eighteen-month program. Selected from the proposals students brought from their companies, these projects represent an opportunity for students to apply newly acquired capabilities collaboratively to grow revenues, reduce costs, trim inventories, and improve lead time in a global context.
For more information, **visit www.emil-scs.gatech.edu.**

Connecting the Classroom to Real-World Practice:

Supply Chain Engineering MS Students Create a Framework for a Warehouse Design Tool Through Capstone Project

An important component of ISyE's Master of Science in Supply Chain Engineering (MS SCE) program is the capstone project, required of all students prior to graduation. It provides them with professional practice experience and creates an opportunity to apply classroom ideas to real-world projects, which, in many cases, are sponsored by a business or government agency. Under the guidance of a faculty advisor, students may complete their capstone project by working with a small project team or by pursuing an individual internship.

"These capstone projects require students to demonstrate effective use of supply chain engineering methodology and to deliver significant value to the sponsor of the research project," said Alan Erera, associate professor in the Stewart School of Industrial & Systems Engineering (ISyE). "We believe that one key aspect of our program that differentiates us from our competitors is that we require the students to get hands-on experience in applying analytical skills to problems before they graduate."

One of the most recent groups of supply chain engineering master's students successfully completed a capstone project titled "Development of a Framework for a Warehouse Design Tool in SysML (Systems Modeling Language)."

Steffen Schieweck, Tim Skrotzki, and Martin Thormann worked on this project to help designers make design decisions about very complex warehouse facilities, using an engineering approach with integrated software tools.

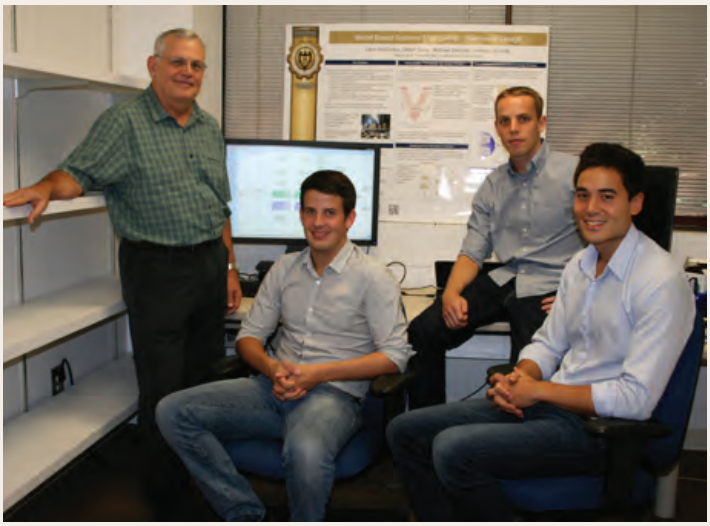
"The project was about creating a framework, or tool, which guides the designer through a specific design process," said Thormann.

Throughout the course of their project, Schieweck, Skrotzki, and Thormann worked closely together in the lab, sharing intense discussions about their project, cross-checking each other's work, and gaining feedback.

"One of the benefits of working with a team is that it increases the quality of your work," said Schieweck.

Throughout the project, their faculty advisor, ISyE Professor Emeritus Leon McGinnis, provided support and guidance.

"Professor McGinnis gave us insight into the real challenges warehouse designers face daily. Through that insight and working with real data, we gained practical experience that will be valuable to us in a future real-world setting," said Skrotzki.



(Left to right) Professor Emeritus Leon McGinnis, Steffen Schieweck, Tim Skrotzki, and Martin Thormann.

Describing the capstone project as "a bridge between the classroom and real-world practice," McGinnis commended the students' work both on the project as well as in the classroom. McGinnis is part of a team of faculty members who teach SysML at Georgia Tech, the only academic institution working as a named contributor on SysML.

The MS SCE program is a professional graduate degree program created to meet the growing demand for business-savvy engineers who can design and operate highly complex global supply chains. The program's 12-month curriculum delivers knowledge in analytic methods, supply chain engineering, and enterprise management while building professional practice skills and real-world industry experience.

For more information, visit **www.sce.gatech.edu.**

Are the NCAA bracket arrangements more helpful to some teams than others?

How many servers should I employ?

Does The Varsity have enough space to accommodate customers before the next UGA game?

How many medical personnel should we schedule in an emergency room?

Are hub-and-spoke systems more efficient for your airline than direct point-to-point flights?

The Power of [Mα+h²]ematic(s)

in Industrial & Systems Engineering

By Dave Goldsman

As industrial engineers, we probably all remember taking various prerequisite mathematics courses like calculus and linear algebra, then moving on to some of the mathematically oriented courses within the Stewart School of Industrial & Systems Engineering (ISyE) itself. Every once in a while, it's a good idea to take a step back and think about why all of that math was necessary as part of a strong ISyE experience. This article offers some reminders about the uses and power of mathematics in our discipline—at least for those who want to work on cutting-edge applications or emerging research areas.

The short story in industrial engineering and operations research is that, for most practical purposes, all of the easy problems and results are gone, having been discovered and thoroughly studied long ago. That doesn't mean we can't go out into the world and solve real-life problems with appropriate existing technology; it just means we may have to roll up our mathematical sleeves a bit as we delve into applications that are becoming more and more challenging. For instance, it's quite easy to "solve" a steady-state single-server queuing system with some simple equations if the customer interarrival times and service times are independent and identically distributed exponential random variables. But what if you have an entire network of queues (like, say, a call center or a popular fast-food restaurant) experiencing transient arrival processes that vary throughout the day, or different server schedules and abilities, or equipment breakdowns? These types of problems obviously take a little more effort; a trivial equation isn't enough.

This article will address some of the mathematics techniques that can be brought to bear on interesting ISyE applications and research problems. You would undoubtedly have been exposed to some of these methods in your travels as a student and in the real world (perhaps, at least, elementary versions), but some may be completely new to you. In any case, the idea is to provide a glimpse of the terrific power of mathematics that's available for use in problems important to industrial engineers and operations researchers.

Going for a Walk

Let's begin with a discussion concerning a beautiful application of probability theory and stochastic processes. Of course, the most basic experiment in any probability course is that of flipping a coin. We'll show how this concept can be turned into something that's quite sophisticated from a mathematical point of view. Suppose every time I toss tails (T), I earn a dollar, and every time I toss heads (H), I lose a dollar. An interesting question involves that of determining how much money I will have after a certain number of tosses. Where do my total winnings stand after ten tosses? After 100? After one million? As an example, the ten-toss sequence TTTHHTTHTT would have given me a well-deserved net gain of $4.

Associate Professor Shijie Deng illustrates a financial model incorporating Brownian motion.

Such an experiment is called a random walk. Think of me taking a step to the left or a step to the right with equal probability (just like my earnings with the coin flips). In terms of my experiment, I'd like to know where I stand after I've been meandering around a while. What's the probability that I'll have at least $4 by the tenth toss? Will I earn $4 before I lose $4? But the random walk gives us so much more than a description of the probabilistic behavior of a finite number of coin flips. The magic happens as we increase the number of steps in the random walk, because the process then converges to what is known as Brownian motion.

Here is an example of what an exponential version of Brownian motion looks like *(see photo below)*. Notice that it bears a striking resemblance to a time series plot of stock prices. In fact, many financial engineers use Brownian motion to model stocks, options, and other financial instruments. Brownian motion is so important and mathematically deep that scientists have won at least two Nobel Prizes explaining it and using it in all sorts of applications. In ISyE, researchers use Brownian motion to:

- analyze what goes on in busy queuing systems (like call centers);
- study the movement of ants;
- model how computer compilers process data lists;
- fit complicated probability distributions;
- develop efficient quality control charts;
- analyze difficult data sets coming out of simulations; and, of course,
- model stock and option process.

Going Nowhere Fast

Speaking of queuing systems as in the last set of examples, how many of us have had to wait in lines a bit more than we would have liked at a store, on the phone, or at an amusement park? The science of queuing (line) theory allows us to analyze the flow of entities through all sorts of systems, where the terms "entities" and "systems" can be quite general. For instance, we might be interested in a problem as simple as that of customer movement through a barber shop (perhaps encountering a tasty barber queue along the way), or more complicated systems such as airport baggage handling services, or a large call center handling millions of customer inquiries.

What are some of the issues involved in queuing theory and how can mathematics help us understand the performance of these types of systems? If you are a customer, you are certainly interested in moving through lines (queues) quickly and being served quickly. If you are the service provider, you may want to keep the lines short in order to save space and avoid customer dissatisfaction. On the other hand, if you are the post office, you'll likely want to keep the lines nice and long—to show your customers who's boss. In addition to the issue of line length, you'd want to keep your servers relatively busy—after all, an idle server is the devil's workshop (and is costing you money). A number of important questions arise from all of these considerations:

- Which one of several lines should I enter at the grocery store's checkout? Normally, you'd pick the shortest one, but what happens if certain servers are quicker or more talented than others? What happens if you spot particularly slow customers in one of the lines? How about the self-service checkout machine?
- How many servers should I employ? Too many servers cost too much money; too few could cost customers.
- Should we route different types of customers to different service stations in different orders?
- What kind of cross-functionalities should our servers have in order to make the system more efficient?

ISyE researchers study questions such as those described above using a combination of techniques arising from stochastic processes, differential equations, optimization, and computer simulation. The implications of such questions are tremendous and can generate considerations such as:

- How many medical personnel should we schedule in an emergency room?
- Will we have enough voting machines and staff to carry out their proper functions during a national election? And, of course,

- Does The Varsity have enough space to accommodate customers before the next UGA game?

Taking a Tour

Suppose you are a traveling salesman and you need to visit the following cities to show off your goods: Atlanta (A), Buffalo (B), Chicago (C), and Denver (D). Starting from and ending at Atlanta, what's the best way to do this? This is what ISyE researchers refer to as the Travelling Salesman Problem (TSP).

Here are the possible routes you could take: ABCDA, ABDCA, ACBDA, ACDBA, ADBCA, ADCBA

Notice that we have six potential routes (or "tours"), corresponding to the six permutations of the cities B, C, D. If we are interested in minimizing the distance travelled, then we really only have to look at the three tours ABCDA, ABDCA, ACBDA since, for example, the distance required for ABCDA is the same as that for ADCBA—assuming we are comfortable walking backward. All we have to do is go on the web and look at the distances for the three routes to get our optimal answer. Pretty simple, right? But what happens if we have n cities on our agenda? Then it is very easy to show that we'll have to do the look-ups for (n-1)!/2 tours, and this number gets incredibly big very quickly.

Indeed, if we were to try to find the optimal tour by hand for just twenty cities, it would take a huge amount of effort, and it would be exceptionally tedious and time-consuming. Fifty cities by hand would be out of the question. Using mathematical tools from combinatorics, graph theory, and even topology (along with a liberal dose of computer science), ISyE researchers have optimally solved TSPs involving almost 100,000 cities—and they can get nearly optimal solutions for much larger problems!

This is not just a pie-in-the-sky mathematical exercise. You can use TSPs to:

- find the optimal route for a delivery truck;
- design the optimal pattern for semiconductor chip etching;
- deliver meals on wheels to homebound infirmed patients; and
- schedule bus pickups for school children.

For more information on TSPs, visit **http://www.tsp.gatech.edu/**.

Getting from Here to There

Travel is an aspect of all of our lives that ISyE touches in many ways. Think of an airline trip from Atlanta to New York. Typically, you start the process by going online to purchase your ticket at one of the major travel portals (or at the airline itself). The prices you see are dependent on a number of factors, such as time and date of your trip and class of service, and are actually determined by a combination of optimization, regression, and forecasting techniques. For instance,

Jose Sarmiento, ISyE undergraduate student; Professor Anton Kleywegt; Kyungha Lim, ISyE undergraduate student; and Xinchang Wang, ISyE PhD student, plying the tools of the trade at Delta's Tech Ops Center.

if your airline has determined via its data analytics that the Atlanta-New York route is popular on Labor Day weekend, it will likely try to take advantage of that forecast by keeping most of that route's prices higher than usual, reducing the number of low-price tickets, reducing the availability of free frequent flier tickets, and perhaps scheduling aircraft with greater capacities.

Your airline almost certainly makes multiple flights from Atlanta to New York every day on a variety of different planes with different capacities. How are the decisions made regarding which planes fly to which cities, at which times, carrying how many people? In particular:

- How does one assign the crew for a specific flight, especially in the presence of tight FAA safety restrictions regarding the amount of time that a crew can serve during a given time period?
- How does one determine flight schedules for a specific aircraft, while adhering to strict maintenance requirements?
- Should the plane fly back and forth between two cities (e.g., Atlanta-New York), or is it more efficient to fly a larger circuit?
- Are hub-and-spoke systems more efficient for your airline than direct point-to-point flights? Should your airline augment its route network with those of smaller commuter airlines?
- Should overbookings be allowed, given proper statistical analysis with respect to no-shows?
- How should staff be assigned and how should the lines be configured at the airport's security checkpoints?

These are all extremely difficult problems that require the use of optimization, statistical tools, and simulation (among others). ISyE is very lucky to have several researchers specializing in integer programming optimization techniques who are well-known for their work on many of the listed questions. The work—though highly theoretical—has financial consequences that result in millions and millions of dollars in savings.

Follow the Bouncing Ball

As yet another example of mathematics used in our field, let's talk about something almost every sports fan can relate to: Which college basketball team is going to win the NCAA championship this year? This is a tough problem that involves a number of tricky aspects of probability, statistics, and optimization. The goal is to somehow use our analytical skills from these mathematical areas along with some intelligent data mining to make reasonable predictions (and to win our office pools). In terms of data mining, there's certainly a lot of information out there. For instance:

- Are the bracket arrangements more helpful to some teams than others?
- Did certain teams already play each other and how did they do?
- Are there any games with obvious home court advantages?
- Are some of the teams currently on a hot streak?
- Do any of the teams have injury issues?
- How have various seeds done in the past?
- Can a team's margin of victory give us any clues about future performance?
- What about a team's conference performance?

NCAA tournament prediction is clearly an active area, both from a seat-of-the-pants perspective as well as an analytical perspective. We are very lucky in ISyE to have a number of researchers who have developed an extremely successful prediction technology called the Logistic Regression / Markov Chain (LRMC) method. The interesting name

Professors Joel Sokol and Paul Kvam apply their predictive analytics skills on the basketball court. They developed LRMC, a prediction technology program that is better at predicting the outcome of NCAA tournament games than almost all of the other ranking systems.

ISyE Professor Sigrún Andradóttir, ISyE PhD student Mi Lim Lee, and Emory University Biostatistician Azhar Nizam collaborate on pandemic influenza simulation research.

reflects the statistical and probabilistic techniques the tool uses. What is nice about the LRMC ranking system is that it is designed to use only basic scoreboard data: which two teams played, whose court they played on, and what the margin of victory was—though a new so-called Bayesian add-on has been developed recently that allows users to incorporate some gut feeling into the equation.

Obviously, you have to go out and play the games, so you can't predict things correctly all of the time, but LRMC has done very well compared to just about any other prediction methodology, and ISyE has garnered a great deal of positive play from this terrific application of mathematics. If you would like more information about LRMC, visit **http://lrmc.isye.gatech.edu/**.

Getting Home Safe and Sound

Another example involving mathematics and modeling in ISyE concerns the important problem of disease propagation. In 2009 and the early part of 2010, the northern hemisphere had to cope with the first waves of a new H1N1 influenza pandemic, also known as swine flu.

Despite high-profile vaccination campaigns in many countries, delays in the administration of vaccination programs were common, and high vaccination coverage levels were not achieved, so the disease was not effectively controlled.

We were lucky this time. This particular strain of swine flu wasn't too awful in terms of mortality; in fact, it wasn't much worse than regular seasonal flu. Next time, things might not go our way. So what else could have been done to stem the march of a pandemic disease through the population? ISyE researchers have used a variety of mathematical tools to model the disease as well as certain mitigation strategies. These tools include everything from probability, statistics, differential equations, and optimization, which are then used in conjunction with computer simulations to come up with strategies to mitigate future pandemics. What kinds of strategies are out there? Here are some possibilities:

- school closure and social distancing
- better vaccination compliance
- more reliable vaccination supply chains
- use and procurement of more effective antiviral medicines
- use of face masks
- working from home
- placement of resources in locations that will allow healthcare officials to respond optimally to a pandemic

Of course, these strategies all cost a great deal of money and some work better than others. ISyE researchers are interested in optimizing health outcomes subject to budget constraints and are actively working in this area.

One advantage of this work is that it can be extended to other healthcare arenas, for instance:

- measles outbreaks
- malaria
- cholera

Conclusion

This article has just touched the surface of how the mathematical tools used by ISyE folks can be adopted to solve a variety of theoretical and applied problems. Some of these mathematical technologies are available through courses in ISyE (or from a good math department), but there is no doubt that such cutting-edge methods are required reading for today's modern practitioners of industrial engineering and operations research.

Check out this video to hear Professor Dave Goldsman talk about some interesting uses of mathematics in industrial engineering and operations research. **http://bit.ly/SfliaP**

Professional Education Makes a Difference in Humanitarian Relief

By Pinar Keskinocak

The Georgia Tech Center for Health & Humanitarian Logistics (HHL) has launched a new professional education certificate program. The three-course program draws tactical and strategic members of nongovernmental organizations, employees from companies involved in humanitarian relief or health delivery, domestic and foreign government employees and public health officials, foundation members, donors, and others interested in health and humanitarian topics.

The goal of the program is to enhance participants' knowledge of and experience in logistics and supply chain topics related to a broad range of activities including preparation for, response to, and recovery from natural and manmade disasters, as well as ongoing humanitarian crises due to war, famine, infectious diseases, and chronic health problems.

Participants who attended the first two courses earlier this year have lived or worked in countries all over the world. Current participant Amy Coombe commented that "this course elevates the rigor" with which she can "determine efficient mechanisms and strategies to make the best use of limited resources."

Some participants, including Chris Knobel, mentioned that most of their experiences have been hands-on and that they learned from other logisticians. "It was fascinating listening to the complexities of modeling and forecasting and their benefits for decision making. I personally feel that having a basic understanding of the concepts will benefit my own knowledge of logistics," said Knobel. "There are very few courses in the world that address the concepts that this class did."

The program consists of three courses:

1. Pre-Planning Strategy for Health and Humanitarian Organizations (2 days)
2. Tactical Decision Making in Public Health and Humanitarian Response (2.5 days)
3. Systems Operations in Health and Humanitarian Response (2.5 days)

Each course is currently offered once a year in January, May, and September, respectively. Participants who successfully complete the requirements of all three courses receive a certificate from Georgia Tech in Health & Humanitarian Logistics. Course topics include demand management and forecasting, procurement, inventory management, distribution, network design, strategies for allocating limited resources, collaboration and coordination, and measuring and evaluating system performance.

The learning experience is maximized through a blended delivery format, consisting of pre- and post-course online modules, mixed with face-to-face instructor-led classroom time. Referring to one of the hands-on classroom exercises, Nancy Brockway from the American Red Cross explained how the program helped her "understand how the variables impacted decision making, and after plugging it into the model, seeing that the logic to my thinking worked."

Participants have also expressed appreciation of the classroom interactions. "I learned a lot from colleagues from other fields and countries. Having participants with various backgrounds and from different fields was an incentive for fruitful discussions," says Simplice Kamdem Takoubo, from USAID/Benin. "The course provided me with new skills that I use daily in my job to increase the efficiency of U.S. government support in achieving country goals."

Christopher Roberts of Critical Angle Enterprises echoes similar sentiments: "The participants' strong, varied backgrounds brought together many insightful perspectives," he said.

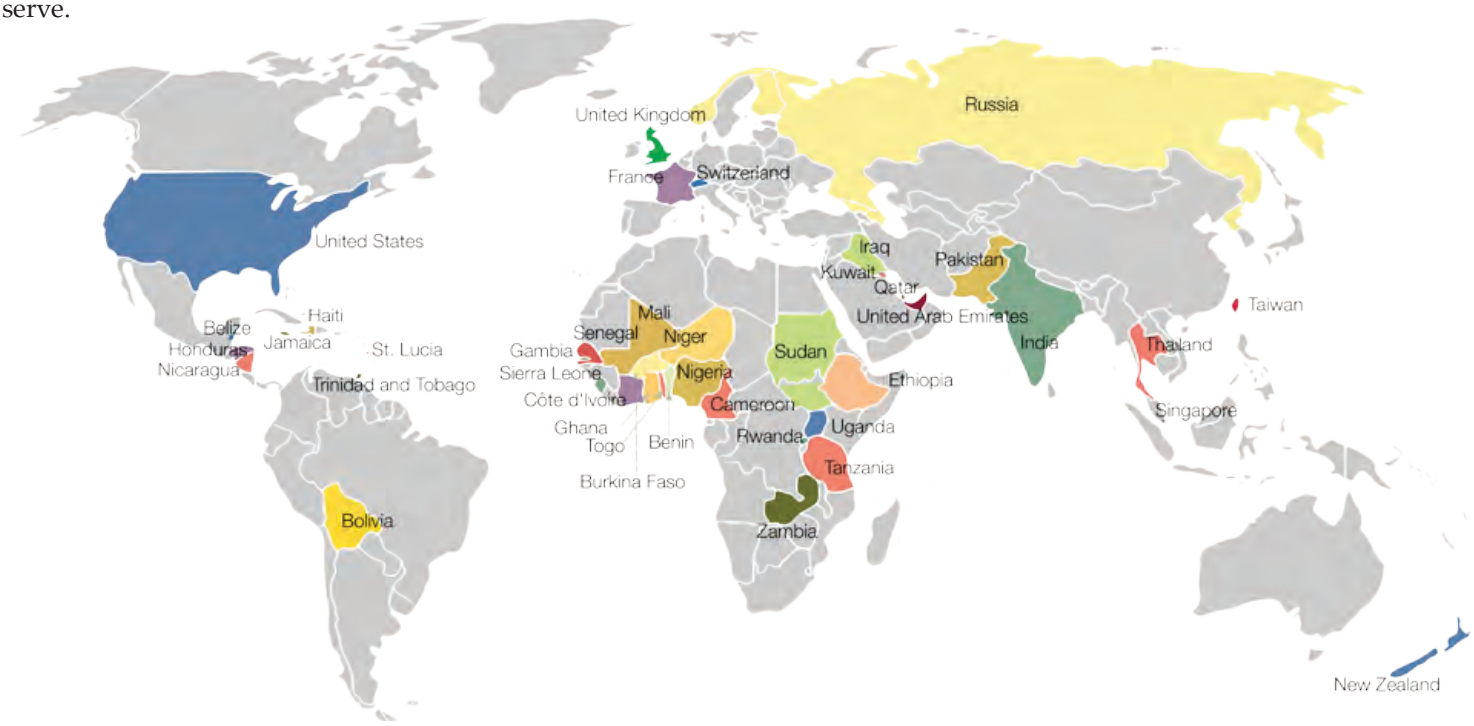
Additionally, the long-term impact of the courses has been viewed very positively by the participants, both for their personal and professional growth, and also in terms of the benefits to their organizations and the constituents they serve.

"For my long-term career goals, I will have the capacity to contribute in my current position at Direct Relief to expand our capacity and efficiency. Having critical logistics thinking along with a background in public health gives me a unique set of skills to aid in any position I may have," says Jennifer Lemberger from Direct Relief International.

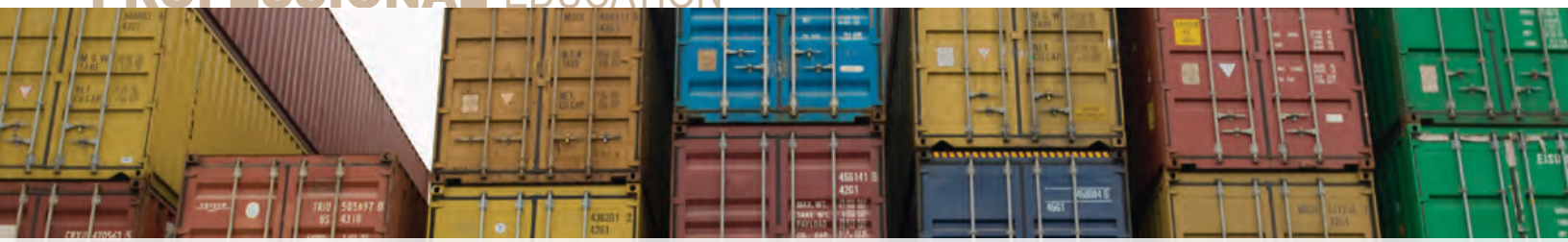
Noah Kafumbe, supply chain manager for International Trachoma Initiative, Inc., believes the new skills he acquired will enhance his capacity "to contribute to the program design and strategy development for an in-country health supply chain system."

Amy Patterson from The Carter Center expects to improve distribution systems and stock management systems for bed nets, malaria treatments, and mass drug administration of treatments for neglected tropical diseases, based on what she has learned from the course.

Scholarship support is made available through the generosity of The UPS Foundation, Andrea L. Laliberte, and Richard E. and Charlene O. Zalesky. For more information about the scholarships, visit **hhls.scl.gatech.edu**. To learn more about the program, visit **www.scl.gatech.edu/HHL**, or e-mail **hhlcourses@isye.gatech.edu**.



Participants who attended the first two courses lived and worked in the countries highlighted on this map.



Are Your Transportation and Distribution Strategies Ready to Cope with the **Global Changes in the Container Shipping Industry?**

SCL Course Addressed These Issues in Savannah

By Amar Ramudhin and Don Ratliff

Higher fuel costs, slow steaming, the increasing trend toward bigger and bigger ships, and the widening of the Panama Canal are some of the factors putting a lot of strain on the container shipping industry—to the point that the current liner services may not be sustainable. This will have a significant impact on shippers that rely on frequent and increasingly time-definite shipments. The big questions are how did the current condition of the industry come to be, and what can shippers do to prepare for the changes ahead?

A bit of history: The concept of using shipping containers is attributed to Malcom McLean, who got the idea in the 1950s while waiting for his truck to be unloaded onto a ship and thinking that there had to be a way to load ships in hours rather than days. This fundamental vision of speed and efficiency motivated the development of cellular ships, land-based container cranes and faster container ships, and enabled the revolution of global trade between Asia, North America, and Europe.

From 2002 to 2008, global trade grew at a roughly linear rate of about $1 trillion per year. Because most of the goods of this trade are transported on container ships, shipping lines were highly motivated to increase capacity in order to retain or increase their market share. They invested massively in bigger ships, given their greater capacity and cost-effectiveness in operating. Estimates of capacity increase vary from about 8 percent to as much as 30 percent on long hauls.

The economic recession caused global trade to decrease from more than $15 trillion in 2008 to less than $12 trillion in 2009. This 20 percent drop in trade meant that there was suddenly an excess in capacity, resulting in decreased revenue for shipping lines. Slow steaming was introduced as a means of reducing operating costs. Modern container ships are designed to run at top speeds of about 25 knots. Slow steaming meant reducing their speed to about 20 knots or lower. When speed is reduced, the amount of fuel consumed per mile is reduced; for example, a 20 percent decrease in speed results in about a 40 percent decrease in fuel consumption. Maersk Line, one of the pioneers of slow steaming, claims that in 2010, 73 percent of the Maersk Line fleet was slow steaming at engine loads below 40 percent, which saved around two million tons of CO_2.

While trade increased in 2010 and 2011, it remains well below what was expected before the 2009 drop. Slow steaming may have worked for the container lines in 2010 to offset much of the losses that they incurred in 2009; however, the $6 billion loss by the industry at the end of 2011 and the fact that the strategy is bad for the shippers are indications that this strategy is not sustainable. Slow steaming lengthens the trips, which means more in-transit inventory for the shipper. The result for more expensive products is that the increase in inventory cost is significantly greater. To make matters worse, many container shipping lines are adopting "super-slow steaming" at speeds of 12 knots or about 14 miles per hour. This more than doubles the in-transit inventory compared to running at 25 knots.

Today, about 60 percent of all containerized cargo from Asia enters the U.S. from the west coast. From there it travels mostly by rail to points east for further distribution. The

other 40 percent travels through the Panama Canal to east coast ports. This "all-water" route is cheaper to the east coast, but it takes four to six days longer, so shippers have more days of inventory in transit, thus higher inventory costs. With the widening of the Panama Canal in 2014, liners are betting on further reducing their operating cost by using bigger ships on this route. And ports all over the east coast are racing and spending large amounts of money to ensure that they are ready for the big ships.

So, how does Georgia Tech help address these shipping industry issues?

In October, Georgia Tech's Supply Chain & Logistics Institute (SCL) offered a professional education course on transportation and distribution at the Savannah campus. It gave participants an overview of the complexities of transportation and distribution planning and educated them as to why this has become a critical corporate function. The course focused on the basic components of a global transportation and distribution system and its operation in terms of capacity development, freight consolidation, network alignment, and synchronization. It developed the principles, practices, and tools required to address all major issues and tradeoffs in domestic and international transportation, including key financial and performance indicators for transportation and design of supply chains to minimize transportation and distribution costs.

As part of the course, participants heard from Executive Director of the Georgia Ports Authority Curtis Foltz. They also toured the Savannah Port, the Intermodal Container Transfer Facility within the Garden City Terminal, and the distribution facilities near port.

For more information on this course and others offered by SCL, visit: **www.scl.gatech.edu.**

Stay in touch! Drop us a line.

The Alumni News section highlights promotions, awards, scholarships, fellowships, and publication of books. Let us hear from you! It's a good way to stay in touch with your classmates.

Who: _____

What: _____

Where: _____

When: _____

Submitted by: _____

Degree: _____

Year: _____

Street Address: _____

City, State: _____

ZIP: _____

E-mail Address: _____

Send your news by e-mail to **communications@isye.gatech.edu** or by mail to:

Communications Department
Stewart School of Industrial & Systems Engineering
Georgia Institute of Technology
755 Ferst Drive
Atlanta, GA 30332-0205

Georgia Tech ISyE
H. Milton Stewart School of Industrial & Systems Engineering

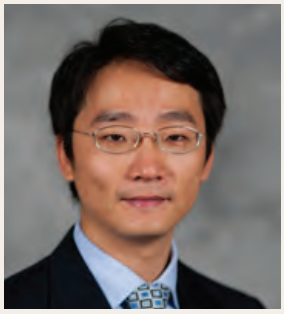
New Faculty Hires

Kamran Paynabar joined the faculty of ISyE as an assistant professor on July 15, 2012. Paynabar received his BSc and MSc in industrial engineering from Iran University of Science and Technology and Azad University in 2002 and 2004, respectively. He graduated in 2012 with a PhD in industrial and operations engineering from The University of Michigan. He also holds an MA in statistics from the University of Michigan.

Paynabar's research interests include data fusion for multi-stream waveform signals and functional data, engineering-driven statistical modeling, sensor selection in distributed sensing networks, probabilistic graphical models, and statistical learning with applications in manufacturing and healthcare systems.

Sebastian Pokutta joined ISyE on August 15, 2012 as an assistant professor. He received both his MS in 2003 and his PhD in 2005 in mathematics from the University of Duisburg-Essen in Germany. Subsequent to his graduate studies, he worked as a postdoctoral fellow at the Operations Research Center at the Massachusetts Institute of Technology (MIT) where the topic of his research was combinatorial optimization and cutting-plane procedures.

Pokutta's research concentrates on combinatorial optimization and polyhedral combinatorics, and, in particular, focuses on cutting-plane methods, extended formulations, and on applications of optimization methods in supply chain management, production planning, mechanical engineering, and especially finance. His research is motivated by exploring these limits of computation and by applications in various disciplines requiring the solution of non-standard, highly complex optimization problems. Examples of Pokutta's applied work include stowage optimization problems for inland vessels, oil production problems, clearing of electricity markets, portfolio optimization problems, and optimal liquidity management strategies.



Andy Sun joined ISyE as an assistant professor on August 15, 2012. Sun received his PhD in operations research from the Operations Research Center at MIT and a BS in electronic engineering from Tsinghua University. Before joining ISyE, Sun spent a year as a postdoctoral researcher at the IBM Thomas J. Watson Research Center.

Sun conducts research in optimization and stochastic modeling with applications in electric energy systems and electricity markets. He also works on theory and algorithms for robust and stochastic optimization, and large-scale convex optimization. Sun's doctoral thesis won second place in the George B. Dantzig Dissertation Award competition.

Chuck Zhang joined the faculty of ISyE as a tenured professor on August 15, 2012. Zhang received his PhD in industrial engineering from the University of Iowa. Prior to the doctoral degree, he received an MS degree in industrial engineering from the State University of New York at Buffalo. He also holds BS and MS degrees in mechanical engineering from Nanjing University of Aeronautics and Astronautics in China.

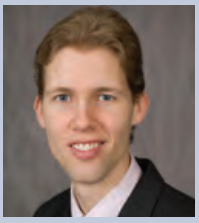
Zhang's research interests include scalable nanomanufacturing, modeling, simulation, and optimal design of advanced composite and nanomaterials manufacturing processes, multifunctional materials development, geometric dimensioning and tolerancing, and metrology. Most recently, he initiated new research and education programs in advanced materials and manufacturing engineering for orthotics and prosthetics applications.

2012 INFORMS HONORS & AWARDS

Phoenix, Arizona October 14-17

John Bartholdi, Manhattan Associates Chair of Supply Chain Management, along with **Don Eisenstein**, MS IE 1983, PhD IE 1992, were awarded the 2012 TSL Best Paper Prize for their paper, "A Self-Coordinating Bus Route to Avoid Bus Bunching."

Jim Dai, Edenfield Professor in ISyE, delivered the Markov Lecture, a prestigious honor bestowed by the Applied Probability Society of INFORMS.



Assistant Professor **Ton Dieker** won the prestigious Erlang Prize for his outstanding contributions to several areas, including the theory of stochastic processes, stochastic networks, and stochastic analysis of algorithms.

George Nemhauser, the A. Russell Chandler Chair in ISyE, along with his colleague **Laurence Wolsey**, professor at the Catholic University of Louvain, were named winners of the prestigious John von Neumann Theory prize.

PhD student **Rodolfo Carvajal** won the Energy, Natural Resources, and the Environment Best Paper Award in Environment and Sustainability Sponsored Sessions for his paper, "Imposing Connectivity Constraints in Forest Planning Models," co-authored by **M. Constantino**, **M. Goycoolea**, PhD IE 2006, **J.P. Vielma**, PhD IE 2009, and **A. Weintraub**.

PhD student **Kaibo Liu**, advised by Professor **Jianjun Shi**, won the 2012 INFORMS Data-Mining Section Best Student Paper Competition for his paper "Health Index Development Based on Sensory Data Fusion for Degradation Modeling and Prognostic Analysis."

PhD student **Diego Morán** won the 2012 INFORMS Optimization Society Student Paper Prize for his paper "A Strong Dual for Conic Mixed Integer Programs," co-authored with his advisor, Assistant Professor **Santanu Dey**, and **Juan Pablo Vielma**, PhD IE 2009.

Jon Petersen, PhD IE 2012, advised by Professor Emeritus **Ellis Johnson** and **John-Paul Clarke**, associate professor in the Daniel Guggenheim School of Aerospace Engineering with a courtesy appointment in ISyE, won the 2012 TSL Dissertation Prize for his thesis "Large-Scale Mixed Integer Optimization Approaches for Scheduling Airline Operations Under Irregularity."

PhD student **Matthew Plumlee**, advised by Associate Professor **Roshan Vengazhiyil** and Professor **Jianjun Shi**, won the Quality, Statistics, and Reliability Best Student Paper Competition for his paper "Tractable Functional Response Modeling using Nonstationary Covariance Functions."

PhD student **Luyi Gui** won an honorable mention in the SPPSN Best Paper Competition for her paper "Fair and Efficient Implementation of Collective Extended Producer Responsibility Legislation," co-authored by her advisor, ISyE Associate Professor **Ozlem Ergun**, and Assistant Professor **Atalay Atasu** and Professor **Beril Toktay** from the Georgia Tech College of Management.

Guided by faculty advisor **Donna C. Llewellyn**, ISyE Senior Design undergraduate students **Jacmara Katheryn Ching Sanchez**, **Santiago Diaz Kieffer**, **Antonio Elosua Cantu**, **Oscar Andres Harasic-Yaksic**, **Yonatan Dov Mintz**, and **Mario Solares Nassarwere** received honorable mention for the INFORMS Undergraduate Research Award for their project "Wind Turbine Offloading Optimization Strategy."

Professors **Sigrún Andradóttir** and **Paul Kvam** received the Class of 1934 Course Survey Teaching Effectiveness Award in March 2012 for their exceptional response rates and scores on the Course Instructor Opinion Survey.

Bill Cook, Chandler Family Chair, was elected the new chair of the Mathematical Optimization Society.

Jim Dai, Edenfield Professor, was appointed editor-in-chief of *Mathematics of Operations Research*, the international journal of the Institute for Operations Research and the Management Sciences.

Assistant Professor **Santanu Dey** received the prestigious National Science Foundation Career Award for his work on nontraditional cutting-plane algorithms for mixed integer programs.

Ozlem Ergun, associate professor and codirector for the Center for Health & Humanitarian Logistics, was elected the 2012 INFORMS vice president of Membership and Professional Recognition.

Jaymie Forrest, managing director of the Supply Chain & Logistics Institute (SCL), was selected as a finalist for the Supply Chain Professional of the Year Award, and was also selected by the *Supply & Demand Chain Executive* as one of the 2012 Practitioner Pros to Know.

Professor **Dave Goldsman** was named a fellow of the Institute of Industrial Engineers (IIE) in May 2012.

Associate Professors **Steve Hackman** and **Joel Sokol** took first place in the Innovations in Curriculum Competition at the 2012 IIE Honors and Awards Banquet for their "effective approach to integrated learning in capstone design."

FACULTY NEWS

Xiaoming Huo was promoted to the rank of professor in ISyE in August 2012.

Coca-Cola Chair and Professor **Ellis Johnson** retired from Georgia Tech on June 1, 2012 after a lifetime of teaching, research, and significant contributions to the fields of operations research, mathematical programming, and industrial engineering. Johnson now carries the honorary title of Professor Emeritus.

Pinar Keskinocak, Joseph C. Mello Professor, associate director of research for the Health Systems Institute, and codirector of the Center for Health & Humanitarian Logistics, has been serving on the Clinical Decision Support Expert Panel, the Immunization Information Systems support branch at the Centers for Disease Control and Prevention.

Associate Professor **Seong-Hee Kim** was named vice-president/president-elect of the INFORMS Simulation Society, where she will serve as vice-president for two years and then as president for two years.

Professor **Paul Kvam** was appointed the new associate chair for Graduate Studies in December 2011.

Leon McGinnis was named professor emeritus after retiring from Georgia Tech on December 31, 2011, after forty years of service. McGinnis was among those recognized by Boeing for multidisciplinary research at Georgia Tech.

Professor **R. Gary Parker** retired November 30, 2011 after forty years of dedicated service to Georgia Tech.

Donald Ratliff, executive director of SCL, participated in the panel "Creating a 21st Century Supply Chain" at the Center for Strategic and International Studies in Washington, DC on August 28, 2012. Ratliff also spoke at the 2012 DHL Public Policy Forum on July 10 in Washington, DC.

Ratliff and **Amar Ramudhin**, director of the Center for Supply Chain Management & Technology, coauthored a chapter in the World Economic Forum's 2012 Global Enabling Trade Report titled "Logistics Investment and Trade Growth: The Need for Better Analytics."

William B. "Bill" Rouse, professor and executive director of the Tennenbaum Institute for Enterprise Transformation, retired from Georgia Tech on August 15, 2012 after over thirty years of service.

Nicoleta Serban was promoted to the rank of associate professor with tenure in ISyE in August 2012.

Professor **Alex Shapiro** was named editor-in-chief of *Mathematical Programming*, the official journal of the Mathematical Optimization Society.

Julie Swann, Harold R. and Mary Anne Nash Associate Professor and codirector of The Center for Health & Humanitarian Logistics, was recognized as the College of Engineering's Georgia Power Professor of Excellence for 2012.

Valerie Thomas, Anderson Interface Associate Professor of Natural Systems, attended the 2012 Congressional Visits Day in Washington, DC in April where she met with members of Congress and their staff to champion federal support of science, technology, engineering, and mathematics (STEM) research.

Professor **Craig Tovey** was a plenary speaker at the 2012 International Workshop on Computational Social Choice in Krakow, Poland where he spoke on "Computational Methods for the Spatial Model of Social Choice." The field of computational social choice was principally inspired by several papers written by Tovey, **John Bartholdi**, and **Michael Trick**, MS IE 1984, MS PhD 1987.

Associate Professor **Roshan Vengazhiyil** was elected a fellow of the American Statistical Association for his significant and definitive contributions to engineering statistics, especially in design and modeling of experiments, and for dedicated service in the profession, as well as excellence in teaching and mentoring.

Ben Wang, who was named the Eugene C. Gwaltney Jr. Chair in Manufacturing Systems in the College of Engineering in January 2012, presented his ideas and viewpoints at the U.S. Department of Energy Roundtable "Strengthening Advanced U.S. Manufacturing in Clean Energy" on August 9, 2012.

Chip White, the Schneider National Chair in Transportation and Logistics, has been appointed a member of Georgia Tech's Center for International Business Education and Research (GT CIBER) Advisory Council. Administratively located within the Scheller College of Business, GT CIBER serves as a catalyst to integrate international business into the curriculum and works to ensure the long-term international competitiveness of the United States.

C.F. Jeff Wu, professor and Coca-Cola Chair in Engineering Statistics, gave the 2012 Deming Lecture, a prestigious honor from the American Statistical Association given to an individual who has made significant contributions in the field of statistics.

Associate Professor **Ming Yuan** was awarded the Coca-Cola Junior Professorship, which is given to outstanding faculty to support teaching and research efforts for a three-year term.

IN MEMORIAM

Retired Professor **Jerry Banks** passed away on September 25, 2012, surrounded by his family. Banks will be fondly remembered for his passion for knowledge and his ability to enrich the lives of tens of thousands of people from all over the world.

Retired Professor **Marakada "Mike" Chitharanjan Shetty** passed away on February 25, 2012 in Great Falls, Virginia. Shetty, who retired from ISyE after 25 years of service, was instrumental in attracting new faculty, many of whom are now senior faculty and considered him a mentor.

Clockwise from top left:

Bill George, IE 1964, Honorary PhD 2008, his wife Penny George, and Gayle Ober, all representing the George Family Foundation, visited ISyE to meet some of the current George Fellows. Over tea, there was a lively discussion on leadership and ways to improve healthcare. ISyE is grateful to the Georges for their continued support of the School and their extensive contributions in making this world a better place.

Lamar Stewart, IE 2006, is working as a comedic actor in Los Angeles, California. Check out a recent YouTube video for a retrospective of his work: **http://bit.ly/TWJWse.**

Susan Clemmons, IE 1969, was the first female at Georgia Tech to run for a student body officer position. "I always seem to be 'the first woman ever,' but there's nothing like the rewards of doing a job you really like."
- Susan R. Clemmons (1946-2003)

James Wade, IE 2010, finished a close second after competing in the U.S. Kayaking Olympic trials, which left him as the 2012 Olympic alternate. Wade is currently pursuing a PhD in BME at Georgia Tech.
PHOTO COURTESY OF BRETT HEYL.

1960s

Ronald Allen, IE 1964, was named president and CEO of Aaron's Inc. on February 22, 2012.

David L. Bailey, IE 1969, received the Academy of Distinguished Engineering Alumni Award at the 2012 College of Engineering Alumni Awards Induction Ceremony.

Bill George, IE 1964, Honorary PhD 2008, was elected to the National Academy of Engineering for his accomplishments in applying engineering principles in manufacturing to advance healthcare.

James M. McClelland, IE 1966, was awarded the 2012 Matthews Entrepreneurial Award from Goodwill Industries International. He is the president and CEO of Goodwill Industries of Central Indiana.

Bruce McEver, IE 1966, returned to Georgia Tech this past spring to teach a seminar in the School of History, Technology and Society titled, "Witness to a Changing Conscience: Writing and Personal Transformation."

Thomas "Thos" Muller Jr., IE 1963, received the Engineering Hall of Fame Alumni Award at the 2012 College of Engineering Alumni Awards Induction Ceremony.

Oscar N. Persons, IE 1960, was recognized as a 2012 Georgia Super Lawyer. He is of counsel with Burr & Forman.

Larry R. Westbrook, IE 1967, retired as founder, president, and CEO of PULS North America after 45 years in the power distribution, automation, and industrial control industry. He will remain with the company as executive chairman and coach.

1970s

Dwight Delgado, IE 1977, was named operations manager of PremaTech Advanced Ceramics in Worcester, Massachusetts, and will lead the company's production and new product and service development activities.

Guy Gober, IE 1975, retired from the U.S. Army National Guard in August 2011. His military career began in 1969 when he joined the First Army Signal Corps as a private. He was honorably discharged as a corporal in 1971, then re-enlisted as a captain in 1987 after pursuing undergraduate studies at Georgia Tech and the University of Georgia and receiving his medical degree from the Medical College of Georgia. He served as a medical officer and was mobilized five times during conflicts in Iraq and Afghanistan. His career decorations include the Iraq Campaign Medal with two campaign

stars and the Army Commendation Medal. He owns and operates Tiger Urology in Rabun County, Georgia.

G. Fred Milburn, IE 1979, retired from the U.S. Marine Corps as a colonel after thirty-one years of service, and accepted a position as the strategic plans director for Cyber Command in Fort Meade, Maryland. In addition, he became a cofounder of ESP Solutions, a business planning and execution consulting business, in November 2011.

1980s

Steve Hopper, IE 1986, and three experienced partners have cofounded StoneCross Group, LLC, a new supply chain management consulting firm headquartered in metro Atlanta. StoneCross Group's mission is to help companies of all sizes improve their bottom lines by streamlining operations and implementing solutions to boost the performance of the people, inventory, facilities, equipment, material handling systems, and supply chain IT systems. For more information, visit the StoneCross Group's website at **www.stonecrossgroup.com**.

1990s

Jason Brownlie, IE 1998, and his wife, Jennifer, welcomed son Jack Robert on January 26, 2012. Jack joins sister, Alexa, at their home in Roswell, Georgia. Brownlie is an account manager at Manhattan Associates.

Kathryn Folk, IE 1999, is the leader of The Band Alumni Affinity Group, which has grown under her leadership. As president, she has organized the group's presence at Homecoming and performances at Yellow Jackets basketball and volleyball games. Folk is also active in community service.

Bill Harber, IE 1990, was named vice president of corporate marketing for Miami-based Carnival Corporation & plc, the world's largest cruise vacation group. In this capacity, Harber is responsible for working across the company's ten cruise brands on marketing and profit improvement initiatives, as well as identifying guest source markets and operational models for growth.

Keith Hollingsworth, IE 1990, MS IE 1992, PhD IE 1995, president of the Co-op Affinity Group, has been a champion for the program, helping to honor past participants and raise scholarship funds. He helped organize the Co-op Alumni Centennial Award.

Errika Mallett, IE 1996, graduated as a member of the tenth anniversary class of the Diversity Leadership Academy, a program of the American Institute for Managing Diversity. She currently serves as president of the Georgia Tech Black Alumni Organization.

Bruce Marshall, IE 1991, owns the California bike shop A Road Bike 4U, which was named Best Bike Shop in the Best of Orange County Critic's Choice Awards.

Meredith Moore, IE 1998, received a Womenetics 2012 POW! Award, an award that recognizes Atlanta's twelve most innovative female leaders. Moore is a financial planner.

Jeff W. Rehberg, IE 1996, and **Melissa Mobley Rehberg**, IE 1996, welcomed daughter Emma Kate on March 19, 2012. She joins sister Isabella, 5, at home in Doraville, Georgia. Jeff and Melissa work for Children's Healthcare of Atlanta.

Darcy Delano Riley, IE 1999, and her husband, Chris, welcomed daughter Sydney Madelyn on November 27, 2011. They live in Houston, Texas.

Jud Savelle, IE 2002, MS IE 2005, and **Rachelle Scott**, IE 1996, were listed on the *Albany Herald*'s "40 Under 40" list.

Evan Toporek, IE 1993, is the CEO, partner, and member of the Board of Directors for Alternative Apparel, a leading lifestyle apparel brand that specializes in casual clothing for young men and women.

Tyler Townsend, IE 1998, received the Outstanding Young Alumni Award at the Georgia Tech Alumni Association's 2012 Gold & White Honors. Townsend is the vice president of Investments at Townsend Wealth Management.

Matthew Zenus, IE 1996, has joined SAP as a director of data warehousing and business intelligence technologies. He currently lives near Palo Alto, California, with his wife and daughter.

IN MEMORIAM

Terrance Edwards Anderson, IE 1965
Carl Bryce Arvidson, IE 1977
Ralph K. Baber, IE 1954
Thomas Wesley "Wes" Bailey, IE 1959
Charles Hunt Brown Jr., IE 1950, MS IE 1951
Oscar V. Bryan, IE 1968
Marvin F. Coffee, IE 1959
Thomas E. Costello, IE 1965
John Russell Davis, IE 1956
James Nicholas Day, IE 1949
Wade Hampton Dennis, IE 1947
Joseph Roy DePriest Jr., IE 1961
Jerald L. Deriso, IE 1969
Mark Anthony Donihe, IE 1986
Robert D. Fannon Jr., IE 1951
Bradley Robert "Brad" Gay, IE 2011
William "Bill" R. Gilliam, IE 1958
Howard Rutgers Grainger Jr., IE 1969
David B. Gray Sr., IE 1964
John Donald Hambrick, IE 1965
James E. Harwood III, IE 1958
Irwin "Win" M. Hecht, IE 1950
David R. Hendrix, IE 1960
A. F. Herchenhahn, IE 1955
William Callaway Henry, IE 1952
Walter Lee Hughey, IE 1961, MS IE 1968
Larry Buford Jones, IE 1958
Richard Kahler, IE 1970
David C. Katx, IE 1963, MS IE 1965

2000s

Terry Comer, IE 2004, received the Council of Outstanding Young Engineering Alumni Award at the 2012 College of Engineering Alumni Awards Induction Ceremony.

Kristin Goin, MS HS 2008, was selected as the Institute of Industrial Engineers' representative for the New Faces of Engineering 2012, and was featured in a *USA Today* ad during National Engineers Week, February 19-25. Goin is currently working with Shepherd Center as a senior improvement consultant on its Quality, Outcomes, and Patient Safety team.

Eric Goodwin, IE 2004, and **Katherine Boedecker Goodwin**, IE 2003, welcomed daughter Lillian Margaret on August 27, 2011. They live in Charlotte, North Carolina.

Preeth K. Gowdar, IE 2000, was selected to work with the United Nations to develop a publication on social enterprise and emerging market impact investing. He is a strategy consultant in New Jersey.

Holly Anne Hoenes MD, IE 2000, and Kevin Wayne Larrick were married December 10, 2011 in Morrow, Georgia. Hoenes completed her pediatric neurology training at Cincinnati Children's Hospital and is practicing in Forsyth, Georgia.

Ran Jin, PhD IE 2011, accepted a position as an assistant professor at the Grado Department of Industrial and Systems Engineering at Virginia Tech.

Erin (King) Kennedy, IE 2003, MS IE 2004, gave birth to a baby boy, James Franklin, on January 26, 2012. Kennedy resides in Prince Frederick, Maryland.

Matthew Oatts, IE 2010, and **Sarah Marriner**, BIO 2010, were married on April 30, 2012 in Atlanta and left their reception in the Ramblin' Wreck. Oatts said, "This memorable experience was made possible by a gift from my grandfather, **John 'Bucky' Oatts**, EE 1952, who even skipped out on part of our reception for a ride of his own!"

Kalpana Oommen, IE 2009, was promoted from information technology audit manager to advisory and assurance director at Cox Enterprises.

Sherri Ramson, IE 2011, and **Eric Ramson**, IE 2011, siblings from South Florida, recently graduated from ISyE, each returning for their undergraduate degrees after more than ten years in the workforce. Since graduation, Sherri has taken a position as a consultant with Clarkston Consulting, and Eric works as a software implementation consultant at Power Plan Consultants.

Will S. Randall II, IE 2005, was named an associate in the Corporate/ Commercial Group at the Edmonton, Alberta, Canada office of Davis LLP. Randall was called to the bars of Alberta and Texas, and his practice focuses on energy and natural resources law in western Canada.

Stephen Selfridge, IE 2001, MBA 2006, and **Jennifer Dykes Selfridge**, BIOL 2001, announced the birth of their son, Luke Jackson, on June 19, 2012. Luke joins his one-year-old sister, Kate, at the family's home in Huntersville, North Carolina. Stephen is a vice president of the Online and Mobile Channels team at Bank of America.

Chris Swenson, IE 2001, and **Kim Tate Swenson**, EE 2000, MS ECE 2002, welcomed daughter, Katelyn Ashley, on March 20, 2012. She joins them at home in Austell, Georgia. Chris is a project manager at AMDOCS.

Stephanie Bright Villano, IE 2002, and **Jason Villano**, MGT 2002, welcomed twins, Reece and Gabriella, on July 5, 2012. They join their brothers, Chase and Cole, at the family's home in Woodstock, Georgia. Stephanie is a part-time engineer with GDS Associates, Inc. and a full-time mother.

John Harty Keating, IE 1963
Don Dean King, ME 1951, IE 1951
H. William "Bill" Kruse, IE 1951
Cecil Morefield Lemon, IE 1950
Harlow E. Lichtwardt, IE 1954
Arthur Luedtke Jr., IE 1965, MS IE 1968
Charlie McLaughlin, IE 1948
Kenneth C. Melvin, IE 1949
George E. Mena, IE 1949
William Wesley Mills Jr., IE 1958
Sherry Ann Muhl, MS IE 1993
Bruns McKie Myers Jr., IE 1949
Robert Elsmere Odell Jr., IE 1951
John H. Olden Jr., IE 1947
Clement Francis Perschall Jr., IE 1969
Clifford Nicholas Roberds III, IE 1954
Donald L. Roberts, IE 1958
Edward Grady Rodgers, IE 1959, MS ISyE 1966
Julie Rodgers, IE 1987
Edward Allen Shiver, IE 1950
Robert A. "Bobby" Tillery Sr., IE 1972
William "Bill" Randall Walker, IE 1957
James L. Ward, IE 1965
Durward "Will" Wilson, IE 1950
Clinton S. Winter Jr., IE 1949
Freddie Haas Wood, Textiles 1952, IE 1953
Walter Andrew Wren, IE 1968

Mission Possible: High School Students Discover Industrial Engineering in ISyE's First Summer Program

The Stewart School of Industrial & Systems Engineering (ISyE) hosted the first annual Mission Possible, a STEM summer enrichment learning program, in June 2012. Twenty-four rising tenth to twelfth grade high schoolers, from schools across the country, participated in the weeklong program where they were introduced to the exciting field of industrial engineering.

ISyE School Chair Jane Ammons and College of Engineering Dean Gary May kicked off the program with an official welcome. Throughout the week, students interacted with industry representatives from companies such as Coca-Cola, Procter & Gamble, and Caterpillar Inc., and gained insight from ISyE students, faculty, and academic advisors.

"We had an exceptional and diverse group of students who were highly motivated and engaged in the daily activities presented to them throughout the week," said Valarie DuRant-Modeste, academic advising manager in ISyE and program director for Mission Possible. "Each student had a strong thirst for knowledge and desire for excellence, and left with an understanding of the vital role industrial engineers play globally."

For more information on the program, contact Valarie DuRant-Modeste at **vrd@isye.gatech.edu**. If you would like to help sponsor this program, contact Nancy Sandlin, ISyE director of Development, at **nsandlin@isye.gatech.edu**.

The Scholarship Advantage

"The key is to be persistent in applying for scholarships. Never give up if you don't receive one because there will always be other opportunities. These scholarships have given me the incredible opportunity to pursue my degree."
- Breona Jenkins

On track to graduate in the fall of 2013, Breona Jenkins is the recipient of the Jack C. Webb Scholarship, Women in Engineering Scholarship, and the Atlanta Gas Light Scholarship. In addition to her high honors, Jenkins holds several leadership and extracurricular positions such as Tau Beta initiate, FASET leader, Kids@Kollege committee chair, peer advisor for the Office of International Education, Team BUZZ project coordinator, and member of the Mentor and Mentee Program with Women in Engineering. Jenkins urges students to persevere in seeking scholarship opportunities.

Leadership Advice

"Honing your leadership skills, in any capacity, is key to understanding teamwork and problem-solving. My advice for someone thinking of running for a leadership position is to take initiative, and make sure you love what you do."
- Eran Mordel

Eran Mordel is the undergraduate student body president for the 2012-2013 school year. Outside of Student Government, he is involved in GT Ambassadors, GT Hillel (Jewish Student Union), the Society of Professional Hispanic Engineers, GT Water Polo, Omicron Delta Kappa, and Alpha Pi Mu. Drawing from his experiences, Mordel shares his advice for students interested in pursuing leadership opportunities.

Research Inspiration

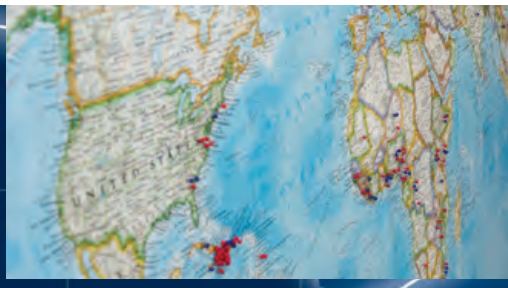
"Undergraduate research gives you a chance to make an impression and show your abilities. It brings you closer to real-world challenges and teaches you that no matter how hard a problem may be, there is always something that can be done."
- Jose Sarmiento

Jose Sarmiento chose Georgia Tech because he believed it would provide him with the momentum to achieve his goal of making a difference in the world. Sarmiento is a member of the Institute of Industrial Engineers, Alpha Pi Mu, and serves on the College of Engineering Undergraduate Advisory Council. Since coming to Georgia Tech, he has become involved in undergraduate research and encourages other students to explore these opportunities.

To hear more from these students, view their Student Spotlight videos featured on ISyE's Facebook page located at:
www.facebook.com/georgiatechisye/videos

Georgia Tech ISyE
H. Milton Stewart School of Industrial & Systems Engineering

Communications Department
Georgia Institute of Technology
755 Ferst Drive
Atlanta, GA 30332-0205



DYNAMIC

INNOVATIVE

INSPIRED

PROGRESSIVE

LOGICAL

CREATIVE

PRODUCTIVE