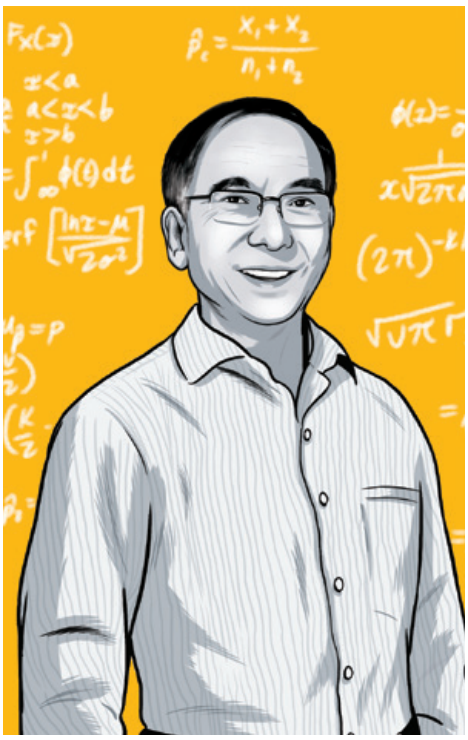
GEORGIA INSTITUTE OF TECHNOLOGY

INDUSTRIAL AND SYSTEMS ENGINEERING

FALL 2020

THE H. MILTON STEWART SCHOOL ALUMNI MAGAZINE



ISYE: LEADING THE WAY

75 Years of Industrial Engineering at Georgia Tech

Meet Some of Our Past, Present, and Future Leaders

ISyE Responds to Covid-19

On behalf of the entire team at the H. Milton Stewart School of Industrial and Systems Engineering (ISyE), I am proud to share the latest edition of the ISyE alumni magazine with you.

2020 was a monumental year for us. We celebrated many milestones, including 26 and 30 years at No. 1 for our undergraduate and graduate programs, in addition to the 75th anniversary of becoming an established department at Georgia Tech. We have grown to become the largest program of our kind in the world and continue to attract the best and brightest students and faculty to ISyE.

From the beginning, tremendous vision and leadership — at both the School and Institute levels — has led ISyE to where it is today. This edition of the magazine offers a brief history, highlighting just a few of the people and events that helped position us at the top of our field. You will also read about current students, alumni, faculty, and staff who continue to innovate and lead the way in their respective disciplines.

While 2020 was an exciting year of achievement for the Stewart School, like the rest of the world, we also have been significantly impacted by the Covid-19 pandemic in ways never before seen in this lifetime. In March, as an Institute, we moved operations and classes online in a matter of weeks to keep everyone safe and finish the spring semester.

Members of our community pivoted immediately to help fight the pandemic. Faculty optimized supply chains for personal protective equipment, created data-driven forecasting tools to help leaders make decisions about reopening the economy, and assisted the Institute in its plans to reopen for the fall semester. Students examined and improved supply chains to get scrubs and masks to essential workers on the front lines, and one alumnus even retooled his business to produce innovative, breathable, and highly protective face coverings for people in need.

Much work remains to be done, and I know we will continue to use our expertise to address this challenging situation. While I have always been proud to helm this incredible group of people, the way everyone has responded to this situation has exceeded my expectations.

As always, alumni involvement is a key component to our success, and we have many opportunities available for you to get involved with the School and our students, including Senior Design projects, job recruiting, and mentoring. If you are interested in any of these options, please let us know. I hope you enjoy this year's edition of the ISyE alumni magazine.

Take care and be well.

Edwin

H. Edwin Romeijn, Ph.D.

H. Milton and Carolyn J. Stewart
School Chair and Professor

H. Milton Stewart School of Industrial
and Systems Engineering

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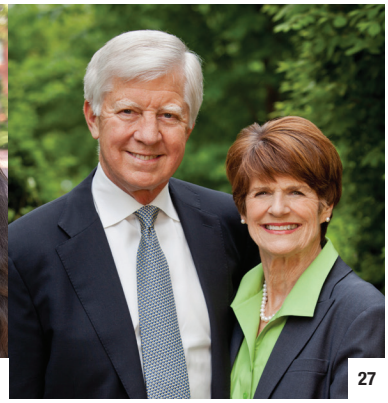
8 ISyE: Leading the Way

13



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ISYE NEWS AND ADDITIONAL FEATURES

ISyE by the numbers

Rankings

ISyE is the No. 1 program of its kind, as ranked by *U.S. News & World Report.*

30 Number of consecutive years the ISyE graduate program has been ranked No. 1

26 Number of consecutive years the ISyE undergraduate program has been ranked No. 1

Degrees Offered

1 B.S. in IE Degree

WITH 7 CONCENTRATIONS IN:

- Advanced Studies in Operations Research and Statistics
- Analytics and Data Science
- Economic and Financial Systems
- General Industrial Engineering
- Operations Research
- Quality and Statistics
- Supply Chain Engineering

8 Master's Degrees

SPECIALTY MASTER'S DEGREES:

- Master of Science in Analytics
- Master of Science in Health Systems
- Master of Science in Quantitative and Computational Finance
- Master of Science in Supply Chain Engineering

GENERAL MASTER'S DEGREES:

- Master of Science in Computational Science and Engineering
- Master of Science in Industrial Engineering
- Master of Science in Operations Research
- Master of Science in Statistics

ONLINE MASTER'S DEGREE:

- Online Master of Science in Analytics*

**Same degree as on-campus program*

6 Doctorate Degrees

- Industrial Engineering with specializations in:
  - Economic Decision Analysis
  - Statistics
  - Supply Chain Engineering
  - System Informatics and Control
- Algorithms, Combinatorics, and Optimization
- Bioinformatics
- Computational Science and Engineering
- Machine Learning
- Operations Research

Fall 2020

Enrollment

Undergraduates: **1,352***

Master's: **257** on-campus

4,246 online/video

Doctoral: **194**

**Includes co-op and study abroad students*

Faculty

60 tenured/tenure-track faculty

5 academic professionals

5 research faculty

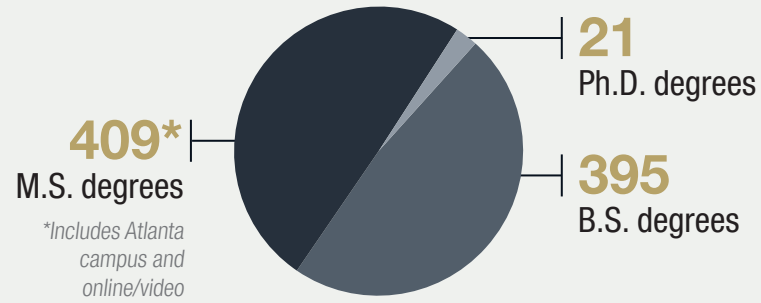
1 professor of the practice

4 lecturers

Academic Year 2019-20

825

ISyE Degrees Awarded



For undergraduates:

- **47** participated in undergraduate research
- **191** participated in an internship
- **178** participated in a co-op
- **14** participated in the Denning Technology & Management Program
- **17** were Stamps President Scholars
- **173** participated in study abroad

Of the 395 B.S. IE degree recipients in 2019-20:

- **74%** graduated with honors
- **19%** graduated with a co-op designation
- **50%** were female
- **$72,050** was the median starting salary

Introducing STEM and Industrial Engineering to the Next Generation

The H. Milton Stewart School of Industrial and Systems Engineering (ISyE) is dedicated to inspiring the next generation of industrial engineers, by providing K-12 students with opportunities to explore STEM fields by solving real-world problems. Young students have a natural curiosity about how the world works, and in response, ISyE's K-12 outreach program seeks to promote critical thinking and confidence in this age group. Further, ISyE is committed to promoting STEM education for students in underrepresented groups, including those in minority demographics or who have disabilities.

Tuba Ketenci is an academic professional who develops K-12 outreach programs for ISyE. She facilitates programs that connect ISyE faculty with teachers and students, and develops teacher workshops that show them how to incorporate industrial engineering principles into their curriculum. She is especially focused on eliminating obstacles that students in underrepresented demographics — such as students with disabilities or who are BIPOC or female-identifying — may face in STEM education.

Globally, female students tend to go into STEM-related professions significantly less than do their male peers. And in general, "studies show that only 16% of all American high school seniors are interested in STEM careers," Ketenci noted. "This is because they don't feel confident in their STEM abilities, so it is our responsibility to assure them that they are capable."

Another goal for Ketenci is to show that everyone deserves a place in STEM studies and careers, and that Georgia Tech's and ISyE's doors are open to all.

"Systemic racism and the cultural perception of a 'typical' STEM student discourage many minority students from even trying computer programming or engineering," she said.

For that reason, ISyE is committed to recruiting at least half the participants from underrepresented populations for its outreach activities, such as the Seth Bonder Camp in Computational and Data Science for Engineering led by ISyE A. Russell Chandler III Chair and Professor Pascal Van Hentenryck. *[Learn more about the camp on the next page.]*

"After the Seth Bonder Camp, students regularly tell us that learning how to code wasn't as difficult as they thought it would be, and that it is something that they could do," said Ketenci.

The K-12 outreach program tries to connect with students in multiple ways. ISyE faculty have visited grade and secondary schools, and the academic office has invited students to Georgia Tech for camps and presentations. The experience of visiting campus, attending a class, and having lunch with an ISyE professor allows students to see what ISyE is all about.

The Covid-19 pandemic has introduced new challenges to this K-12 outreach. "Teachers are trying to teach online effectively, and their students are at home. It's a very complicated environment for them," Ketenci said. The presence of family members, the absence of an adequate Wi-Fi connection, or the lack of necessary technology all create a difficult space in which to learn. During this time, engaging students with engineering pathways is more important than ever. These new obstacles bring about creative solutions, something at which Ketenci excels.

As classroom instruction moved online, ISyE's outreach events also used online environments. Ketenci brought together a group that includes ISyE faculty members, graduate and undergraduate students, and professional industrial engineers. They are organizing online sessions demonstrating how ISyE has everyday applications and can be incorporated into various K-12 curricula through lessons in health, computer science, and even AP statistics. Such lessons enable students to see themselves in a variety of STEM-related professions, regardless of their race, gender, or physical ability.

"To see even one student — especially if they're from an underserved population — realize their potential as an engineer makes me more determined to find ways to bring these opportunities to as many students as possible," Ketenci concluded. ▪ TAYLOR HUNTER

Participants in the 2019 Seth Bonder Camp get hands-on experience in the ISyE computer lab.

The Seth Bonder Camp Goes Online

The Seth Bonder Camp in Computational and Data Science for Engineering is designed, as the name suggests, to introduce high school students to data science and computer programming, and their applications in social sciences, biology, medical diagnosis, and industrial and systems engineering.

Pascal Van Hentenryck, A. Russell Chandler III Chair and professor in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE), leads participants in four days of learning and exposure to industrial engineering, all while socializing with one another. Van Hentenryck's goal is to engage students who don't typically have the experience and opportunities to engage with STEM fields and to give them the confidence to continue developing their skills.

To facilitate this, Van Hentenryck teaches Snap!, an entirely visual computer programming language. What discourages many people from learning how to program is frustration from failing to code. Snap! gets rid of the need for syntax and uses animation to show the effects of code. It is very easy to learn the basics of thinking like a computer. "The fact that Snap! is visual means that you can't make simple mistakes," Van Hentenryck said. "The focus is on the logic and then developing cool, small-scale applications in the targeted domains."

A solid foundation in computer programming can set up students for successful academic and professional futures in many disciplines. Targeting beginners and reassuring them that they can overcome their lack of confidence and knowledge about computer science is the camp's main goal. Van Hentenryck said, "The biggest takeaway for the campers is that they can learn these tough concepts, and they can do it in a week." Similar to learning a foreign language, exposing kids early on to computer science promotes lifelong understanding and helps with critical thinking skills.

The camp typically uses a face-to-face format during the summer, but given the Covid-19 outbreak, the 2020 camp looked a little different. The entire camp took place online, so Van Hentenryck worked hard to maintain students' interactivity and communication with one another.

"You lose this unique contact with the students, and previously you would build relationships, so it was hard," Van Hentenryck noted. "Moving the camp online required a combination of making sure the material was delivered with high-quality videos while also building contact, interactions, and face-to-face time with the students."

Fortunately, the experience gave Van Hentenryck many ideas for future iterations of the camp, including smaller group interactions and using (even) more entertaining videos.

"We eventually want to expand the camp into two groups: an advanced level and a beginner level," Van Hentenryck said. He also wants to visit Atlanta high schools to show teachers how to use programming and data science principles in their classrooms. Such initiatives hopefully will prompt more students to pursue industrial engineering. The Seth Bonder Summer Camp could be setting up the next generation of Georgia Tech Yellow Jackets. ▪ TAYLOR HUNTER

To learn more about the Seth Bonder Camp in Computational and Data Science for Engineering, visit ***sethbondercamp.isye.gatech.edu****.*

Partnership Between SCL and the Department of Juvenile Justice Leads to Success

At a ceremony on Nov. 13, 2019, seven teens with the Georgia Department of Juvenile Justice (DJJ) received certificates for completing Georgia Tech's Logistics Education And Pathways (LEAP) program. The LEAP program gives participants the foundation for a brighter future.

"It's about workforce development," said LEAP Program Manager and Instructor Chuck Easley. "And with this certificate these young people have something in front of them that says, 'I've done this training, I've invested this, people are investing in me, and now I have a chance to do something different from what I may have been doing that caused me to be here in the first place.'"

This version of the LEAP program was the result of a partnership between the Georgia Tech Supply Chain and Logistics Institute (SCL) and DJJ to help students further their education and find employment. As of April 2020, 11 of 13 DJJ participants had graduated from the program and nine had found jobs, making the program a great success.

> "And with this certificate these young people have something in front of them that says, 'I've done this training, I've invested this, people are investing in me.'"
>
> CHUCK EASLEY

Participants received certificates of completion at the LEAP certification ceremony at Georgia Tech's Savannah campus.

"From the start, we have seen very active involvement and engagement from every level within DJJ, from the leadership to the instructors to the students," said Carole Bennett, director of the LEAP program. "Everyone has been very committed to completing the program and making sure that everything that needed to happen did, which is what made this cohort so successful."

The certification ceremony in November took place at Georgia Tech's Savannah campus. Attendees included state officials and DJJ leadership in addition to representatives from partnering organizations and neighboring school systems. The spring graduation ceremony was cancelled due to the Covid-19 pandemic.

LEAP was originally created by SCL in 2015 for 16- to 24-year-olds and veterans in Metro Atlanta. It was made possible by a grant from JPMorgan Chase & Co. to promote workforce development and to "bridge the gap between the talent employers need and the qualifications of the local talent pipeline." LEAP consists of eight stand-alone online courses in supply chain and logistics. The program also offers warehouse and campus tours, online supply chain gaming simulations, lectures, career advising, and career fair opportunities. Students earn continuing education units on an official Georgia Tech Professional Education transcript. The program has graduated more than 702 participants since its inception. ▪ LAURIE HAIGH

To learn more about SCL's LEAP program, visit ***scl.gatech.edu/LEAP****.*

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For more details or to register, visit **scl.gatech.edu/fundamentals**.

Georgia Tech Supply Chain and Logistics Institute

ISYE: LEADING THE WAY

The students, faculty, alumni, and staff composing the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) are pioneers — and have been since the department's humble beginning in 1945. The stories that follow highlight a few of the individuals who paved the School's path to No. 1, in addition to our current and future leaders. From developing models to help slow the spread of a global pandemic to using augmented and virtual reality to enhance user experiences, we continue to lead the way.

Colonel Frank Groseclose (left) and faculty member Bob Eskew in 1951

75 Years of Industrial Engineering at Georgia Tech: A Brief History

For decades, ISyE has led the way as the largest industrial engineering program in the world, with its undergraduate and graduate programs ranked No. 1 in the U.S. for 26 and 30 years, respectively. ISyE's rise to the top parallels Georgia Tech's own ascent to become one of the nation's top public institutions, with the largest and most diverse college of engineering in the country.

The Institute began as the Georgia School of Technology in 1888 with 84 students enrolled in the only major offered: mechanical engineering. An "industrial option" was added to the curriculum in 1924.

In 1945, the Department of Industrial Engineering was created, and Colonel Frank Groseclose — known as the "father of industrial engineering" at Georgia Tech — served as the department's first director and professor. Fifteen students — all white men — took Tech's first official industrial engineering (IE) class. In 1947 a master's program was created, and the department was elevated to the School of Industrial Engineering in 1948.

In 1952, Georgia Tech opened its doors to female students, and Elizabeth Herndon and Diane Michel — both IE majors — were the first two women to enroll. Four years later, Michel became the first woman to complete her degree from start to finish at the Institute and graduate.

Georgia Tech was also one of the few universities in the South to desegregate without a court order, and in 1961 the first Black students enrolled. The first Black industrial engineer, William Johnson, graduated in 1970.

A STRONG FOUNDATION

Georgia Tech's School of Industrial Engineering quickly grew in prominence. Although there were no national rankings during Groseclose's time, Tech's undergraduate program was recognized as one of the best. "The industrial engineering program under the Colonel was a place where there were high expectations. That was true for all Georgia Tech," recalled ISyE Professor Emeritus Leon McGinnis in the 2005 issue of *Engineering Enterprise*.

When Groseclose left the School in 1965, Professor Robert Lehrer, who had previously served as associate director and helped establish the graduate program, assumed the role of school chair and began to modernize the curriculum to reflect IE applications that expanded beyond a factory setting. In 1969, the word "systems" was added to the School's official name to further emphasize this.

At the same time, the Institute's reputation was growing. When Joseph Pettit became president of Georgia Tech in 1972, he began a campaign to elevate Georgia Tech to a top-tier

Top: In 1946, Colonel Frank Groseclose became the first director of the department of industrial engineering at Georgia Tech.
Above: Diane Michel, the first woman to complete her degree from start to finish at Tech, graduates with a degree in industrial engineering in 1956.

1924 — INDUSTRIAL ENGINEERING FIRST APPEARS AS THE "INDUSTRIAL OPTION" IN THE MECHANICAL ENGINEERING CURRICULUM

1945 — THE DEPARTMENT OF INDUSTRIAL ENGINEERING IS CREATED

1947 — GRADUATE PROGRAM IS CREATED (M.S. IE)

1948 — THE DEPARTMENT IS ELEVATED TO THE SCHOOL OF INDUSTRIAL ENGINEERING

Georgia Tech President Wayne Clough (left) with Carolyn and Milt Stewart at the announcement reception of the school's naming in 2006

Professor Emeritus Augustine Esogbue

research institution with an emphasis on doctoral education. To help execute Pettit's vision, Lehrer hired mathematically and quantitatively oriented faculty members, many of whom had research backgrounds, while continuing to deliver quality education to students. During this time, Georgia Tech and ISyE saw another first: Augustine Esogbue, an expert in fuzzy sets and neural networks, arrived at the Institute and became the first Black faculty member to receive tenure and be promoted to full professor.

In 1978, Michael Thomas, who had previously chaired the IE department at the University of Florida, followed Lehrer and became ISyE's third school chair. To enhance ISyE's research portfolio, Thomas continued to recruit key faculty in both traditional IE and operations research (OR) fields from well-respected research institutions. Many of these hires became leaders in their fields and spent the majority of their careers at ISyE.

To assist in hiring top research faculty for the Institute, Tech began its first capital campaign to create an endowment that would support research opportunities. In 1985, A. Russell Chandler III (IE 1967) — a successful IE alumnus — funded the A. Russell Chandler III Chair in ISyE, the first endowed chair for both the School and Georgia Tech. Thomas recruited renowned OR expert George Nemhauser as the first faculty member to come to Tech as part of the capital campaign. Just a year later, Nemhauser was the first sitting faculty member at Georgia Tech elected to the National Academy of Engineering (NAE), one of the highest distinctions accorded an engineer. Nemhauser, who continues to be a world leader in his field, still holds his endowed chair at ISyE 35 years later. (Nemhauser will be retiring from ISyE at the end of the 2020 calendar year.)

According to ISyE Professor Emeritus R. Gary Parker, who served as a faculty member from 1972 until his retirement in 2011, Thomas "created a culture that valued deep and fundamental research and its application in important practical domains. Theoreticians were respected, as were real-world problem-solvers. That got noticed and began to further set the School apart."

Increasing the size and quality of the School's graduate program was necessary to support the Institute's expanded research focus. Nemhauser, along with a core of like-minded faculty, revamped ISyE's doctoral curriculum and recruiting strategy, making it one of the best in its class. In addition to the robust curriculum, the unmatched quality of ISyE's faculty helped attract top Ph.D. students, which further strengthened the program.

"Mike was able to pursue and achieve excellence by identifying and hiring faculty, both young and senior, who were among the best in the field," said Nemhauser. "He

1952 THE FIRST TWO FEMALE STUDENTS ENROLL AT GEORGIA TECH AS INDUSTRIAL ENGINEERING MAJORS

1958 PH.D. PROGRAM IS CREATED

1972 AUGUSTINE ESOGBUE BECOMES THE SCHOOL'S FIRST BLACK FACULTY MEMBER

1974 SENIOR DESIGN IS ADDED TO THE UNDERGRADUATE CURRICULUM

1982 JANE AMMONS BECOMES THE SCHOOL'S FIRST FEMALE FACULTY MEMBER

changed ISyE at the graduate/research level from pedestrian to among the top to the very top. While now all engineering schools at Tech are in the top 10, ISyE led the way."

In 1989, Thomas left his position at ISyE to serve Georgia Tech at the Institute level, and Professor John Jarvis stepped into the role of school chair.

ISYE BECOMES NO. 1

The graduate program continued to grow in size and quality, propelling it in 1990 to become the No. 1 graduate program of its kind as ranked by *U.S. News & World Report*. Five years later, the undergraduate program was also ranked No. 1 for the first time. Both programs have maintained their top rankings ever since.

Jarvis continued to seek out the best students and faculty, and pursued funding opportunities to support both. During Jarvis' tenure as school chair, 1989-2001, the School raised more than $25 million as part of The Campaign for Georgia Tech. This generous support from prominent alumni was an instrumental component in ISyE's continued success by funding additional professorships and chairs, cutting-edge programs, fellowships, and scholarships.

In addition to Chandler, H. Milton Stewart Jr. (IE 1961) and his wife Carolyn (Honorary Alumna 2008) have been two of the school's biggest supporters. In 1999, the Stewarts endowed the H. Milton and Carolyn J. Stewart School Chair in ISyE, which allowed the School to attract leaders that would continue its momentum. It was also the first endowed school chair position at Georgia Tech, and was initially held by Jarvis; he stepped down in 2001 after 12 years in the role. The school chairs that succeeded Jarvis have continued the school's upward trajectory. They include William Rouse (2001-04); Chelsea "Chip" White III (2005-10); Jane Ammons (2011-14), ISyE's first female Ph.D. graduate in 1982 and the first female school chair in the College of Engineering; and current H. Milton and Carolyn J. Stewart School Chair Edwin Romeijn (2015-present).

"Quality attracts quality," noted Parker. "The school chairs have understood what keeps ISyE at No. 1. They continue to attract top faculty who understand our science and respect the relevance of its application and work hard to attract top doctoral students — the ones a first-rate faculty demands."

In 2006, the Stewart family made an even bigger contribution and endowed the School as the H. Milton Stewart School of Industrial and Systems Engineering.

CONTINUING SUCCESS

ISyE's unmatched size allows for strong groups in both traditional IE research and in new interdisciplinary research initiatives such as analytics and machine learning; energy and sustainable systems; and health and humanitarian systems. This breadth provides both students and faculty with a unique, rich environment in which to conduct cutting-edge research.

Similarly, the Institute is now one of the leading research universities in the U.S., with more than 25,000 undergraduate and graduate students, six colleges, and 28 schools. Its College of Engineering is ranked No. 4 in *U.S. News & World Report*'s

ISYE SCHOOL CHAIRS

Frank Groseclose
(1946-65)

Robert Lehrer
(1966-77)

Michael Thomas
(1978-89)

John Jarvis
(1989-2001)

William Rouse
(2001-04)

Chelsea "Chip" White III
(2005-10)

Jane Ammons
(2011-14)

Edwin Romeijn
(2015-present)

Jane Ammons, ISyE's first female Ph.D. graduate, first female faculty member, and first female school chair in the College of Engineering

1984 THE ISYE ADVISORY BOARD IS CREATED

1985 ISYE ESTABLISHES ITS FIRST ENDOWED CHAIR, THE A. RUSSELL CHANDLER III CHAIR, AND RECRUITS GEORGE NEMHAUSER

1986 GEORGE NEMHAUSER IS THE FIRST SITTING FACULTY MEMBER AT GEORGIA TECH ELECTED TO THE NAE

1990 ISYE'S GRADUATE PROGRAM IS RANKED NO. 1 BY *U.S. NEWS & WORLD REPORT*

1995 ISYE'S UNDERGRADUATE PROGRAM IS RANKED NO. 1 BY *U.S. NEWS & WORLD REPORT*

George Nemhauser carries the ceremonial mace at the Fall 2015 Commencement for Ph.D. and master's graduates. The mace, with its three brass rods, symbolizes Georgia Tech's mission and its three primary components: education, research, and service.

Best Undergraduate Engineering Programs, and all its graduate programs are ranked in the top 10.

In February 2020, Georgia Tech received approval from the University System of Georgia and the Board of Regents to move forward with construction plans for ISyE's new home in Technology Square. George Tower, named in honor of longtime ISyE supporters William "Bill" (IE 1964, Honorary Ph.D. 2008) and Penny George, will provide ISyE students, faculty, and staff with a newly designed space for research and instruction. George Tower will bring ISyE into the vibrant ecosystem of Tech Square along with innovative startups, the global headquarters for many businesses, and the Scheller College of Business. *[To learn more about George Tower, read the article on page 27.]*

"Our rise to the top was the result of the hard work and dedication of the School's faculty and alumni throughout the years who were able to execute their vision for what Georgia Tech and ISyE could become," said H. Milton and Carolyn J. Stewart School Chair Edwin Romeijn. "We are working hard to continue this legacy of excellence and provide our community with the resources necessary to stay at the top of our field."

The program that began with just 15 students now has more than 1,300 undergraduate and 4,000 graduate students, and one in 10 graduates will rise to the top position in their organization. What exactly the future holds for ISyE is unknown, but one thing is certain — the Stewart School will continue to lead the way. ▪ LAURIE HAIGH

THE EVOLUTION OF THE SUPPLY CHAIN AND LOGISTICS INSTITUTE

In 1992, The Logistics Institute was formed by merging three ISyE-sponsored organizations — the Production and Distribution Research Center, the Computational Optimization Center, and the Material Handling Research Center — along with the School's executive education program. The Logistics Institute allowed ISyE's many faculty members specializing in supply chain engineering and logistics to connect with businesses around the globe, which included research centers in Singapore and Panama. In 2006, The Logistics Institute was renamed the Georgia Tech Supply Chain and Logistics Institute, which is now an Interdisciplinary Research Center at Georgia Tech and the largest supply chain and logistics leadership institute in the world.

1999 — H. MILTON STEWART JR. AND CAROLYN J. STEWART ESTABLISH GEORGIA TECH'S FIRST ENDOWED SCHOOL CHAIR, THE H. MILTON AND CAROLYN J. STEWART SCHOOL CHAIR

2006 — THE SCHOOL BECOMES ENDOWED AS THE H. MILTON STEWART SCHOOL OF INDUSTRIAL AND SYSTEMS ENGINEERING

2011 — JANE AMMONS BECOMES THE FIRST FEMALE SCHOOL CHAIR IN THE COLLEGE OF ENGINEERING

2020 — GEORGIA TECH RECEIVES APPROVAL TO BUILD GEORGE TOWER, ISYE'S FUTURE LOCATION IN TECHNOLOGY SQUARE

Student Leaders

Nearly one in 10 graduates of the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) will rise to the top position in their respective organization, and it's no surprise that many students start at the campus level. Here we highlight five ISyE students and recent alumni who became leaders during their time at Georgia Tech and made an impact on the individuals they served.

SAMANTHA GUADA // IE 2020
Society of Hispanic Professional Engineers

"As a first-year, I looked up to the president, and I just knew I would be in that position one day. As president, I wanted to have a similar impact."

Originally from Venezuela, Guada and her family emigrated to Panama to avoid the economic challenges and political strife taking place in her home country. As an international student at Georgia Tech, Guada found an extensive support system through the Society of Hispanic Professional Engineers (SHPE), which aims to empower Hispanics in STEM fields. She immediately began applying for leadership positions. By her second semester, Guada was planning the group's events and overseeing the mentorship program. Older members encouraged her to keep leading, which culminated in her becoming SHPE president her final year at the Institute. Guada graduated in May 2020 and moved to Seattle, Washington, to work for Microsoft as a program manager. She plans on remaining involved in SHPE on a larger scale so she can continue to give back to others.

ILESH JAIN // IE 2020
Student Alumni Association

"Everything on campus is influenced by alumni in one way or another, and they make a big contribution to the students. It's very empowering for me to potentially make an impact on a large portion of the student population, both undergrad and grad."

With over 6,000 members, Georgia Tech's Student Alumni Association (SAA) is the Institute's largest organization and connects current students with Tech alumni to foster personal and professional growth. Jain served as SAA president during the 2019-20 school year. He came to Georgia Tech on an alumni-funded scholarship, so the importance of alumni giving back to students stuck with him. His journey to the presidency was natural, beginning when he joined the organization the fourth week of his first semester. One of Jain's goals as president was to better understand what students wanted from SAA and to provide related programming and events. This past spring, he graduated from the Institute and plans on being an active alumnus. Jain will start as a full-time consultant for the Boston Consulting Group in January 2021.

POOJA JUVEKAR // SGA President

"For me, being a leader has always been about being open-minded, ambitious, and putting other people first. I've learned that as a leader, it's important to listen more than you talk, have empathy, and that it matters how you choose to both uplift the people around you and how you execute on tasks and initiatives."

Pooja Juvekar's FreShGA experience began her love for the Student Government Association (SGA). From there, Juvekar became freshman and then sophomore representative in the Undergraduate House of Representatives and, eventually, vice president of internal affairs. Taking all these experiences into consideration, she ran for and won the role of president. Her platform focused on introducing more art to Tech's primarily STEM-focused campus; improving and evaluating existing mental health programs; and collaborating with student organizations to improve communication between the administration and the student body. She used her ISyE skills to analyze data and track trends over time, identifying problems on campus and devising solutions. Juvekar will graduate in December 2020 and hopes to work in a field that combines her passions for policy and technology.

STAVAN SHAH // Startup Exchange

"Having been on Startup Exchange's executive team for three years, it's been exciting to see the rise of student entrepreneurship on campus. More than ever before, students feel as though they have the resources and network to build out their own ideas here in Atlanta."

Startup Exchange is an organization dedicated to building up the startup community among Georgia Tech students. Shah became interested in entrepreneurship as a high school student, and when he arrived on campus, he knew he wanted to empower the Institute's enterprising students. He was drawn to Startup Exchange, which provides extensive networking opportunities for students with all majors and interests. Two years ago, Shah himself developed and implemented the Startup Exchange Membership Program for first-year and second-year students. The program teaches the basics of starting a company — everything from handling legal issues to marketing. This semester, he has moved to an advisory role for the organization. Shah will graduate in December and hopes to work at a high-growth startup before eventually starting his own endeavor.

NDEYANTA JALLOW // IE 2020
Georgia Tech Society of Black Engineers

"I've never wanted to get involved in something just to have a line on my resume. I really want to help others get to where they want to be. It has been a way I give back to the organization and the people who gave so much to me."

The Georgia Tech Society of Black Engineers (GTSBE) equips its members with the confidence to succeed professionally and academically. Jallow joined GTSBE her first semester and eventually held three executive board positions, including president. Jallow originally focused on her academic pursuits, and she thought a leadership position would be too much of a time commitment. However, with the support of GTSBE's past two presidents, she was inspired to apply for an executive position her second year. From these leadership experiences Jallow learned how the world works, how to interact with people, and how to successfully lead an organization. She graduated in May and is working for Accenture in Atlanta as a strategy analyst.

ISyE Alumna Charu Thomas and the Growth of Oculogx

The northwest region of Arkansas, set within the beautiful Ozark Mountains, is well known as an outdoor paradise for camping, hiking, kayaking, and fishing. So it might surprise you to learn that the area is also home to a quietly burgeoning retail-tech industry that supports three of the biggest Fortune 500 companies that are headquartered there: J.B. Hunt, Tyson Foods, and of course the world's largest retailer (by revenue), Walmart.

One of those retail-tech startups is Oculogx, the brainchild of 22-year-old Charu Thomas (IE 2018) who — while still a student at the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) — came up with the idea of using augmented reality (AR) wearable devices to make warehouse order picking faster and more accurate.

As a second-year undergraduate, Thomas took her concept to Thad Starner, a professor in Georgia Tech's College of Computing, who also happened to be the technical lead/manager for Google Glass. As Thomas explored how to make her idea a reality, she also conducted research with Starner on wearables. Thomas wrote about their research and won the Best Paper Award at the 2018 ACM (Association for Computing Machinery) International Symposium on Wearable Computers.

Fast-forward to 2020. Thomas and her team of five have grown Oculogx into a company that serves industry-leading businesses with household names like Walmart and Google. Oculogx is a rarity among startups in that it is primarily revenue-funded. Thomas herself was recently named to the 2020 Forbes 30 Under 30 list.

How did you end up headquartering Oculogx in northwest Arkansas, rather than, say, Silicon Valley? After I graduated in 2018, I moved to Bentonville, Arkansas, to participate in the Fuel startup accelerator created by Startup Junkie and Revunit. It's specifically designed to help early companies become enterprise ready, and to bring economic growth in the form of entrepreneurship to northwest Arkansas. The people who live here are really passionate about the area — and with good reason. Because Walmart, as well as the other Fortune 500 companies that are here, is such a major player in the retail industry, there's a huge retail-vendor ecosystem in the state that doesn't exist anywhere else in the U.S. Through Fuel, Google and Walmart became Oculogx clients, and I was able to begin growing my company.

What specifically did you learn through Fuel? The program was four months long. We were taught workshop-style and learned about intellectual property, contract terms, legal issues, how to negotiate, IT, security, and employee happiness — essential and practical knowledge for successfully developing a startup.

In addition, I made some incredible connections. Fuel introduced me to high-level individuals working at Walmart, and I still cherish those relationships now.

Oculogx's initial technology, which is now called Ocx One, provides AR order fulfillment for retailers. What makes Ocx One so powerful? Ocx One offers hands-free order picking via an ecosystem of wearable devices. This can include eyewear like Google Glass, wrist devices, or even ring scanners. It's really designed to help enterprise-level companies with significant infrastructure, like Walmart, to be more efficient. Our technology has been shown to make associates more efficient at order picking compared to manual methods like handheld technology, and it can offer a 2600% IRR [internal rate of return] over two years.

Given that Oculogx is geared toward retailers, what changes have you seen in the retail industry as a result of the Covid-19 pandemic? We focus on retailers in general, which can mean retail distribution center operations as well as actual retail stores. This market has absolutely exploded because of Covid-19. Online grocery sales in August 2019 were $1.2 billion; in comparison, sales were $7.2 billion this past July. The average grocery order was nearly five times larger. People need their groceries but aren't super comfortable going into a store to get them.

We have been working in that space to make online grocery operations more efficient through Ocx One, and this is something we do especially well. We also quickly built and brought to market two new products, Ocx Portal and Ocx Outline.

Tell us about these two products. Ocx Portal is a real-time order management system. Retailers can connect their orders through our third-party storefront, Shopify, or their order management system, and upload facility maps. Ocx Portal batches and optimizes pick walks with artificial intelligence. With Portal technology, associates can fulfill multiple orders at a time.

Ocx Outline is a modular mobile order fulfillment application. An associate — like an Instacart shopper, for example — can use a phone or any existing hardware like a scanner to access Outline to automatically optimize picking.

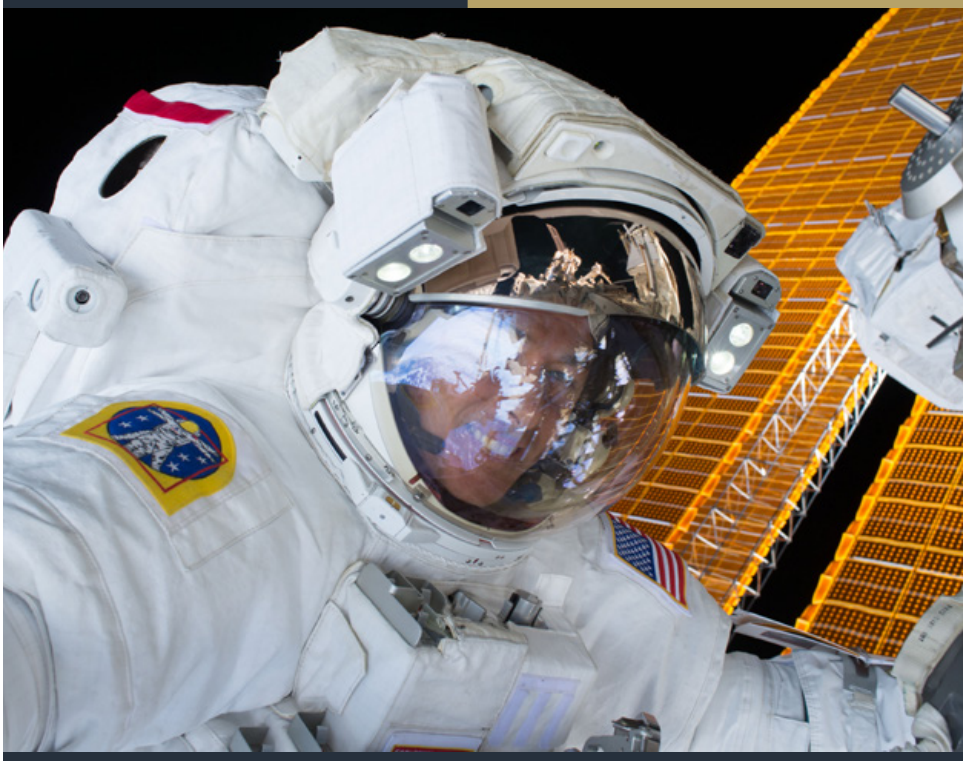
Ocx Outline is geared toward medium-sized enterprises that may have more manual-type processes in place, such as Excel or even a paper list. Ocx Outline completely digitizes the operation.

Given Oculogx's tech-heavy products and your current entrepreneurial career path, why did you choose ISyE as your major, instead of something like computer science or business? I didn't know I would be an entrepreneur coming into college. Originally, I wanted to be an academic mathematician, and ISyE was a great fit because it gave me the theory of math with practical applications built in. In hindsight, I see how ISyE had a really big impact by pushing me toward the supply chain industry, which is where Oculogx operates now.

What was it like being named to the 2020 Forbes 30 Under 30 list? It was a shock and an incredible honor — I definitely didn't expect it! I'm thankful to be recognized, but it's important to keep in mind that Oculogx is more than just me. We have an amazing group of people who make Oculogx run — including our stellar team, our industry-leading customers, our sharp investors, and our best-in-class advisors.

You've spoken enthusiastically about the future of wearable technology, such as brain or eye implants. What about this is so exciting to you, and why? I'm bullish on the idea that wearable technology and cybernetics represent the next step of human evolution. For example, gloves with vibration motors can teach us a new skill without practicing; tattoos on our skin enable us to interact with technology in alternative ways. Wearable and implantable computers enable us to overcome our limits.

What's next for Oculogx, and for you personally? At Oculogx, we're focused on building out a proven sales cycle in the next two quarters. Personally, my goals align pretty closely to Oculogx's goals. I want to build technology that impacts millions of store and distribution center associates. ▪ SHELLEY WUNDER-SMITH



Shane Kimbrough during a 2017 spacewalk aboard the International Space Station
PHOTO COURTESY OF NASA

ISyE Alumnus Named Commander of SpaceX Crew-2 Mission to Space Station

Astronaut Shane Kimbrough, who received a master's degree in operations research in 1998 from the H. Milton Stewart School of Industrial and Systems Engineering, will serve as spacecraft commander for the next collaborative mission between NASA and SpaceX.

Kimbrough will lead Crew-2, a planned group of four astronauts aboard a SpaceX Dragon spacecraft flight to the International Space Station as part of NASA's Commercial Crew Program.

Crew-2 is currently scheduled to launch in spring 2021, after the launch of NASA's SpaceX Crew-1 mission planned for late October 2020. NASA's SpaceX Demo-2 test flight mission launched on May 30 and returned to Earth on Aug. 2, 2020.

Crew-2 will remain aboard the space station for six months, joining up with three crewmates who will arrive via a Russian Soyuz spacecraft.

Kimbrough grew up in the Atlanta metro area and was selected to be an astronaut in 2004. This will be his third trip to space. ▪ STEVEN NORRIS

Toyya Pujol: A World in Numbers

For Toyya Pujol, numbers tell a story. "They give a concreteness to people's experience," she noted in a recent interview. An alumna (Ph.D. IE 2020) of the H. Milton Stewart School of Industrial and Systems Engineering (ISyE), Pujol has taken this perspective to an assistant professorship at Purdue University, where she is examining statistical data related to issues of social justice and public health.

This viewpoint has in fact defined Pujol's academic and career choices since she was an undergraduate student at MIT's Sloan School of Management. Most of her peers pursued full-time positions in banking or consulting. However, Pujol declined such job offers after deciding that she was not interested in helping companies make more money. She began bartending in Boston while considering her options.

"You can imagine the complaints of my mother," Pujol said, laughing. "After she had just paid for four years of MIT tuition, I was tending bar!"

Eventually, Pujol recognized that what she really cared about was channeling her natural talent for numbers to help others — specifically, using math to describe the world with direct applications to social good problems. She accepted a civilian position with the U.S. Air Force as an operations research (OR) analyst, a role she held for six years. Pujol was responsible for using data to develop cost estimates, especially for advanced communications systems.

And where was the social good factor in that work, you might ask? "Everything we did was geared toward saving the warfighter's life," she explained.

Even after Pujol earned her master's degree in OR from Northeastern University, the itch remained to apply numbers toward improving people's lives, and she enrolled in ISyE's Ph.D. program with a concentration in statistics. Her work focused on applying data analytics and machine learning to examine health outcomes and ways to provide patients with better treatment. In pursuit of that goal, Pujol joined an interdisciplinary Georgia Tech team that studied biomedical informatics and personalized medicine through a T32 training grant from the National Institutes of Health. She also spent a year at Harvard Medical School's Department of Health Care Policy as a visiting scholar. Harvard's interdisciplinary department included medical doctors working alongside biostatisticians and economists to drive health policy decisions; she learned biostatistics, rather than straight engineering statistics, for healthcare research.

These research opportunities clarified for Pujol where she wanted to land, career-wise, after defending her ISyE thesis. She decided on Purdue's industrial engineering department, with a joint affiliation with the Regenstrief Center for Healthcare Engineering, where colleagues from many different engineering disciplines have come together to solve major healthcare issues. Pujol also liked the center's access to large amounts of data and its government connections. This means that she has been able to step right into doing the work she cares about most.

Additionally, Pujol — recipient of a scholarship through the prestigious Sloan Minority Ph.D. Program — sees the ongoing public conversation around issues of race and social justice as a way of looking at numbers that significantly impact minority communities: infant/maternal mortality rates or implicit bias by medical professionals or inadequate access to telehealth, which has become essential during the Covid-19 pandemic. She hopes to be in the vanguard addressing concerns that profoundly influence the quality of life for entire demographic groups.

Pujol hopes to be in the vanguard addressing concerns that profoundly influence the quality of life for entire demographic groups.

"People are starting to see how statistics around these questions represent human stories," Pujol said. "This is why the work is important — no one would know about these issues if no one was looking."

She added, "You can describe the world through numbers." ▪

SHELLEY WUNDER-SMITH

ISyE Doctoral Student Spotlight

DIPAYAN BANERJEE // Ph.D. Student, Operations Research

The Graduate Research Fellowship awarded by the National Science Foundation recognizes and supports outstanding graduate students who are pursuing groundbreaking research, and Dipayan Banerjee fits the bill. Banerjee is studying the tactical design of last-mile delivery systems, which are a challenging supply chain problem. The last mile in a supply chain represents the transport of goods being delivered, for example, from a local warehouse to a home or business. "It's a really exciting time to be studying transportation and logistics systems," he said. "There are many fascinating new challenges being faced in the last mile as companies seek to deliver more and more goods on increasingly tighter deadlines. These include issues of accessibility and environmental sustainability." Because of the Covid-19 pandemic, Banerjee's research is in high demand. "We have data and advanced computing power at our disposal that wasn't available five or 10 years ago," he said. "I'm excited about the opportunity to develop new operations research approaches to solving these problems."

JOVAN JULIEN // Ph.D. Student, Operations Research

Jovan Julien, H. Milton Stewart School of Industrial and Systems Engineering (ISyE) Ph.D. student, is researching cirrhosis of the liver for their dissertation — work for which they have received the prestigious Lee B. Lusted Award from the Society for Medical Decision Making, and also been named a Robert Wood Johnson Foundation Health Policy Research Scholar. Julien has been conducting a meta-analysis using nationally representative surveys of when people start drinking alcohol and how much they consume — research that has expanded to examine drinking behaviors related to the Covid-19 pandemic. "In this unprecedented moment, my research has shifted focus to include how changing consumption of alcohol due to Covid-19 policies, making it easier to access and sell alcohol, can lead to liver disease later in life," Julien explained. "That being said, I think my greatest impact as a graduate student has been lending my data analysis skill set to local Atlanta community efforts like the Metro Atlanta Mutual Aid (MAMA) Fund to help support those most affected by the pandemic."

ISABELLA SANDERS // Ph.D. Student, Industrial Engineering

With two Georgia Tech master's degrees completed (geographic information systems and operations research) and an MBA and Ph.D. in progress, Isabella Sanders is an interdisciplinary superstar. She came to Tech in 2016 after earning a bachelor's degree in mathematics from MIT. "I wanted to be able to use my math undergraduate degree in an applied context, which is why I came to Georgia Tech for my Ph.D. in industrial engineering. The ISyE department has enabled me to do just that, through research collaborations with various companies — from startups to global organizations," said Sanders. Her dissertation focuses on data-driven computational optimization and risk modeling for solving decision-making problems within supply chains in the food and defense industries. In addition, Sanders has been instrumental in reestablishing the graduate group within Georgia Tech's section of the Society of Women Engineers (SWE), serving as president for the past two years. In the fall of 2020, she received the SWE Outstanding Collegiate Member award for her contributions to SWE, the engineering community, and Georgia Tech.

SIReN Lab Brings Immersive Technologies to Supply Chain and Logistics Research

The Georgia Tech Supply Chain and Logistics Institute (SCL) is the largest such group in the world, and it provides researchers with many opportunities to help solve global supply chain and logistics problems. The latest addition is the SIReN (Sentient Immersive Response Networks) Lab, dedicated to research leveraging immersive technologies to enhance human capabilities for engineering and managing supply chains and logistic systems.

The SIReN Lab is an associate international laboratory, the result of a partnership between SCL's Physical Internet Center and IMT Mines Albi, part of the Mines-Telecom Institute in France. The two organizations have historically collaborated on research surrounding artificial intelligence and its interface with these immersive technologies. The SIReN Lab is an extension and formalization of that relationship.

The U.S. arm of the lab is housed in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) and is directed by Benoit Montreuil, Coca-Cola Material Handling & Distribution Chair and professor in ISyE. Montreuil is also co-director of SCL and director of the Physical Internet Center. The French lab is led by Frederick Benaben, head of the Interoperability of Organizations research team at IMT Mines Albi. Because of the virtual nature of the work, it is possible to have researchers from both labs working on the same experiment, in the same environment, at the same time.

SIReN Lab research is centered around four main types of response networks — demand, health, humanitarian, and crisis — and the human response to them. A demand response network focuses on how the supply network responds to demand and how to prepare for this response, rather than the other way around. The health and humanitarian response networks, which have become increasingly visible due to the Covid-19 pandemic, relate to issues like disaster recovery and various healthcare supply chains.

The French lab has a significant emphasis on crisis response networks, in which a group of people work together to respond to a crisis in a smart, fair, and efficient manner.

"We currently have a crisis management project where 10 people in France and a few in the U.S. are working together at the same time in a digital twin environment," said Benaben. "For example, we can have everyone in a building where they can fight a fire, but we can also have some of them in a virtual control room exchanging ideas and making decisions. The options are limitless."

Researchers are using tools such as dashboards, simulations, games, and in some cases virtual or augmented reality to allow participants to see — and in some cases experience — a vivid picture of a situation with other players in the network.

"In augmented reality, we reinforce what participants see with facts, maps, graphs, and other information that enhance what they are experiencing," explained Montreuil. "In virtual reality,

Participants prepare to fight a fire in an immersive training experience using the IOMEGA virtual reality platform in the SIReN Lab.

During an exercise at the SIReN Lab, participants walked through a virtual building during a crisis simulation. Participant views included a virtual fire, building occupants to be evacuated in offices and in common areas, and the arrival of firetrucks.

we project the user into a virtual world, which can be a very vivid representation of the current world, or it can be an abstract world. It can be a very powerful tool."

"When we put someone in an environment where they can touch, learn, train, experiment, and ultimately decide, it changes the way they approach the problem," added Benaben.

The French lab launched on Nov. 15, 2019. While the spring 2020 launch of the U.S. lab was postponed due to the Covid-19 pandemic, the team already has several projects underway and is fully operational. Eventually, they would like to see additional SIReN labs join the network to further scale the work being conducted.

"We want to become a global leader in making response networks become more sentient and immersive," said Montreuil. "This is an exciting new approach that we are bringing to ISyE and to the domain." ▪ LAURIE HAIGH

"In virtual reality, we project the user into a virtual world, which can be a very vivid representation of the current world, or it can be an abstract world. It can be a very powerful tool."

BENOIT MONTREUIL

ISyE's National Academy of Engineering Members

Election to the National Academy of Engineering (NAE) is one of the highest professional distinctions accorded an engineer. Its members are senior engineering professionals who have made significant contributions to their fields. Over the years, the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) has had 10 faculty members in the NAE, nine of whom were elected while at Georgia Tech.

"Our faculty are innovators and leaders in their fields, and their elections into the NAE further confirm this," said ISyE School Chair Edwin Romeijn. "They have all made — and many continue to make — tremendous contributions to their fields of study, to ISyE, and to Georgia Tech."

George Nemhauser

Donald Ratliff

C.F. "Jeff" Wu

GEORGE NEMHAUSER // A. Russell Chandler III Chair and Institute Professor // Election year: 1986

Election Citation: For fundamental operations-research contributions in scheduling methodology and for contributions to large-scale combinatorial optimization problems.

George Nemhauser joined the ISyE faculty in 1985 as the holder of the first endowed chair position at Georgia Tech. Just a year later he was elected to the NAE, making him the second member of the Georgia Tech community to join the prestigious organization (the other was then–Georgia Tech President Joseph Pettit). For a time, Nemhauser was the only NAE member at Georgia Tech and in the state of Georgia.

Nemhauser's research interests are in solving large-scale mixed-integer programming problems. He has done significant work in airline optimization and is a partner in the Sports Scheduling Group, which provides schedules for Major League Baseball and university athletic conferences.

DONALD RATLIFF // Regents Professor Emeritus and Co-Executive Director of the Georgia Tech Panama Logistics Innovation & Research Center // Election year: 1996

Election Citation: For research, education, and leadership in the development and implementation of interactive network optimization methods for logic systems.

Donald Ratliff joined ISyE in 1978 as the UPS Professor of Logistics. He was founding executive director of the Supply Chain and Logistics Institute at Georgia Tech, which under his leadership became the largest research program of its kind in the world. In this role he also managed research centers in Panama and Singapore.

He helped pioneer the development of software tools to design supply chain networks and optimize last-mile delivery processes. He has worked with a wide variety of companies and organizations during his career to improve their supply chains.

In 2012, Ratliff became professor emeritus at ISyE and currently serves as co-executive director of the Georgia Tech Panama Logistics Innovation & Research Center. He is also founder and CEO of Delivery Dynamics.

C.F. "JEFF" WU // Coca-Cola Chair in Engineering Statistics and Professor // Election year: 2004

Election Citation: For conceiving and building modern systems of experimental design based on contemporary methods for parameter estimating to provide quality improvements.

Jeff Wu joined ISyE in 2003. Throughout his career, he has made fundamental contributions to the methodological and theoretical developments of a wide variety of statistical and application areas. In his 1997 inaugural lecture for the Carver Chair at the University of Michigan, he coined the term "data science" and advocated that "statistics" be renamed "data science" and that "statistician" become "data scientist."

Wu's work is widely cited in professional journals and magazines. He has served as editor or associate editor for several major statistical journals and has published more than 180 research articles in peer review journals.

ARKADI NEMIROVSKI // John Hunter Chair and Professor // Election year: 2017

Election Citation: For the development of efficient algorithms for large-scale optimization problems.

Arkadi Nemirovski joined ISyE in 2005, and he has made many fundamental contributions to the field of continuous optimization theory and algorithms during his impressive career. These include the invention, at just 27 years old, of the ellipsoid method — one of the most fundamental developments in optimization — and developing the interior point method with Yurii Nesterov.

He has made significant contributions in almost all aspects of continuous optimization including complexity, numerical methods, and stochastic optimization, and in non-parametric statistics.

JIANJUN "JAN" SHI // Carolyn J. Stewart Chair and Professor // Election year: 2018

Election Citation: For development of data fusion–based quality methods and their implementation in multistage manufacturing systems.

Jianjun "Jan" Shi joined ISyE in 2008. His research covers the development and application of data-enabled manufacturing. Shi's methodologies integrate system informatics, advanced statistics, and control theory for design and operational improvements of manufacturing and service systems by fusing engineering systems models with data science methods.

Shi is a pioneer in his field, and the technologies developed in his group have been widely implemented in various production systems with significant economic impacts.

ALEXANDER SHAPIRO // A. Russell Chandler III Chair and Professor // Election year: 2020

Election Citation: For contributions to the theory, computation, and application of stochastic programming.

Alexander Shapiro joined ISyE in 1991. He has made extensive contributions to the field of optimization, including simulation-based optimization, stochastic programming, and nonsmooth analysis. He has used stochastic programming — a technique useful for modeling complex systems under conditions of uncertainty — to optimize power systems and ensure that electricity generation meets demand at the lowest possible cost.

Shapiro's research interests also focus on risk analysis, sensitivity analysis of nonlinear programs, and multivariate statistical analysis.

In addition to the faculty listed above, four more NAE members have been part of the ISyE community: John White, Ellis Johnson, William Rouse, and William Cook.

JOHN WHITE joined the ISyE faculty in 1975 and was elected to the NAE in 1987 "for the creative development of engineering principles and computational procedures used in the design and analysis of material handling systems." From 1991 to 1997, White served as dean of the College of Engineering at Georgia Tech. In 1997 he left Georgia Tech to become chancellor at the University of Arkansas.

ELLIS JOHNSON was elected to the NAE in 1988 "for fundamental contributions to discrete optimization and software design and its practical applications to distribution and manufacturing systems." He came to Georgia Tech in 1989 and served as Coca-Cola Chair and professor at ISyE from 1993 until his retirement in 2012, when he became professor emeritus. Johnson is a world leader in integer programming and airline optimization and made many significant contributions to these fields during his time at ISyE.

WILLIAM ROUSE was a member of the ISyE faculty from 1981 to 1987 and became an adjunct professor in 1988. He served as school chair from 2001 to 2004. In 1991 he was elected to the NAE "for pioneering development of models of human-system interaction for applications in complex engineering systems." He holds professor emeritus status at ISyE and is currently on the faculty at Georgetown University.

WILLIAM COOK was a member of the ISyE faculty from 2002 to 2013 and served as Chandler Family Chair and professor. He was elected to the NAE in 2011 "for theoretical and computational contributions to discrete optimization." He is currently on the faculty at Johns Hopkins University.

Arkadi Nemirovski

Jianjun "Jan" Shi

Alexander Shapiro

Four ISyE Alumni in Inaugural Class of GTAA 40 Under 40

On July 15, 2020, the Georgia Tech Alumni Association (GTAA) announced 40 distinguished honorees as part of its inaugural 40 Under 40 class. Selected from more than 250 nominations, the Class of 2020 represents a wide range of industries and sectors and includes four outstanding alumni from the H. Milton Stewart School of Industrial and Systems Engineering (ISyE): Maithili Appalwar, Sheereen Brown, Jennifer McKeehan, and Evren Ozkaya.

"We are very proud of these four alumni who have made, and are continuing to make, a difference in the world," said ISyE School Chair Edwin Romeijn. "They have all had amazing careers thus far, and I look forward to seeing what they accomplish in the future."

MAITHILI APPALWAR, IE 2018
CEO, Avana

After learning that drought was the leading cause of suicide among farmers in a district in India, Maithili Appalwar used her passion for manufacturing and affordable design to address their situation. Through her company, Avana, she's helped more than 10,000 farmers conserve 50 billion liters of water with an eco-friendly polymer lining that creates artificial ponds on farms by harvesting rainwater. After farmers used the liner for just one year, their income increased by 98.7%. "I want my legacy to be a world where every farmer lives with dignity and is empowered to create a world that they want to live in," said Appalwar.

Fun fact: She once followed a professor around until he gave her a waiver to enroll in his Medieval Literature class.

SHEEREEN BROWN
IE 2013, M.S. HS 2014
Senior Business Analyst, The Task Force for Global Health

Sheereen Brown likes to say that her work is about getting the right information (data) to the right people at the right time via the right tech to make the right decisions. As senior business analyst for The Task Force for Global Health, Brown travels the world from Johannesburg to Geneva to fulfill the organization's mission to eliminate disease and protect populations. Working in partnership with the World Health Organization and the Bill & Melinda Gates Foundation, she helps bring innovative solutions to global health challenges. Brown supported the establishment of an outpatient care system at the largest national hospital in Tanzania to reduce patient wait times, and implemented a cloud-based solution to equitably allocate government healthcare workers in sub–Saharan African countries. For inspiration, she looks to her two sisters, also ISyE alumnae, who have used their experience at Tech as launching pads to successful careers in the sciences and art. "Our parents raised us to be tenacious women. Tech reinforced that tenacity, and I'm proud of what my sisters have accomplished with it. I strive to be like them," Brown says.

Fun fact: This jet-setting humanitarian dreams of becoming a kindergarten art teacher in retirement.

JENNIFER MCKEEHAN, IE 2005
Founder, Smith and James LLC, and Former Vice President Supply Chain, The Home Depot

Jennifer McKeehan's trailblazing career at The Home Depot over the last 15 years has been nothing shy of extraordinary. In 2016, she was named vice president of inventory for all 2,000 U.S. stores and online businesses, responsible for leading a $15 billion portfolio and 250 associates. It's worth mentioning that at the time she was also the youngest officer and was a working mom with two children. Most recently, she founded Smith and James, a retail consulting firm. But perhaps even more noteworthy than her professional career is her commitment to service. She's a member of Children's Healthcare of Atlanta's Emerging Leaders Board, which recently raised $639,000 for pediatric cardiology research. She also serves on the Cobb Health Futures Foundation Board. "What I find most energizing, hopeful, and inspirational is when some of the biggest mountains are moved or seemingly impossible problems are solved," McKeehan said.

Fun fact: She was part of the Yellow Jacket Marching Band in college, which cemented her love for Georgia Tech football and gameday!

EVREN OZKAYA, PH.D. IE 2008
Founder and CEO, Supply Chain Wizard, LLC

Dealing with end-to-end operations in today's global supply chain requires a true wizard like Evren Ozkaya. As the founder and CEO of Supply Chain Wizard, Ozkaya is making pharmaceutical supply chains more secure, and ultimately safer for patients, by reducing the risk of counterfeit drugs with track-and-trace technologies. But Ozkaya didn't land in his consulting career easily. During his last year at Georgia Tech, he forgot to register for an internship course, which put him just short of the full-time requirement for his international student visa. He not only lost his right to work on campus, but in one day also lost his three part-time jobs. "That was probably the worst day of my life at the time, but unbeknownst to me, it created an opportunity," he said. He studied for consulting interviews every day that month while his visa was reinstated. "I ended up getting multiple offers from top consulting firms and accepted an offer from McKinsey & Company in Atlanta, which forever changed my life and propelled me much faster in my career."

Fun fact: He considers time his most valuable asset, so he tracks every hour of his time 24/7 to learn how to improve his time management.

Content provided by the Georgia Tech Alumni Association. To view all 40 honorees in the Class of 2020, visit ***gtalumni.org****.*

Professor Pinar Keskinocak on Her Role as INFORMS President

Pinar Keskinocak has been serving as president of the Institute for Operations Research and the Management Sciences (INFORMS) since January 2020. Keskinocak, William W. George Chair and professor in the H. Milton Stewart School of Industrial and Systems Engineering and director of the Center for Health and Humanitarian Systems, is the first faculty member from Georgia Tech to hold this position.

In some ways, this office represents the pinnacle of Keskinocak's long-standing service to INFORMS; her involvement began when she was a junior faculty member. Keskinocak has served on the INFORMS board as both vice president of membership and professional recognition and as secretary. She was co-founder and president of the Junior Faculty Interest Group Forum and Public Sector Operations Research Section, and has been president of the Women in OR/MS Forum and the Health Applications Society. After her presidential term ends, Keskinocak will remain on the executive board for one year as past president.

What has been most exciting to you about this opportunity to serve as INFORMS president? INFORMS has been on a positive trajectory for a number of years — just look at our performance metrics in terms of our membership, participation in our conferences, our journals, the quality and number of journal articles published, and how these articles are consumed by readers. So this is a fantastic time for INFORMS. We can communally be proud of it, especially since our current position of strength gives us opportunities to take some bigger leaps.

INFORMS OPTIMIZATION SOCIETY

The Covid-19 pandemic occurred almost simultaneously with the beginning of your presidential term. How has the INFORMS community responded to this crisis? Historically, our community has developed and used operations research (OR) and analytical methods to help make the world a better place. Many INFORMS members have worked on issues related to infectious diseases including pandemic flu, healthcare, transportation, supply chains, finance, etc., and all these sectors benefit from the applications of OR and analytics as we face high levels of uncertainty and cascading impact across multiple sectors locally and globally.

What are some other organizational projects that you are excited about? One of our new initiatives, the INFORMS Diversity, Equity, and Inclusion (DEI) Ambassadors Program, is moving forward at a fast pace. The program provides a platform for our members to engage in DEI initiatives in a variety of areas. During this first year of the program, we have received proposals that range from outreach to high schools, HBCUs, or underserved communities to exploring diversity in our journals' editorial boards to community-building within INFORMS.

In addition, to celebrate the 25th anniversary of INFORMS, we launched a new scholarship fundraising campaign: $25 for 25 Years of INFORMS. While student membership has increased over the years, these scholarship funds will help us further attract, engage, and retain student members. We aim to provide undergraduate students an opportunity to attend the INFORMS annual meeting, where they can experience academic and professional development. Scholarships will provide travel and registration reimbursements up to $1,250. By investing in promising students, we hope to pave the way for the next generation of OR, management science, and analytics professionals.

After your presidency, what will your future involvement in INFORMS look like? I have always been committed to INFORMS, and I envision my involvement will continue beyond 2020-21, via journal editorial boards, outreach, etc. I hope to further contribute to the DEI Ambassadors Program's progress and success. INFORMS is an incredible organization. I am grateful to be a member, and I encourage and invite everyone to engage. ▪

SHELLEY WUNDER-SMITH

ISyE Gets a New Home: Technology Square Phase III to Include George Tower

Momentum for Technology Square Phase III continues to grow with the naming of George Tower in recognition of philanthropists William "Bill" (IE 1964, Honorary Ph.D. 2008) and Penny George, longtime supporters of Georgia Tech. The Board of Regents of the University System of Georgia approved the naming of George Tower at its meeting on Feb. 11, 2020.

George Tower will be home to the nation's No. 1–ranked H. Milton Stewart School of Industrial and Systems Engineering (ISyE), as well other programs. George Tower will accompany Scheller Tower, also planned on the site, which will house the graduate and executive education programs of the Scheller College of Business.

"We are incredibly grateful to Bill and Penny George for their long-standing support of Georgia Tech," said Georgia Tech President Ángel Cabrera. "The George family legacy of support can be seen and felt in the experiences of our students who benefit from various scholarships and fellowships, and through the impact of our faculty, made possible because of the generosity of Bill and Penny George. We are honored to affix the George name to this transformative next step in Tech Square and our campus."

Bill George began his career at the U.S. Department of Defense. He had been an executive at Honeywell and Litton Industries before joining Medtronic as president and chief operating officer. He became CEO of Medtronic in 1991 and chairman of the board in 1996. George is currently a professor of management practice at Harvard Business School.

"Generous support from Bill and Penny George over the years has enabled ISyE to maintain its position of leadership and strengthened the School's ability to make cutting-edge contributions to research and education," said ISyE School Chair Edwin Romeijn. "This latest gift will bring us closer to the companies and startups in the vibrant Technology Square ecosystem, which will be of tremendous value to the School. We are delighted to call George Tower our future home."

Technology Square Phase III will be a 400,000-square-foot, multi-building complex in Midtown Atlanta, located on the northwest corner of West Peachtree and Fifth streets. A total of $75 million in private philanthropy will be included toward the $200 million estimated cost of construction. ▪ DENISE WARD

THE GEORGE FAMILY FOUNDATION

has provided funding to launch the George Fellows Leadership Program for the 2020-21 academic year. George Fellows, who are ISyE graduate students conducting research in health systems and analytics, will receive a leadership stipend in addition to their fellowship award and will participate in the new year-long leadership program.

The program is led by Terry Blum, Tedd Munchak Chair in Entrepreneurship and professor in the Scheller College of Business, and Pinar Keskinocak, ISyE William W. George Chair and professor. Participants will study the True North approach to leadership development created by Bill George that has been implemented at both Harvard Business School and Harvard Kennedy School. Program activities include opportunities to examine self-awareness; values and principles; motivations; and how to lead an integrated life — all of which underlie becoming an authentic leader.

"Historically, healthcare providers have been focused on and were incentivized for treating disease, instead of a holistic systems approach that promotes overall health and well-being and is supported by new advances in analytics and data science," said Keskinocak. "We hope that graduates of our master's in health systems program will combine their knowledge of health systems with the skills they gain in this exciting leadership program to lead systemwide transformation from 'sick care' to 'healthcare.'"

Triple-Major Daniel Gurevich Wins Love Family Foundation Scholarship

After four years at Georgia Tech, Daniel Gurevich graduated in spring 2020 with bachelor's degrees in industrial engineering, physics, and math. As a result of his academic excellence, he was awarded the Love Family Foundation Scholarship, the highest honor Georgia Tech can give to a graduating student. Gurevich was nominated for the $10,000 award by both the College of Sciences and the College of Engineering.

"We couldn't be prouder of Daniel for being granted this prestigious award," said Steve McLaughlin, provost and executive vice president for academic affairs. "His excellent scholastic record, as well as his involvement in multiple research labs here at Georgia Tech, is an outstanding accomplishment that sets an exceptional example for all students."

For Gurevich, receiving the prestigious Love Family Foundation Scholarship is the culmination of his hard work and dedication. As a first-year physics major, he realized that the college credits he had earned in high school would make a second major in industrial engineering manageable. When Gurevich shared his academic plans with his family, friends, and professors, everyone supported him. But a third major?

Gurevich recalled talking with Fran Buser, an academic advisor in the H. Milton Stewart School of Industrial and Systems Engineering, about his intention to study math as well.

"She asked, 'Well, are you sleeping? Are you eating? Is everything okay?'"

Gurevich remembered. "When I said, 'Yes, I'm doing fine. Everything is good,' she said, 'Go ahead.'"

The commonality among Gurevich's majors is applied mathematics. "The ability to explain how things work is something that really attracts me about math," he explained. It is this passion for using mathematics to understand how the world and its people function that drove him during his time at Georgia Tech. This fall, Gurevich began his Ph.D. studies at Princeton University in applied and computational mathematics.

He hopes to continue the research on cardiac arrhythmias he began at Georgia Tech. He was first attracted by the field's importance to society — arrhythmias are a leading cause of death worldwide — as well as its rich mathematical background. Now, Gurevich aims to develop low-energy defibrillation protocols that are more effective with fewer side effects.

When not busy with his studies or research, Gurevich can often be found playing chess. Chess has been a major part of his life — he began playing at age 5 and became an international master in high school. At the beginning of his third year at Georgia Tech, Gurevich joined the chess club. The group's Friday afternoon meetings comprise his favorite school memories.

"It was really the main source of challenge for me. I had to learn to work hard because competing against all these proven players is very tough," he said. "It's definitely something that has helped me succeed in my academics."

Gurevich is very appreciative of his undergraduate education, and the Institute will always hold a special place in his heart.

"I can't think of a more welcoming place that has such great people and, of course, Georgia Tech is an academically outstanding institution," Gurevich said. "My education here has been the best possible opportunity for me to lay a foundation of knowledge that will propel me forward."

He is looking ahead to further learning, further research, and — someday — teaching the next generation of students. ▪ TAYLOR HUNTER

Two ISyE Staff Members Complete Georgia Tech Inclusive Leaders Academy

Joscelyn Cooper-Rodriguez, program and operations manager for the Center for Health and Humanitarian Systems, and Nancy Sandlin, director of development for the H. Milton School of Industrial and Systems Engineering (ISyE), successfully completed the 2020 Inclusive Leaders Academy (ILA) program offered by Georgia Tech's Office of Staff Diversity, Inclusion, and Engagement.

The ILA provides personal and professional development of self-awareness, social intelligence, and courage for Institute employees who hold a supervisory position. Participants complete a series of self-guided trainings and group workshops and also write a personal reflection that becomes part of the Institute's digital story library, known as *Transformative Narratives*.

When asked about a favorite activity in the ILA, Cooper-Rodriguez noted, "One assignment was to write an 'I Am' poem. We were given questions to respond to that helped us describe ourselves, and I found the words flowing out of me while writing this poem. It really got to the heart of how I feel about myself, which is something a lot of us don't take the time to discover. The exercise helped me see how I need to be more compassionate toward myself."

The program is centered around Brené Brown's book *Dare to Lead*. "One of my favorite sessions involved a deep dive into self-awareness and vulnerability as the book talks about them, and how these qualities take courage," said Sandlin. "That courage paves the way to helping to identify and develop the potential of people and processes — which is the heart of leadership." ▪ SHELLEY WUNDER-SMITH

ISyE Responds to Covid-19

As the coronavirus spread rapidly throughout the U.S. in Spring 2020, members of the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) used their skills to help fight the pandemic and save lives. From optimizing personal protective equipment (PPE) supply chains, to making and distributing reusable face coverings to those in need, to creating models to help leaders make educated decisions to slow the spread of the disease, the ISyE community led the way. **Here are a few of their stories.**

Centralized Ordering, Modeling Keeps PPE Supplied to Research Labs

As Georgia Tech ramped up laboratory operations shut down by Covid-19 in March 2020, a perfect storm of challenges arose in providing the PPE required to reopen — surgical masks, cloth face coverings, gloves, hand sanitizer, and disinfectant materials.

The coronavirus pandemic severely disrupted global PPE supply chains, resulting in long lead times and unreliable deliveries. At the same time, Covid-19 precautions mandated the use of PPE in laboratories where it wasn't required before, such as computer and electronics labs. And as researchers, staff, and graduate students slowly returned to their labs during the summer, predicting how many people would be at work on any given day created yet another unknown.

With $1 billion in sponsored activity during 2019, Georgia Tech has hundreds of research laboratories studying everything from viral antibodies and stem cells to robotics and electronic defense. In peak times, those researchers use approximately 400,000 gloves a month and 20,000 surgical masks. Under new disinfecting guidelines, labs were expected to use more than 4,000 gallons of hand sanitizer a month.

Supply chain and logistics experts from ISyE put their knowledge to work, using the modeling and machine-learning technologies that major retailers rely on to keep products on store shelves. In just one month, the research team built an automated, centralized system to replace traditional purchasing systems in which individual labs hunted for their own supplies.

The new centralized system allows administrators to see how much of each PPE item is available on campus, and asking lab researchers to report details of PPE usage each day supplies the system with data to predict demand. This in turn enables Georgia Tech to place large orders and stock a centralized warehouse to bridge the gap during supply chain interruptions. ▪ JOHN TOON

ISyE Alumnus Pivots Company to Manufacture Reusable Antimicrobial Face Masks

At the beginning of March, Bryan Kilbey spoke with a business partner in France about the novel coronavirus that was spreading across Europe, causing widespread social lockdowns, straining healthcare systems, and fomenting economic instability.

Kilbey, an ISyE alumnus (IE 1982), quickly realized that Covid-19 would have a similar impact in the U.S. and began contemplating how his company, EZY Wrap, could be part of the solution. PPE — specifically surgical and N95 face masks — were already in high demand by medical and essential workers. It was a natural shift for EZY Wrap, a medical device manufacturer, to begin making face masks.

Two days after Kilbey heard from his colleague, the company had a workable prototype for a new kind of mask: fully adjustable for people of any size, thanks to the Velcro ear straps; reusable (when handwashed and air-dried); and remarkably breathable. A week after that propulsive conversation, the company had filed patent applications in the U.S. and the European Union and had begun round-the-clock manufacturing.

One additional quality of the EZY Wrap products sets them apart: They are treated inside and out with an antimicrobial agent that is 99.99% effective. "Covid-19 comes from a novel coronavirus, but it has 'brothers and sisters' in other coronaviruses," Kilbey noted. "SARS, MERS, H1N1 — they come from the same gene pool as Covid-19, and the antimicrobial treatment on our mask has been shown to kill them all. We are confident that it will kill Covid-19 as well."

Sales of EZY Wrap's antimicrobial mask number in the millions. The company has also donated thousands of them to groups in Florida, where it is headquartered, ranging from first responders to private businesses seeking to protect their employees. And Kilbey was able to provide help in yet another way, hiring people who had been laid off because of the pandemic to staff the ramped-up production lines. ▪

Bryan Kilbey

SHELLEY WUNDER-SMITH

EZY Wrap has developed a second-generation product — a multilayer mask with a reusable N95 filter — and is pursuing FDA Class 2 registration for it.

Interdisciplinary Team Develops Covid-19 Policy Simulator

Turgay Ayer, George Family Foundation Early Career Professor and associate professor in ISyE, is a healthcare analytics expert. He also serves as research director for healthcare analytics and business intelligence in the Center for Health and Humanitarian Systems at Georgia Tech and holds a courtesy appointment at Emory Medical School. Throughout his career, he has created numerous models and simulators to help slow the spread of various infectious diseases.

Along with ISyE Ph.D. student Jade Yingying Xiao, Ayer partnered with research teams from Harvard Medical School, Massachusetts General Hospital, and Boston Medical Center to create a Covid-19 simulator. This interactive tool, designed to inform Covid-19 intervention policy decisions in the U.S., evaluates the impact of different social distancing interventions on reducing the spread of Covid-19 at both a national and state level.

In early March, many states began implementing safety measures — limiting social gatherings, staying 6 feet away from others, wearing masks in public, closing schools and businesses, teleworking, and other measures to "flatten the curve" and slow the spread of the disease. The Covid-19 simulator is designed to predict outcomes at various levels of intervention, to help policymakers make educated decisions when lifting various restrictions, and to give individuals information to determine their own actions going forward.

The simulator received a great deal of attention after its launch. In its first week the website received more than 100,000 hits, and the simulator was featured on MSNBC's *Rachel Maddow Show*, NPR, the U.K.'s *Daily Mail*, Fox News, and others. In June, the team was awarded a National Science Foundation grant to continue its work on the simulator. ▪ LAURIE HAIGH

Faculty and Students Develop Campus Recovery Analytics

As colleges prepared to return to face-to-face learning for the Fall 2020 semester, ensuring physical distancing in instructional spaces was a key component of plans to reduce risk to faculty and students. To help campus planners make educated decisions and manage uncertainty, a team of faculty and students, many from ISyE, created tools to help educators model the number of students that can fit into a classroom under different physical distancing criteria.

The team was led by Fouts Family Professor Natashia Boland, Director of Professional Practice Dima Nazzal, and Assistant Professor Lauren Steimle; it included undergraduate, graduate, and doctoral students from ISyE, computer science, urban design and city planning, and statistics.

The resulting physically distanced classroom layout designer can generate classroom layouts to keep students a given distance apart and help planners better estimate classroom capacities under alternative physical distancing policies. The team also developed room assignment optimization models to help campus planners assign classes to classrooms based on reduced room capacities and preferred course delivery modes. The model's flexibility allows campus planners to simultaneously optimize course modality (in-person, hybrid, remote) and classroom assignments. ▪ LAURIE HAIGH

This work was supported by seed grants through ISyE's Thos and Clair Muller Research Endowment Fund and the Georgia Tech EVPR Covid-19 Rapid Response Seed Grant Program.

A Machine-Learning Model for Optimal Allocation of Limited Medical Resources to Covid-19 Patients

The escalating number of Covid-19 cases in the U.S. led to a critical shortage of medical supplies, including medicine, equipment, and personnel to treat infected patients. To make the best use of available resources, a team led by Harold E. Smalley Professor Chuck Zhang and Gwaltney Chair in Manufacturing Systems and Professor Ben Wang developed a machine-learning model to inform clinical decisions and optimize resource allocation.

Specifically, the team built a predictive model based on patient data collected by Georgia hospitals — medical history, symptoms, and test results — to anticipate the course of the disease for each individual. The goal? Identify which patients would recover and could be safely sent home; determine which patients would deteriorate quickly and require hospitalization and/or life support; and predict the outcome of patients requiring life support.

Phase one of the project was a success. "We achieved our goal by creating the predictive model that can help medical professionals and hospitals optimize treatment plans and resource utilization, which has been confirmed by our collaborators in the hospitals," Zhang said.

During the second phase of the project, the team will develop a comprehensive model to help health-care systems optimize operations and resource allocation for future Covid-19 outbreaks or other pandemics. ▪

LAURIE HAIGH

The Impact of Social Distancing on Covid-19 Spread

As Covid-19 spread throughout the U.S., researchers from Georgia Tech's Center for Health and Humanitarian Systems (CHHS) and Health Analytics Group joined forces to help predict the spread of Covid-19 considering various levels of social distancing.

The study was led by ISyE William W. George Chair and Professor Pinar Keskinocak and Virginia C. and Joseph C. Mello Professor Nicoleta Serban. Keskinocak is co-founder and director of CHHS, and Serban leads the Health Analytics Group.

Together with ISyE Ph.D. students Arden Baxter and Buse Eylul Oruc Aglar and visiting scholar John Asplund, the team developed a comprehensive agent-based disease spread model to help determine the best path to slow the spread of the disease, flatten the curve, and save lives.

The model estimates the spread of the disease geographically and over time based on various social distancing scenarios, which include school closures, shelter-in-place, and voluntary quarantines. It also projects resource needs such as hospital beds, ICU beds, and ventilators, and enables the team to evaluate the impact of various intervention scenarios to determine the best course of action.

As the pandemic worsened in the spring, Keskinocak and Serban discussed the impact of social distancing and shelter-in-place orders with various media outlets.

In addition to her work with Serban, in spring 2020 Keskinocak was appointed by President Ángel Cabrera to Georgia Tech's Coronavirus Task Force to assist with the campus response to the pandemic, and also to the Covid-19 Recovery Task Force to oversee the return to campus in fall 2020. ▪ LAURIE HAIGH

ISyE Students Optimize Scrub Distribution to Medical Professionals

From left: Annie Robinson, Mary Claire Solomon, and Gabi Falcone

This summer, a Georgia-based manufacturer of medical scrubs employed three ISyE undergraduate students as interns to help build a more efficient order fulfillment process.

Due to the Covid-19 pandemic, the company experienced increased orders, shipping more than 20,000 units daily from its Lithonia Springs warehouse. The interns — fourth-year Mary Claire Solomon and second-years Gabi Falcone and Annie Robinson — knew their project was crucial to fulfilling the high demand.

They focused on implementing a process to quickly fix short orders, which are orders that can't be completed in the first round of picking because an item is missing. The previous process of resolving short orders took five days or more, and as a result unresolved orders piled up.

Before devising and proposing ideas, the team conducted extensive research and worked in the warehouse, which was vital to optimizing the distribution process. While following physical distancing rules and wearing face coverings, the students worked side by side with warehouse employees.

"We knew that getting scrubs to the doctors and the nurses in the field fueled their success," Solomon said.

The outcome was a process they called "order hospital," in which a select group of trained pickers investigates short orders to ensure items are not in inventory and determines if a replenishment is on the way or needs to be ordered. Once the missing item is located in inventory or is restocked, the order is fulfilled and shipped.

As a result of this project, short orders can now be fixed in just one day and the number of orders that go through the inventory control team has decreased significantly. ▪ TAYLOR HUNTER

Resiliency of On-Demand Multimodal Transit Systems during Pandemic Response

On June 3, 2020, the Socially Aware Mobility (SAM) Lab met to discuss the resiliency of On-Demand Multimodal Transit Systems (ODMTS) during a pandemic response. In order to adapt to the changes brought on by a pandemic, transit systems must be equipped to handle both depressed demand and social distancing.

The SAM Lab has been working to configure an ODMTS pipeline that accounts for changed behaviors to curb the spread of the virus on the part of both individuals and transit agencies.

Using ridership data provided by the Metropolitan Atlanta Rapid Transit Authority (MARTA), the SAM team was able to map different demand scenarios. Comparing data from March and April 2019 to March and April 2020, the team found a significant decrease in rail ridership. While ridership was down at all MARTA stations, the decrease varied noticeably at different locations due to the activities that generate ridership.

Using novel state-of-the-art optimization techniques for planning and operating transit systems, the team demonstrated the benefits of ODMTS using a real-time simulation for three different demand scenarios: (1) a normal "base case" scenario with 100% demand; (2) early- and post-pandemic scenarios with 60% demand; and (3) a late-pandemic scenario with 20% demand. The team found that not only can the system handle the different demand scenarios smoothly, but also the average wait time decreases across the board due to depressed demand. In addition, the proposed ODMTS induces significantly less pressure on the budget while simultaneously creating more jobs. ▪ RACHEL MUELLER

ISyE Staff, Students Volunteer to Support Mask-Making Organization

Sewing Masks for Area Hospitals (SMAH) is a 501(c)3 organization that provides supplementary cloth face coverings to healthcare and essential workers experiencing shortages of PPE due to the Covid-19 pandemic. Founders initially expected the group to make about 1,000 face coverings, but by the end of August, SMAH's volunteers had made and donated nearly 60,000.

Eight-thousand-plus group members have helped 152 facilities since SMAH's inception. One of these members is Shelley Wunder-Smith, a member of ISyE's communications team, who serves as SMAH's communications director during her off hours. Her duties largely involve managing SMAH's creative team and assisting with strategic planning for the organization. She also responds to media requests, develops blog posts, and edits all external documents for the organization.

Twelve ISyE students also have volunteered to assist with the organization, including Maya Menon, a third-year student, and Nithya Koganti, a fifth-year student, who are working with Wunder-Smith on social media. The remaining 10 students have addressed the group's supply chain issues to create a smoother operation.

When asked what she has learned from this experience, Wunder-Smith said, "Go where the important work is happening, and give yourself to it. Sometimes that means you don't get to do the thing you're best at. Sometimes that means you find a new way to do that thing. Sometimes you find that the thing you're actually best at is being willing to give yourself where you can help. Because if the work is really important, you don't have to be. Because it's not about you." ▪ VICTOR ROGERS

LINDSAY SWEENEY

Alumnus Joins GeorgiaALIVE in Support of Public Health, Managing Pandemic Response

Bird Blitch (IE 1997) has long been interested in improving healthcare operations, to the point that he co-founded Patientco, an Atlanta-based payment technology company that works with healthcare systems to provide patients with an easier and more affordable billing strategy. So when the Covid-19 pandemic hit Georgia in mid-March, it was natural for Blitch to join the steering committee of GeorgiaALIVE, an organization founded to protect Georgia's public health while fostering economic growth.

GeorgiaALIVE is currently focused on driving awareness of public safety protocols, ensuring resource availability, supporting innovation efforts related to the prevention and treatment of Covid-19, and testing for the coronavirus. For example, the organization has initiated a social media and billboard campaign that encourages Georgians to wear face coverings for the health and safety of others. Through an online exchange with nearly 400 listings, GeorgiaALIVE has also connected suppliers and buyers of Covid-19 resources.

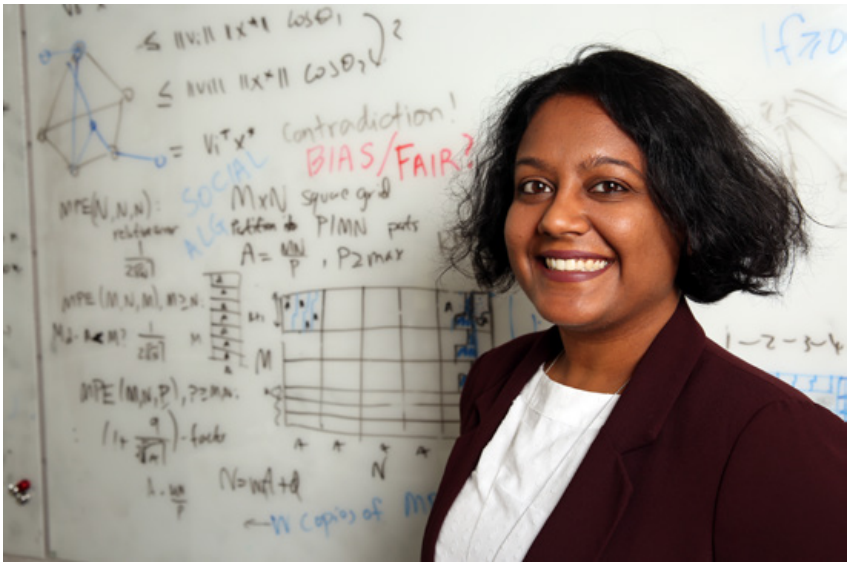
"One of GeorgiaALIVE's initiatives includes sourcing and distributing masks for health systems and others in need. By aggregating, organizing, and connecting supply and demand data across Georgia, we make it easier for businesses to receive and offer help as we battle the pandemic," said Blitch. ▪ SHELLEY WUNDER-SMITH

DARPA Awards $9.2 Million Grant to Interagency Team Researching Quantum Computing

Quantum computing is a young, exciting field in computer science. Experts hope that its powerful processing capabilities will help the world solve increasingly complex problems.

To explore these new possibilities, the U.S. Defense Advanced Research Projects Agency (DARPA) has awarded several high-value, multi-stage grants. One such grant has gone to interagency group OPTIQ (Optimization with Trapped Ion Qubits). Led by the Georgia Tech Research Institute (GTRI), OPTIQ is a collaboration with Georgia Tech, Oak Ridge National Labs, and the National Institute of Standards and Technology. Creston Herold, senior research scientist in GTRI's quantum systems division and head of the measurement branch, is the lead primary investigator (PI). Swati Gupta, an assistant professor in the H. Milton Stewart School of Industrial and Systems Engineering, is the Georgia Tech PI. DARPA has given OPTIQ up to $9.2 million over a four-year period for its investigations.

"Our OPTIQ team is going to explore special-purpose quantum hardware tailored to solving combinatorial problems like Max-Cut, as well as to show what's called 'quantum advantage,' — i.e., quantifiable advantage over specific instances of such problems where quantum hardware can outperform classical algorithms," explained Gupta. Max-Cut is one of the most famous NP-hard problems that arise in operations research applications. Researchers have been attempting to solve it for over five decades using classical computers.



CANDLER HOBBS

A faculty member in one of the foremost optimization departments in the country, Gupta is particularly interested in examining how challenging problems in classical optimization can be solved by quantum computing.

"This program is really a race between classical and quantum models of computation. This means that we need to identify blind spots, i.e., identify the really hard problem instances, for classical methods that can be improved by current quantum hardware," she said. "This will give us an opportunity to find barriers for classical optimization and develop a deeper understanding of what makes problems solvable classically."

The OPTIQ team will build quantum hardware based on trapped ions to run combinatorial optimization problems, like Max-Cut, and benchmark its performance against the best classical optimizers.

Gupta continued, "What particularly excites me about this project is the opportunity to think beyond the classical model of computation that has paved the way for algorithmic design for decades, and to look for new computational primitives that might change the face of computation, as well as train a new generation of researchers who are adept at both classical and quantum techniques."

Quantum computing has promising applications in pharmaceutical discovery and faster scientific simulations, as well as revolutionizing artificial intelligence and the search for new materials. The OPTIQ team is looking forward to the potential insights that may be generated by bringing together quantum physicists and optimization experts. ▪

SHELLEY WUNDER-SMITH

Pascal Van Hentenryck and Interdisciplinary Team Model Risk-Aware Use of Natural Energy Sources

As U.S. power grid operators increasingly incorporate natural sources such as solar and wind into their energy mix, they must grapple with the irregular supply of such resources. In contrast, while conventional energy resources such as natural gas and coal contribute to climate change, they are advantageous in their predictability. Grid operators have been able to accurately forecast their supply and demand for decades, resulting in reliable power availability for their customers.

In order to find a way to manage the intermittency — or stochasticity — of natural energy sources that introduce additional risks and uncertainties into energy supplies, the U.S. Department of Energy has awarded a three-year, $3.25 million grant to an interdisciplinary team led by Pascal Van Hentenryck, A. Russell Chandler III Chair in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE). The team also includes the Department of Civil and Environmental Engineering at Vanderbilt University and the Midcontinent Independent System Operator (MISO). Their project, "Risk-Aware Market Clearing for Power Systems" (RAMC), will examine how to assess and minimize risks when integrating renewable sources of energy, and how to advance stochastic optimization, machine learning, and their integration to meet the challenges of incorporating substantial shares of renewable energy in the generation portfolio.

Van Hentenryck is particularly enthusiastic about working with

MISO. The RAMC team will begin by learning from six years' worth of operational data from MISO, which has a large and complex power system that stretches from Minnesota to Louisiana and incorporates numerous wind farms. The collaboration is also unique in that MISO has a strong research team that has already been actively working to solve the challenges of using natural sources of energy.

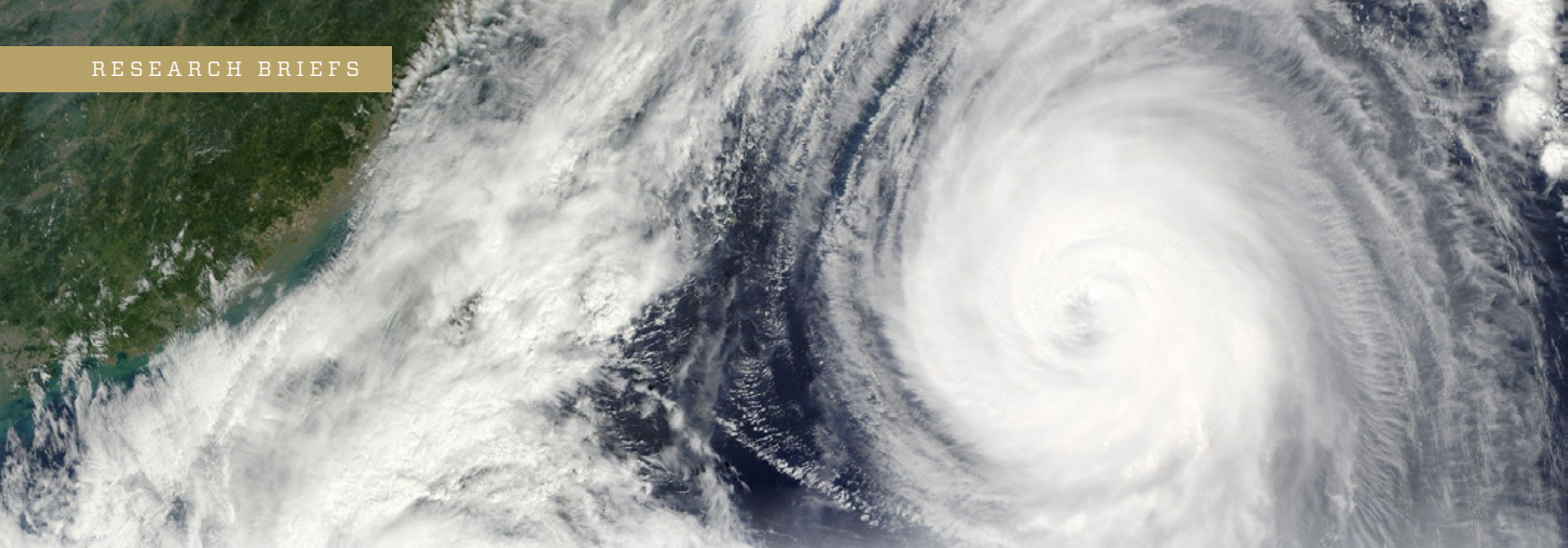
"MISO is one of the most innovative transmission operators in the U.S.," Van Hentenryck said. "This partnership means that the research will be driven by real models and data, and will evaluate, with high fidelity, the impact and benefits of the optimization models the RAMC team creates."

The Vanderbilt team brings decades of experience in risk assessment, which will be an integral part of the paradigm shift needed to address the increased stochasticity in load and generation. The goal is to transfer, adapt, and expand risk models from the financial industry and other engineering disciplines.

The group from ISyE includes A. Russell Chandler III Professor Roshan Joseph, Anderson-Interface Early Career Professor and Associate Professor Andy Sun, and Coca-Cola Chair in Engineering Statistics Jeff Wu, as well as undergraduate, doctoral, and postdoctoral students. They are specifically looking at how to solve the stochastic optimization problems arising in MISO's real-time operations. Their high dimensionality, and the real-time constraints, raise fundamental challenges in computational statistics, stochastic optimization, risk assessment, and machine learning.

"The entire RAMC team brings a distinctive multidisciplinary expertise," Van Hentenryck noted. "It is only through the tight integration of these fields that we can hope to overcome the computational barriers."

Accurate modeling of supply and demand for wind and solar is also a boon for consumers and national security interests, lowering costs and reliance on energy providers outside the U.S. Ultimately, the RAMC team intends to generate scalable solutions that can be adopted by other grid operators in addition to MISO. ▪ SHELLEY WUNDER-SMITH



Rebuild Supply Chains for Quicker Hurricane Recovery

Alleviating suffering more effectively in the wake of hurricanes may require a shift in relief strategies, says a committee report by the National Academies of Science, Engineering, and Medicine.

In the immediate aftermath, relief agencies rush in survival supplies like water, food, medicine, and blankets. But instead of prioritizing and maintaining the relief supply chains, restoring a normal supply infrastructure could help more people more quickly. That's the first recommendation from over 125 pages of case studies and analyses, issued by an eight-member National Academies committee that included Pinar Keskinocak, William W. George Chair and professor in the H. Milton Stewart School of Industrial and Systems Engineering.

Following a hurricane, mangled homes and roads, contaminated water, and shortages of everything compound suffering. The report noted that restoring supply lines, primarily within the private sector, would accelerate recovery — but relief efforts can unintentionally conflict with that.

"Relief supply chains inevitably compete with regular supply chains, given limited resources such as transportation. If the focus is primarily on pushing relief supply rather than restoring infrastructure and supply chains to normalcy, we may unwittingly delay recovery and prolong the aftermath," said Keskinocak, who is also director of Georgia Tech's Center for Health and Humanitarian Systems.

In 2017, after hurricanes Harvey, Irma, and Maria (Maria killed over 3,000 people), the Federal Emergency Management Agency (FEMA) assigned the National Academies to make recommendations on improving relief response. "We spoke to stakeholders in affected areas — local governments, businesses, health systems, and more. We learned about the impact of storms on their community, what their participation was in the response process, and what went well and not so well," Keskinocak said.

Challenges to coordinating resource allocation, especially the logistics, have hindered recovery. This led to the report's other major recommendations.

"Areas where hurricanes may strike need to get a good understanding of how supply chains work under normal conditions along with their vulnerabilities, or weak links, so they can be proactive in strengthening supply," Keskinocak explained.

Disaster preparedness requires collaboration among government, relief agencies, and the private sector. All sectors would benefit from learning about supply chain dynamics and sharing public-private partnership best practices.

"After a big storm strikes, it is typically not possible for any one entity to handle it all alone," Keskinocak said. "Organizations such as FEMA could play the role of a convener to ensure various organizations collaborate, coordinate, and share information well ahead of time and in the aftermath."

The report recommends a focus on preparedness rather than post-disaster response. This could help alleviate situations in which FEMA marshals ample supplies but then finds that these supplies are not needed or cannot be effectively distributed to those in need.

"I have the utmost respect for what FEMA does because they have to work under the most difficult circumstances, and these conditions may put them into binds that are out of their control," Keskinocak said. "More preparedness on the ground could help get FEMA, local governments, private sector, and nongovernmental relief agencies to achieve synergies for saving lives and alleviating suffering." ▪ BEN BRUMFIELD

ISyE Team Places Third in National ARPA-E GO Competition

A team led by Anderson-Interface Early Career Professor and Associate Professor Andy Sun in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) placed third out of 27 teams in the first round of the U.S. Department of Energy's (DOE) ARPA-E Grid Optimization (GO) Competition. The team also included A. Russell Chandler III Professor Santanu Dey and three Ph.D. students — Amin Gholami, Kaizhao Sun, and Shixuan Zhang — advised by Sun.

For the competition, the DOE devised a series of challenges to develop software management solutions for intricate power grid problems to create a more reliable, resilient, and secure American electricity grid.

Decades ago, the national electricity grid was dominated by large, centralized power companies, but in recent years the grid has been broken up into smaller units held by individual power companies, such as Georgia Power.

"All these individual units make coordination, and thus reliability, harder to achieve," Sun explained. "And then if you factor in sustainable energy sources like wind and solar, that also introduces uncertainty, all in an industry where 100% dependability is key. So the goal of the GO Competition was to devise sophisticated software solutions that improve overall grid reliability. This is a problem that industry experts have been trying to solve since the 1960s."

For competition purposes, the DOE provided blind data sets pulled from actual power grids — blind because of security risks. The 27 teams then created algorithms to make the grids operate as efficiently as possible, which was not a simple task.

"To design an algorithm, we had to have some theoretical understanding of the problem and its constraints," said Zhang. "The theory is one thing, but trying to provide code that is robust and resilient to bugs or failures is another. We spent a good bit of time debugging our code and testing the algorithm as extensively as possible on our own server."

Sun praised the Ph.D. students' work. "They've done a fantastic job," he said. "Their task was to build a robust piece of software from scratch in a very short time period. Shixuan, Amin, and Kaizhao took on the responsibility of doing the coding and testing."

The next steps involve further testing of the algorithm and evaluating the economic impact it could have on energy systems. Sun's team will participate in a second challenge round. The top 10 teams share a $3.4 million prize, which is to be used to further develop their respective approaches and pursue industry adoption of their technologies. ▪ SHELLEY WUNDER-SMITH

"The goal of the GO Competition was to devise sophisticated software solutions that improve overall grid reliability. This is a problem that industry experts have been trying to solve since the 1960s."

ANDY SUN

Data Analytics Are Key to Baseball Star Michael Guldberg's Athletic, Academic Pursuits

GT ATHLETICS

Michael Guldberg has a knack for numbers. Just glance at his stat line as a three-year member of the Georgia Tech baseball team.

He has a .374 career batting average and 119 hits in three seasons — only one of which was a full season. After battling injuries in his first two seasons with the Yellow Jackets, he was off to one of the best starts in team history when it comes to batting average.

Over the course of his athletic career in Atlanta the numbers followed Guldberg, leaving no secret as to why he was drafted in the third round of the Major League Baseball first-year player's draft by the Oakland Athletics in June 2020.

But it's not just the numbers on the field that resonate with Guldberg, who was a student in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE). Early in his academic career at Georgia Tech, he took a programming with Python class (CS 1301), a requirement for the major. For the first time he came across programming languages and data analytics, and the dots between academics and athletics instantly connected.

Since then, Guldberg's interest has grown. In the summer of 2019, unable to participate in baseball workouts because he was still recovering from an injury, he accepted a data scientist internship with Terbium Labs in Baltimore. There, he worked in dark web data monitoring, using Python scripts to scrape the dark web to identify credit card or identity fraud.

Back at Tech, Guldberg eventually declared data analytics as his ISyE concentration — a natural route for a baseball player who, throughout his career, will encounter a vast repository of data.

Data analytics as a field has become almost synonymous with baseball. From the use of sabermetrics to charting impacts of infield shifts to decision trees that identify the probability a pitcher will throw a certain pitch in a given count, the numbers in the sport are endless — a perfect hook for a player interested in the field.

"I kind of understand it on both sides," Guldberg said. "More so on the baseball side, and I'm working to understand it on the back end now too.

"Every game we have a hitter's meeting beforehand, and that's the time we use to watch video and see their sprays of where they throw pitches and how often. What I like is getting more into the analytics side, seeing the trees of an 0-0 count, then 0-1 or 1-0 the other way. You can see how pitchers attack hitters and alter your approach in response."

Guldberg said that he could see himself working as a data analyst or in a front office for a major league team down the road.

"I think that's kind of right up my alley to be honest," he said. "The more I get educated and play baseball and am around it, it seems like a good direction to go in."

Guldberg has both the athletic and academic backgrounds for it, having been named a First-Team Academic All-American last year. He is only the fourth Georgia Tech baseball player to receive that honor.

After his baseball career comes to an end, of course. And that may be a ways down the road yet. ▪ DAVID MITCHELL

To learn more about ISyE's undergraduate concentration in data analytics, read the story on page 49.

ISyE Grad Raianna Brown Performs in Super Bowl Halftime Show

She's a full-time engineer and consultant — and a professional dancer who performed on one of the world's biggest stages in February.

Raianna Brown auditioned to dance at Super Bowl LIV in Miami just a few months after she earned her bachelor's degree from the H. Milton Stewart School of Industrial and Systems Engineering. And after being selected as part of an elite cadre of performers, the work began.

"We rehearsed for about a month," Brown explained. "It was definitely one of the best dance experiences I've had. Working with this team has taught me so much about large-scale performances and how to truly put on a show to be seen around the world." It's estimated that 102 million viewers tuned in to the game.

While this might be the biggest stage yet, Brown is used to performing in front of a crowd.

She danced with Georgia Tech's Goldrush and was a mainstay on the sidelines at Georgia Tech football and basketball games.

"I really feel like that prepared me to perform in Hard Rock Stadium," she said.

Georgia Tech also primed her with the skills she needs to keep up with an incredibly hectic schedule. When she's not dancing professionally, Brown is head of software development at CMB Global Partners, a consulting firm in Atlanta. On any given day, she could be splitting her time between coding and choreography.

"My time at Tech really prepared me for how to balance my career and dance," Brown said.

She's also thankful for the support she has received from the greater Georgia Tech community. Aside from being featured by the official Instagram account (@instagram) during the Super Bowl, Brown also got a shoutout from her former college.

"They used my hashtag I started, #WhoSaysEngineersCantBeDancers, and that really meant a lot to me." ▪

STEVEN NORRIS

Brown prepares to dance with Shakira on the biggest stage of her career during the Super Bowl Halftime Show.

Faculty Awards, Appointments, and Promotions

FACULTY AWARDS


Dave Goldsman

Professor Dave Goldsman was chosen as an INFORMS Fellow for 2020. Fellows are selected for outstanding lifetime accomplishments and contributions to the field of operations research (OR) and analytics, and it is one of the highest honors in the OR profession. Goldsman is also director of master's programs in ISyE.

His research interests include simulation output analysis; statistical ranking and selection methods; and medical and humanitarian applications of OR. He has published extensively with over 75 articles in journals such as *Management Science*, *Operations Research*, and *IISE Transactions*. He has co-authored 20 book chapters and three textbooks. Goldsman has also served as associate editor for *Sequential Analysis* and *The Journal of Simulation*, among other journals.


Renato Monteiro

Professor Renato Monteiro was awarded the 2020 INFORMS Computing Society (ICS) Prize. The ICS Prize is given annually for the best English language paper or group of related papers dealing with the OR/computer science interface. It is one of the most prestigious honors bestowed by ICS. Monteiro's co-recipient is his former student, Sam Burer (Ph.D. 2001). In announcing the 2020 award, ICS referenced Monteiro and Burer's "pioneering work on low-rank semidefinite programming."

This is Monteiro's second time receiving the award, making him one of the few researchers to win it more than once. He initially received the ICS Prize in 2001 with co-recipient Yin Zhang.

Monteiro's research interests lie in continuous optimization and complexity of algorithms — both the theory and applications. This balanced research focus has led to major contributions in the field of continuous optimization, most notably in interior point algorithms and low-rank methods for solving large-scale linear and semidefinite programs.


Arkadi Nemirovski

John Hunter Chair and Professor Arkadi Nemirovski was elected to the National Academy of Sciences (NAS). In announcing his election, the NAS commended Nemirovski for "outstanding contributions to foundational mathematics."

NAS membership is a widely accepted mark of excellence in science and is considered one of the highest honors a scientist can receive. Nemirovski was accepted into the National Academy of Engineering (NAE) in 2017 and is one of only two faculty members at Georgia Tech to hold both honors. He is also the first mathematician in the NAS to specialize in optimization.

Nemirovski's research focuses on optimization theory and algorithms, with an emphasis on investigating complexity and developing efficient algorithms for nonlinear convex programs, optimization under uncertainty, applications of convex optimization in engineering, and nonparametric statistics.


Alexander Shapiro

A. Russell Chandler III Chair and Professor Alexander Shapiro was elected to the NAE Class of 2020. Election to the NAE is among the highest professional distinctions accorded an engineer. In announcing Shapiro's election to the prestigious organization, the NAE commended him for "contributions to the theory, computation, and application of stochastic programming."

Shapiro researches stochastic programming; risk analysis; simulation-based optimization; nondifferentiable optimization and nonsmooth analysis; sensitivity analysis and optimization of queuing networks; sensitivity analysis of nonlinear programs; and multivariate statistical analysis.

Coca-Cola Chair in Engineering Statistics and Professor C.F. "Jeff" Wu received the Class of 1934 Distinguished Professor Award, Georgia Tech's highest honor given

to a faculty member. The award recognizes outstanding achievement in teaching, research, and service. Instituted in 1984 by the Class of 1934 in observance of its 50th reunion, it is presented to a professor who has made significant long-term contributions that have brought widespread recognition to the professor, to his or her school, and to the Institute.


C.F. "Jeff" Wu

Wu also received Sigma Xi's Monie A. Ferst Award. This national-level award, sponsored by Georgia Tech's Sigma Xi chapter, recognizes those who have made "notable contributions to the motivation and encouragement of research through education." Wu joins just a handful of Institute faculty members who have been so recognized since the award's inception in 1977. Wu is considered a visionary in engineering statistics. During a 1997 lecture he popularized the term "data science," which is now used worldwide. He was the first academic statistician elected to the NAE, and he has received almost every award in the field of engineering statistics. He is also the only person in statistical sciences to have received all three of the following awards: the Committee of Presidents of Statistical Societies (COPSS) Presidents Award in 1987, the COPSS Fisher Lecture in 2011, and the Deming Lecture in 2012.

Assistant Professor Rachel Cummings was awarded a CAREER grant from the National Science Foundation (NSF). The CAREER grant is the NSF's most prestigious award in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization.


Rachel Cummings

Cummings studies a parametrized privacy notion known as differential privacy. It provides a mathematically rigorous bound on the amount of information leaked about an individual by performing an analysis on a data set that contains that person's information. Differential privacy has quickly become the gold standard for privacy-preserving data analysis.

Georgia Power Professor Nagi Gebraeel received a Student Recognition of Excellence in Teaching: Class of 1934 Award from Georgia Tech.

Professor of the Practice Ron Johnson received the Educational Leadership Award at the Black Engineer of the Year Awards Gala.

Academic Professional Jon Lowe, who leads ISyE's academic advising office, received the 2020 Institute of Industrial & Systems Engineers Southeastern Region Faculty Advisor Award.

Assistant Professor Siva Theja Maguluri received the CTL/BP Junior Faculty Teaching Excellence Award from Georgia Tech's Center for Teaching and Learning (CTL) and BP America.

Lecturer and Advisor Damon P. Williams received a Student Recognition of Excellence in Teaching: Class of 1934 Award from Georgia Tech.

FACULTY APPOINTMENTS

Professor Santanu Dey has been appointed associate chair for graduate studies (ACGS) and to an A. Russell Chandler III Professorship. The professorship was endowed by A. Russell Chandler III (IE 1967) to enhance the ability of ISyE to attract and retain eminent teacher-scholars.

Dey's research focuses on non-convex optimization and mixed-integer linear and nonlinear programming. His research is partly motivated by applications of non-convex optimization arising in areas such as electrical power systems, the petroleum industry, and logistics. The professorship will help further his work in these areas.

In his role as ACGS, Dey provides direction and oversight for all ISyE graduate students and programs, with a specific focus on doctoral programs.

UPS Professor of Logistics Alan Erera has been appointed associate chair for research, which is a new position within ISyE's leadership structure. Prior to this appointment, Erera spent six years as ISyE's ACGS.

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ISyE Welcomes New Faculty






Top row: Jing Li, Nick Sahinidis, Lauren Steimle
Bottom row: Shihao Yang, Brandy Ball Blake, Parisa Yousefi Zowj

Professor Jing Li joined ISyE in August 2020. Prior to coming to Georgia Tech, she was a faculty member at Arizona State University and is co-founder of the ASU-Mayo Clinic Center for Innovative Imaging. Her research develops statistical machine-learning algorithms for modeling and inference of medical image data, and fusion of images, genomics, and clinical records. Her research outcomes support clinical decision-making for diagnosis, prognosis, and telemedicine for various conditions affecting the brain, such as brain cancer, post-traumatic headache and migraine, traumatic brain injury, and Alzheimer's disease. Her research has been funded by the National Institutes of Health, the National Science Foundation (NSF), the U.S. Department of Defense, and industries. Li is an NSF CAREER awardee. She received a Ph.D. in industrial and operations engineering and an M.A. in statistics from the University of Michigan, and a B.S. in civil engineering from Tsinghua University.

Inaugural Gary C. Butler Family Chair and Professor Nick Sahinidis joined ISyE in August 2020. Prior to this appointment, he was a professor of chemical engineering and director of the Center for Advanced Process Decision-Making at Carnegie Mellon University and a faculty member at the University of Illinois at Urbana-Champaign. Throughout his career, he has pioneered algorithms and developed widely used software for optimization and machine learning. Sahinidis' research won the INFORMS Computing Society Prize in 2004; the Beale-Orchard-Hays Prize from the Mathematical Programming Society in 2006; the Computing in Chemical Engineering Award in 2010; the Constantin Carathéodory Prize in 2015; and the National Award and Gold Medal from the Hellenic Operational Research Society in 2016. He is editor in chief of *Optimization and Engineering* and a fellow of INFORMS and the American Institute of Chemical Engineers.

Assistant Professor Lauren Steimle joined ISyE in January 2020. Her research interests include operations research and data analytics with applications to decision-making in medicine and public health. Her work has focused on sequential decision-making, decision-making under uncertainty, and computational optimization including Markov decision processes and stochastic programming. She uses these methods to inform decisions related to the prevention and treatment of diseases and chronic conditions. She received an NSF Graduate Student Research Fellowship and was a member of the third-place team in the *New England Journal of Medicine*'s SPRINT Data Challenge. She earned her Ph.D. and M.S.E. in industrial and operations engineering from the University of Michigan, and her B.S. in systems science and engineering from Washington University.

Assistant Professor Shihao Yang joined ISyE in August 2020. Prior to joining Georgia Tech, he served as a postdoctoral researcher in the Department of Biomedical Informatics

at Harvard Medical School. His primary research interest is using big data to solve real-life problems focusing on three perspectives: methodological development, computational tools, and probabilistic modeling. He has developed methods for infectious disease prevalence forecasts, and built a tailor-made matching method to study cancer immunotherapy with electronic health data. He also introduced a new method for parallelizable Markov chain Monte Carlo and another fast approximation method for inference in dynamic systems. He received his Ph.D. and A.M. in statistics from Harvard University, and his B.Sc. in actuarial science from the University of Hong Kong.

Brandy Ball Blake joined ISyE as director of professional and technical communication in August 2020. In this role, she coaches ISyE students on writing, presentations, visual design, and data visualization for Senior Design and Cornerstone Design classes. Blake also researches perceptions of engineers in culture and how those perceptions shape the way they communicate.

Parisa Yousefi Zowj joined ISyE in August 2020 as a lecturer. Her research focuses on developing multi-resolution analytical tools including wavelets and autocorrelation shells for signal and image processing with applications in medical decision-making. She has also been working on Bayesian methods for modeling genetic consequences of the transatlantic slave trade. She is currently an ISyE teaching fellow.

Faculty Awards, Appointments, and Promotions

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In his new role, Erera will work with the School's faculty members to develop and sustain their research programs. This will include identifying new research opportunities and fostering relationships with funding agencies, foundations, and industry. He will also work to coordinate research efforts with other Institute units and will look for opportunities for ISyE faculty to join or lead interdisciplinary efforts.

Professor Dave Goldsman has been appointed director of master's programs. In this role, Goldsman will oversee ISyE's master's degree programs in industrial engineering, operations research, health systems, statistics, and computational science and engineering. This includes supervising recruitment and admission of master's students, monitoring their progress, and helping deal with other issues as they arise.

Professor Roshan Joseph has been appointed to an A. Russell Chandler III Professorship, which was endowed by A. Russell Chandler III (IE 1967) to enhance the ability of ISyE to attract and retain eminent teacher-scholars. Joseph's research covers the broad areas of applied and computational statistics. A major focus of his research is developing novel statistical methods for solving complex engineering problems. He also has several years of consulting experience in solving quality-related problems in industries. The professorship will help strengthen and advance his research in these areas.

Professor Alexander Shapiro has been appointed to an A. Russell Chandler III Chair. The A. Russell Chandler III Chair endowment enhances ISyE's ability to attract and retain eminent teacher-scholars to a position of academic leadership in industrial and systems engineering. Shapiro's research interests focus on stochastic programming, risk analysis, simulation-based optimization, nonsmooth analysis, and multivariate statistical analysis. This appointment will help develop and support Shapiro's work in these areas.

Prior to this appointment, Shapiro held an A. Russell Chandler III Professorship.

A. Russell Chandler III Chair and Professor Pascal Van Hentenryck has been appointed associate chair for innovation and entrepreneurship, which is a new position within ISyE's leadership structure. In this role, Van Hentenryck will lead the development of "blue sky" initiatives, foster and nurture a culture of innovation and entrepreneurship, facilitate translational research, and build strategic partnerships for ISyE.

Early Career Professorship Appointments

- Assistant Professor **Swati Gupta** — Fouts Family Early Career Professorship
- Assistant Professor **Siva Theja Maguluri** — Fouts Family Early Career Professorship
- Assistant Professor **He Wang** — Colonel John B. Day Early Career Professorship

FACULTY PROMOTIONS

Yajun Mei has been promoted to professor.

Fall 2019 Capstone Expo Winner: Team Sky's the Limit

From left: Afreen Fahad, Valerie Cristobal, Madison Messier, Kelsey Keith, Priya Sharma, Mack Hathaway, Thomas Suh, Carolina Llerena, and ISyE School Chair Edwin Romeijn

Out of 143 teams from seven schools and two colleges at Georgia Tech, including 23 teams from the H. Milton Stewart School of Industrial and Systems Engineering (ISyE), an ISyE Senior Design team took home the prize for best overall project for the Fall 2019 semester. This is just the second time an ISyE team has received the top Capstone award.

The winning team, Sky's the Limit, worked with Delta Airlines In-Flight Services. The project examined Delta's distribution network to consolidate warehouse inventory and optimize trucking. The team evaluated how Delta stores and transports in-flight materials that get packed for flights, such as pillows and snacks. Team members discovered that these items were stored in a range of warehouses and were delivered by partially filled trucks. They found that reducing warehouse operational costs and increasing truck utilization would result in significant yearly savings of 17%.

From left: Emily Kornegay, Brandon Kang, Yihua Xu, Yunsang Kim, Daniel Alayo-Matos, Mayke Vercruyssen, Hailun Chang, Peyton Skinner, and A. Russell Chandler III Chair and Professor Alexander Shapiro (advisor)

Fall 2019 Best ISyE Project at Capstone Expo and Best of ISyE Senior Design Winner: Team Authority Life

Team Authority Life, which worked with the Georgia World Congress Center (GWCC) Authority, not only took home the Capstone prize for best ISyE project but also won the ISyE Best of Senior Design Competition.

The GWCC hosts around 300 events in Atlanta annually and is transforming its business model to a data-driven assessment of profitability on a per-event basis. The Senior Design team developed and implemented three models to achieve this goal: a rooms-to-event assignment optimization model, a cost prediction model, and a profit margin classification. The team also designed a web app to integrate the three models. Through this new integrated data-driven approach, the GWCC Authority's annual profits are projected to increase by about $1.1 million.

Fall 2019 Finalist: Team Ocsic

The team worked with Cisco Systems to maximize recovery value from returned products, which was achieved by introducing a new mathematical model to allocate products to channels based on expected profit; consolidating inventory to facilitate its reallocation between channels; and enabling e-commerce retailers to serve as alternative remarketing channels. Implementing these steps would increase profit by 40% for fiscal year 2019, reduce scrapped products by 12.7%, reduce average inventory by 18.4%, and avoid sending 6,350 pounds of material to a landfill.

Team members: Kenneth Bassett, Kyle Brown, Jayanth Chintham, Nicholas Franco, Mustafa Gharaibeh, Eleana Padilla, Seong Hwan Park, and Erik Pulido, and Director of Student Services Dawn Strickland (advisor)

Fall 2019 Finalist: Team PIVOT

The team worked with PIVOT, a manufacturer of carts and kiosks for food and beverage vendors. Demand for PIVOT's products has increased rapidly, but an essential resource — skilled manufacturing employees — is in short supply. To satisfy increasing demand, the team designed a production system that utilizes lower-skilled employees in the complex assembly process and created tools to help execute it. Once implemented, the improvements doubled system throughput and decreased labor costs by 16.7%.

Team members: Walid Abdi, Jacob Carlton, Sunny Chen, Renee Desprez, David Guo, Mara Hayes, Rizwan Khan, and Chloe Kim, and Associate Professor Anton Kleywegt (advisor)

Spring 2020 Senior Design Results in Tied Winning Teams

Despite the spring semester's challenges ensuing from the Covid-19 pandemic, which included all classes at Georgia Tech moving to 100% online instruction and cancellation of the semiannual Capstone Expo, 30 Senior Design teams from ISyE successfully completed their projects.

ISyE still held its Best of Senior Design competition — virtually via BlueJeans — on Tuesday, April 28. Over 300 people attended the event, at which three teams presented their projects for Buffalo Wild Wings (BWW), GWCC, and Plasmaxis (Kinaxis). Teams GWCC and Kinaxis tied as winners.

Both teams also gained national recognition in the Institute of Industrial and Systems Engineering Capstone Award Competition. Kinaxis made it into the top 10 teams and GWCC was one of the top three finalists.

From left: Benjamin Espy, Erin Abbott, Elena Buter, Sahana Subramanian, Abhita Moorthy, Toral Kadakia, Kiran Gite, and Caleb Tysor (not pictured: Associate Chair for Undergraduate Studies and Associate Professor Chen Zhou, advisor)

Spring 2020 Best of ISyE Senior Design Winner: Team GWCC

The GWCC team's project, "Waste Diversion System Design," created solutions for its client that will have a significant environmental impact. The project diverted 13% of waste from the landfill in 2019; standardized processes and incentive-based fee structures can increase diversion to 45%. Using a custom web application, GWCC can predict conference waste hauls, track conference charges, and reward sustainable conferences. The waste operation can improve from a 7% loss to a 20% profit. The 32% increase in waste diversion saves the equivalent of 3,054 tons of CO_2 and creates a roughly $473,000 impact on the local recycling industry.

Top row, from left: Maria Yagnye, Yash Babulal Lunagaria, Osman Ghandour; middle row, from left: Alice Pagoto, Aniruddh Hari; bottom row, from left: Brice Edelman, Nosrat Chowdhury (not pictured: Professor Emeritus Leon McGinnis, advisor)

Spring 2020 Best of ISyE Senior Design Winner: Team Kinaxis

The team, with a project named "Plasmaxis: Plasma Production Planning," partnered with Kinaxis, a supply chain planning software company, to improve the efficiency of a major biopharmaceutical manufacturer's global supply chain for plasma-derived therapeutics. The team developed an optimization model that plans plasma fractionation into "pastes," an intermediate product in the manufacturing system. This model was integrated into a software tool for use by the client's production planners. The improvements will save the client an estimated $4.5 million annually and allow it to deliver lifesaving medication more rapidly to those in need.

Spring 2020 Finalist: Team BWW

The team worked to improve BWW's beer selection strategy. It implemented demand forecasting and streamlined the product selection process to increase profit and generate the most profitable monthly product mix on a store-by-store basis. The proposed system, which can be utilized at any BWW location, observed a $30,000 average annual increase in profit per store and reduced the product selection process time from six months to two weeks.

Team members: Diego Granizo, Ashwin Haritsa, Selin Karaoguz, Philip Murray, Katie Neil, Wilson Pu, Katie Wah, and Andrew Yowell, and Virginia C. and Joseph C. Mello Professor Nicoleta Serban (advisor)

Carving My Own Path

My name is Yassin, and I will be graduating in May 2021. As a first-generation college student, I ensured that my course of study would both provide support for my family and unite my passions. I seriously considered a variety of fields, but there has always been something especially captivating about the way STEM tickles my brain. To me, these disciplines strike the perfect balance between objective rigidity and creative expression, because even though the goal of STEM work usually involves the use of quantitative benchmarks, the methodologies and tools created to achieve those targets are as diverse as any traditionally artistic endeavor.

I chose to study industrial engineering at Georgia Tech because the applicability of systems analysis offers a limitless array of work opportunities, and it has always been my preference to open doors of possibility rather than take a narrower approach. My confidence in this choice was confirmed during my Senior Design semester in which my fellow students' teams engaged with a plethora of industries. My own team's project focused on the manufacturing and warehousing processes of LW Scientific, a medical device company. Our efforts to improve the efficiency with which laboratories and hospitals receive lifesaving equipment affirmed that my greatest passion is to serve people in medical need. Because of this, I chose to pursue an additional degree in biology to better understand medicine from a scientific perspective.

I am passionate about all aspects of healthcare, but I am most excited by the role of physician. And although the health professions are not a typical path for an industrial engineering student, many aspects of industrial engineering directly parallel medical care.

> **"I chose to study industrial engineering at Georgia Tech because the applicability of systems analysis offers a limitless array of work opportunities."**
>
> YASSIN WATSON

Both disciplines necessitate evidence-based decision-making. In industrial engineering, we begin work by collecting data that is then repeatedly analyzed using statistical methods until a reasonable conclusion can be reached. Similarly, a physician's treatment decisions are backed by medical literature, which is itself a vast collection of numerous individual instances of strikingly similar procedures. Researchers collect information before and after introducing a change to a physiological system in order to understand how the body is affected by a stimulus.

In addition, a systems-level perspective is essential in both fields. A core tenet of industrial engineering is that any change made to a subprocess will invariably affect every other part of its larger process. Likewise in medicine, the body functions as one complete anatomical structure, and even though a patient may have multiple conditions that seem disparate, each directly contributes to overall well-being.

Healthcare is a vitally essential field at the continually expanding forefront of scientific understanding and technological advancement. In combining both of my undergraduate majors, I plan to pursue a master's degree in health systems before applying to medical school. With a strong background in the analysis of health systems and the science that underlies medicine, I aspire to be a physician who carries a holistic view of the industry I serve. ▪ YASSIN WATSON

Yassin Watson completed his ISyE degree and social justice minor with high honors in 2019 and will finish his biology coursework and anatomy and physiology minor in May 2021. The recipient of numerous awards, Yassin has participated in several research projects that include studying Alzheimer's disease, experimental design in biology education, and facility planning in the wake of Covid-19. He serves as a Healthy Jackets peer educator, diversity ambassador, and president of Tri-Beta Biology Honor Society, among many other activities. Yassin will begin his master's degree in health systems at ISyE in August 2021.

Program Enhancements

Due to the increasing demand in both industry and academia for professionals well-versed in machine learning and data analytics, ISyE has created two cutting-edge curricula enhancements for its students: a Ph.D. program in machine learning and an undergraduate concentration in data analytics.

Machine Learning Ph.D. Program

In response to the rapidly increasing use of machine learning in the workforce, Georgia Tech has developed the machine learning (ML) Ph.D. program. An interdisciplinary degree, the program offers classes within the colleges of Computing, Engineering, and Sciences. "With the growing need for research and students with this expertise, it was very important to create a dedicated educational program for this particular field," explained Yao Xie, ISyE associate professor, Harold R. and Mary Anne Nash Early Career Professor, and associate director of the Center for Machine Learning at Georgia Tech.

The multifaceted program provides hands-on training and course flexibility to prepare students to tap the potential of machine learning. The typical ML Ph.D. student has a strong foundation in analytics and mathematical training but also can adapt, academically, to many different subjects.

The flexible coursework provides passionate students the opportunity to focus on what they're most interested in. Additionally, the majority of these students participate in industry-associated projects or faculty-led research projects funded by federal agencies.

"There are plenty of opportunities to work on real-life research projects that have societal and industrial impacts. This research exposure is incredibly valuable and is tightly integrated with the academic program," Xie said.

Jana Boerger, a Ph.D. student studying ML applications for logistics and supply chain management, said, "I realized early in my undergraduate education that companies don't use data as much as they could. I wanted to learn more about how to make data-driven decisions. For example, when you use a smartphone, machine learning decides what ads are going to be shown to you when you're scrolling through various social networks."

While machine learning is virtually everywhere, there is still a lot left to be discovered, and Georgia Tech is paving the way. ▪ TAYLOR HUNTER

Data Analytics Concentration

The demand for a workforce versant in data analytics continues to increase, and ISyE has responded by providing undergraduates a way to specialize and market themselves in this growing field. The analytics and data science (ADS) concentration complements the ISyE bachelor's degree by preparing students to use data science to facilitate decision-making and improve systems.

The coursework is challenging and hands-on. Chen Zhou, ISyE associate chair for undergraduate studies, noted that considerable effort was put into creating a curriculum that prepares students to stand out in the data analytics field.

Alumna Hannah Murray (IE 2020) was looking for an alternative to the supply chain engineering career path taken by many ISyE students, and she decided to try the new ADS concentration. According to her, the opportunity to study data analytics — including machine learning — as an undergraduate means an introduction to topics usually covered in advanced academic study.

"My favorite part was all of the project-based work within the ADS curriculum," Murray explained. "I got to take interesting classes that some people don't take until grad school." This exposure prompted Murray to continue her data analytics education by enrolling in Georgia Tech's Master of Science in Analytics program.

Students with this concentration often become consultants or analysts. Companies are increasingly hiring for positions that process and analyze data, so the introduction of this concentration aims to meet this need. ▪ TAYLOR HUNTER

> **"My favorite part was all of the project-based work within the ADS curriculum. I got to take interesting classes that some people don't take until grad school."**
>
> HANNAH MURRAY

Get to Know ISyE's Newest Advisory Board Members

Alexia Borden, Rita Breen, Kniffen Kelly, Kenneth Klaer, and Evan Toporek joined the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) Advisory Board in the summer of 2020.

These five, along with 15 other distinguished professional and community leaders, serve as a sounding board for the school chair in an advisory capacity and assist with the School's development goals. Each new member will serve a four-year term (2020-24). Ronda Sides (IE 1983), co-founder of Extreme Logic, was named the Advisory Board's new chair, and Scott Herren (IE 1984), CFO of Autodesk, was named vice-chair. Both will serve a one-year term in these roles.

Alexia Borden (IE 2001) is senior vice president and general counsel for Alabama Power Company, the second-largest subsidiary of Southern Company. She is both the youngest person and the first woman to hold this position. Prior to this role, she focused her legal career in environmental/natural resource issues and governmental relations. In addition to her ISyE degree, Borden holds a degree from the University of Alabama School of Law.

Who was your favorite professor?
"I had so many great professors, but I would have to say Spiridon Reveliotis sticks out as a favorite. He always had a smile on his face and brought wit and enthusiasm to applied operations and workflow."

Rita Breen (M.S. IE 1992) is executive director of charitable giving for Georgia Power and is responsible for its foundation and corporate giving programs, with a focus on the Georgia Power Foundation. Prior to this role, she served as chief of staff for the senior vice president of marketing and held management positions in customer service and marketing at Georgia Power. In addition to her ISyE degree, Breen has a B.S. in applied psychology from Georgia Tech.

What ISyE class do you still draw from today?
"Statistics has been a constant companion in my career when examining data — understanding statistical significance with data enhances one's understanding of what's working and where improvements are needed."

Kniffen Kelly (IE 1995, M.S. IE 1999) is CEO of Shebang LLC, a company that provides consulting services in transportation. Prior to starting Shebang, Kelly served as director of customer experience at Amazon and spent 16 years at UPS in various roles, eventually working with every functional business unit.

What was your favorite class and why?
"It seems serendipitous now, but my favorite class was Logistics and Transportation, taught by Professor Don Ratliff, which I took my graduating quarter. I had an instant affinity for networks — their powerful yet predictable behavior and broad applicability. After graduation, I went to work for CAPS Logistics where I worked with amazing people, learned valuable skills, and built and launched products. I couldn't have asked for a better first job out of undergrad."

Kenneth Klaer (IE 1981) is executive vice president of Comcast Cable and president of Comcast Technology Solutions, where he leads Comcast's syndication, wholesale, video platform, and ad delivery businesses. Prior to his career at Comcast, Klaer spent eight years at Cisco Systems in various leadership roles.

What was your favorite class and why?
"My favorite class was the Senior Design project where I got to work with some fantastic team members and apply some of our ISyE learnings to a very real problem. We must have done well, because I completed a co-op for the company and ultimately began my post-graduation career there."

Evan Toporek (IE 1993) is founder and managing member of Thread Ventures, an investment and advisory firm focused on helping early-stage consumer products reach their potential. Prior to launching Thread Ventures, Toporek co-owned and was the CEO of Alternative Apparel, a global lifestyle apparel brand.

What class do you still draw from today?
"Statistics. I help early-stage companies grow. The access to affordable software and analytics tools allows entrepreneurs to make informed decisions on the fly rather than simply trusting their intuition."

In Memoriam

John Bartholdi III

John Bartholdi III, Manhattan Associates/ Dabbiere Chair and professor in the H. Milton Stewart School of Industrial and Systems Engineering (ISyE) and co-executive director of the Georgia Tech Panama Logistics Innovation & Research Center, passed away on Oct. 29, 2019. Bartholdi was a respected ISyE faculty member who made important contributions to the supply chain field, particularly in warehousing and logistics.

"John Bartholdi was a valued colleague and friend," said ISyE School Chair Edwin Romeijn. "He made substantial contributions to his field, to ISyE, and to the Institute as the co-director of Georgia Tech Panama. Our sincerest condolences go out to John's family, friends, and students. He will be missed."

One of Bartholdi's most famous warehousing solutions is the so-called bucket brigade, which offers an innovative method of self-organizing order-picking for warehouse workers and has been implemented in major global distribution centers. He worked with Don Eisenstein (M.S. OR 1983, Ph.D. OR 1992; now a professor at the University of Chicago's Booth School of Business) on this research. As co-executive director of Georgia Tech Panama, Bartholdi applied his expertise toward Panama's logistical challenges, with the goal of making the country the trade hub of the Americas. In 2015, the Ministry of the Presidency designated Georgia Tech Panama as the technical arm of the Logistics Cabinet.

Regents Professor Emeritus Don Ratliff, with whom Bartholdi co-directed Georgia Tech Panama, was also Bartholdi's advisor at the University of Florida. "John was the world's leading expert on warehousing science," Ratliff said. "I encountered an executive in Peru who had never met John but told me that John was considered the father of warehousing science."

Bartholdi earned his bachelor's degree in mathematics from the University of Florida in 1968 and then completed two tours of duty in southeast Asia as a paratrooper in a Naval Special Warfare unit. He returned to the University of Florida to pursue a doctoral degree in operations research, which he completed in 1977.

Bartholdi was devoted to his family and is survived by his wife, Marian. His son, Gabriel, predeceased him.

Robin Thomas

Robin Thomas, Regents Professor in the School of Mathematics and an adjunct faculty member in ISyE, passed away on March 26, 2020. He was also director of the interdisciplinary Algorithms, Combinatorics, and Optimization (ACO) Ph.D. program sponsored by ISyE, the College of Computing, and the School of Mathematics.

"ACO is an outstanding program largely due to Robin's contributions," said Santanu Dey, A. Russell Chandler III Professor and associate chair for graduate studies in ISyE. "He cared deeply about the quality of the program. He is a role model for many of us both as researchers and as administrators. His passing is a huge loss."

In addition to his significant impact on the ACO program, Thomas was a world leader in graph theory and spent more than 30 years as a professor at Georgia Tech. He worked closely with many faculty members in ISyE and was a great friend and colleague to them and others.

"Robin Thomas was an inspiring colleague both for his mathematical work and his integrity," added Santosh Vempala, adjunct professor in ISyE and Frederick G. Storey Chair and professor in the College of Computing. "He approached research and administrative duties in the same spirit — precise, careful, complete, and always with the highest standards. As a graph theorist, he was one of the all-time greats. As a person, he was straightforward, honest, reliable, and fearless. I feel very fortunate to have known him, interacted with him, and learned from him for the past 25 years."

"He was amazing on a daily basis," added Dey. "Even when he was unwell, he was on top of everything. He was truly a 'superman' and will be greatly missed."

Thomas is survived by his wife, ISyE Professor Sigrun Andradottir, and their children Misha, Klara, and Martin.

Connect with ISyE

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Are you interested in collaborating with us? The H. Milton Stewart School of Industrial and Systems Engineering (ISyE) welcomes your engagement and offers many ways to get involved. ISyE works closely with business and industry leaders on a variety of research efforts and other projects, as well as student enrichment activities. You can also connect with ISyE through sponsorships and philanthropy that both bring the best education possible to our students and support our faculty as they tackle research issues that improve the quality of life for all.

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Since 2014, ISyE third-year **Jathan Caldwell** has been a self-taught photographer. It's not surprising, then, that his photo, "*la expression de coraje*," was selected for the Spring 2020 Clough Art Crawl (which was held virtually).

When asked about the inspiration for this photo, Caldwell explained, "There's a spark of magic when you get to absorb the distinct beauty of a family and community. Meeting Roberto when passing through La Perla, Puerto Rico, rushed with that kind of feeling as this moment took place. One minute we were chatting about his family and '*las vibras de PR*,' and in the blink of an eye, he bolted up a staircase, halted at the very edge of the building, and launched into an insane backflip. This picture embodies so much to me, but perhaps one of my favorite parts was the reverie in the expression of those watching. Maybe nothing inspires awe more than courage."