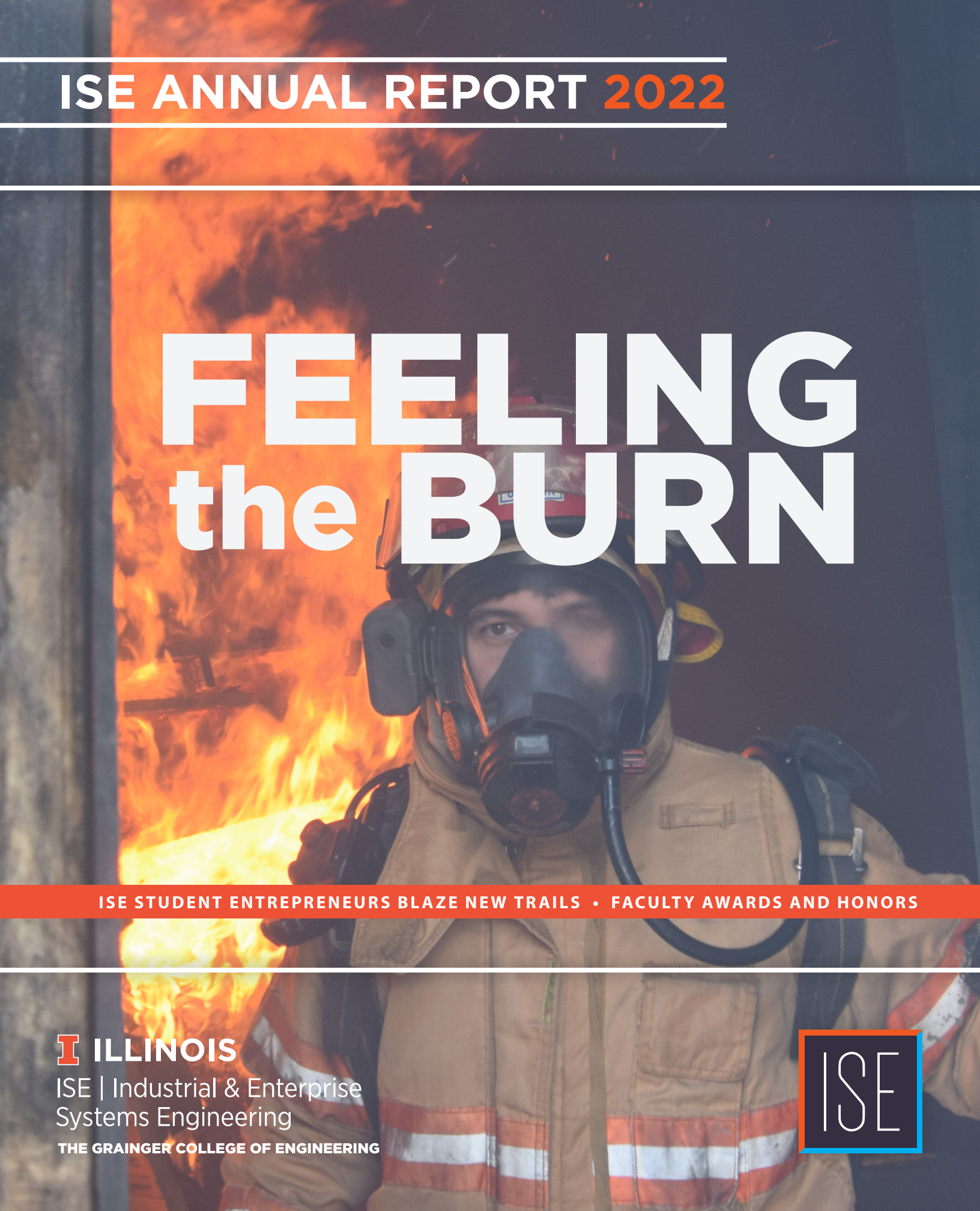
ISE ANNUAL REPORT 2022



FEELING the BURN

ISE STUDENT ENTREPRENEURS BLAZE NEW TRAILS • FACULTY AWARDS AND HONORS

ILLINOIS
ISE | Industrial & Enterprise Systems Engineering
THE GRAINGER COLLEGE OF ENGINEERING

ISE

JEFF SHAMMA

ISE Department Head
and Jerry S. Dobrovolny Chair

Welcome to the latest edition of our department's magazine. I am thrilled to share with you all the exciting developments and accomplishments of our department, students, alumni, and faculty.

Academia is a complex system that relies on the interactions and contributions of many different parties. In the field of Engineering, collaboration across disciplines is essential for success. As the head of the department, I see firsthand the importance of the roles that prospective students, alumni, peer institutions, and donors play in the functioning and success of the academic system and the engineering field as a whole.

To our prospective students, I want to express my excitement for the opportunities that await you if you choose to join our program. You represent the future of our field and the next generation of leaders in Industrial and Systems Engineering. Our program is designed to provide you with a strong theoretical foundation as well as hands-on experience through laboratory work, projects and internships, and collaboration with other engineering disciplines. We are excited to have you be a part of our program and contribute to the engineering community.

To our alumni, I want to express my gratitude for your continued support and for being a part of our department's legacy. Your experiences and successes serve as an inspiration to our current students and the engineering community as a whole. We are proud of all that you have accomplished and your contributions to the field of Industrial and Systems Engineering, and we are excited to hear about your continued successes. We encourage you to stay connected and continue to be a part of our academic and engineering community.

To our colleagues at peer institutions, I want to extend my warm greetings and express my appreciation for the collaboration and support we have shared in the field of Industrial and Systems Engineering. Your contributions help to make our academic and engineering community stronger and more diverse. We believe that collaboration across engineering disciplines is essential for success and we look forward to continuing our collaborations in the future.

To our donors, I want to express my appreciation for your support and investment in our department. Your generosity allows us to provide our students with the best education and resources possible and helps us to achieve our goals. Your contribution is essential to the functioning of the academic and engineering system and we are grateful for your support.

I hope you enjoy reading this edition of our alumni magazine and learning more about the exciting things happening in our department and the engineering community as a whole. We look forward to your continued support.

Jeff Shamma

ISE Department Head and
Jerry S. Dobrovolny Chair

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The Department of Industrial and Enterprise Systems Engineering (ISE) at the University of Illinois, Urbana-Champaign, *innovates* the engineering discipline with forward-thinking research and scientific discoveries; *serves* education, industry, and society; *educates* a new generation of leaders in general, systems, industrial, and financial engineering.

ISE Annual Report is edited by William Gillespie.

Readers, alumni, students: contact us at communications@ise.illinois.edu

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FACULTY AWARDS AND HONORS

Alexander Stolyar: INFORMS fellow

Carolyn Beck: IEEE fellow

Rasoul Etesami: Young Investigator Research Program (YIP)

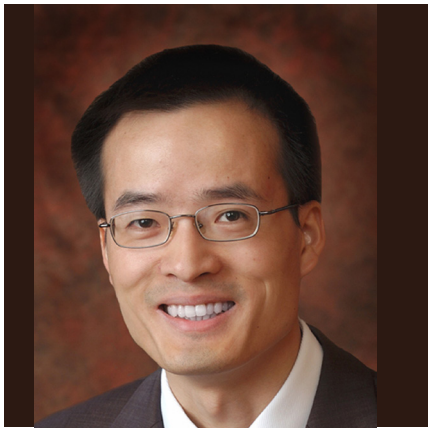
Abigail R. Wooldridge: HFES inaugural Robert L. Wears Early Career Award

James Allison: Engineering Council Outstanding Advising Award

Joe Barich: Campus Award for Excellence in Undergraduate Teaching

Jugal Garg: Dean's Award for Excellence in Research by an Assistant Professor

Molly Goldstein: Department Head Teaching Award



Liming Feng: James Franklin Sharp Outstanding Teaching Award in Industrial Engineering

Rakesh Nagi: IISE David Baker Distinguished Research Award

The David F. Baker Distinguished Research Award, the premier research award of IISE, recognizes significant contributions to the advancement of the industrial engineering profession through outstanding research activity.

Rakesh Nagi has contributed to a wide range of research areas in industrial and systems engineering. In facilities design, he has contributed to new approaches to cellular manufacturing, co-developed the field of location theoretic approaches to facility layout, and promoted the idea of integrated network/aisle and layout design. In operation of production systems, he defined a new field of just-in-time production of large assemblies and has numerous contributions in integrated production logistics and supply chain design. His NSF CAREER award on agile manufacturing and subsequent work was focused on data mining in engineering design and mass customization or variant design of assemblies. He has contributed to ISO-STEP standards in product design and information systems that keep enterprise-wide information consistent. His more recent interests have been focused on military operations research, sensor networks, information fusion, game theoretic applications, autonomy, social networks, and GPU accelerated computing for graph algorithms and large-scale combinatorial optimization.

Jugal Garg, Rakesh Nagi: INFORMS Koopman Prize Award

The winning paper is "Multi-Agent UAV Routing: A Game Theory Analysis with Tight Price of Anarchy Bounds," *IEEE Transactions on Automation, Science and Engineering*, January 2020, Vol. 17 (1), pp. 100-116.

The team studied the loss of efficiency in a fleet of unmanned aerial surveillance vehicles when each vehicle acts independently versus a fleet that operates as a centralized system, with each vehicle acting under the command of an omniscient planner. They write, "Unmanned Aerial Vehicles (UAVs) are becoming increasingly popular for information collection tasks in defense and civilian applications alike. When the collection area is large, it is not unusual that a fleet of UAVs is deployed. Routing of a fleet can be performed in a centralized or decentralized manner. Decentralized routing might be the only possibility when centralized situational awareness is not possible due to bandwidth limitations and centralized optimal routes for each UAV in the fleet are too complex to compute."

This prize was named after Bernard Koopman, a founding father of military operations research. It is awarded for the outstanding publication in military operations research of the previous year.

ABIGAIL WOOLDRIDGE RECEIVES PRESIDENTIAL MEDALLION

CHELSEA HAMILTON

University of Illinois President Tim Killeen honored 30 key leaders of the system's COVID-19 response with the Presidential Medallion, the highest honor the system president can bestow. Those honored included five faculty from The Grainger College of Engineering — Harley T. Johnson, associate dean for research and professor in the Department of Mechanical Science and Engineering, Nigel Goldenfeld, Swanlund Endowed Chair and Center for Advanced Study Professor of Physics, Sergei Maslov, professor of bioengineering and physics and Bliss Faculty Scholar, John Paul, professor of Innovation, Leadership and Engineering Entrepreneurship and chief instigator of the Rokwire initiative, and Abigail Wooldridge, assistant professor in the Department of Industrial and Enterprise Systems Engineering.

In a ceremony attended by Illinois Governor J.B. Pritzker on August 23, Killeen honored Goldenfled, Maslov, Paul and 19 other University of Illinois at Urbana-Champaign leaders behind the development of the SHIELD test-and-trace system and subsequent organizations created to expand use beyond the system's universities. Also honored were the leaders of clinical trials for vaccines at the University of Illinois Chicago and a mass-vaccination effort at UIC that has inoculated hospital staff and patients, students, faculty and members of the public. On August 27, Killeen honored Johnson and Wooldridge for their key roles in the development of a prototype laboratory to process COVID-19 tests as part of the SHIELD test-and-trace system developed at UIUC and mobile labs now deployed around the country by Shield T3, a system-related organization created to provide the tests outside Illinois.

"I have never been more proud than I am today to recognize these colleagues and their leadership," said Killeen, awarding the first Presidential Medallions in his six years as president. "Their ingenuity and dedication and the hard work of thousands of their colleagues across the U of I System have saved lives on our campuses, in the surrounding communities and well beyond. Their efforts have demonstrated in real time what the U of I System means to the people of Illinois and ensured that our response to the pandemic has been unlike that of any university system in the world. These initiatives are reflective of the power of the U of I System as a real force for innovation, positive change and the public good.

Pritzker praised those honored for their service to the state of Illinois and its residents.

"In our fight against COVID-19, the efforts of the University of Illinois System have been a real asset to millions of Illinoisans," Gov. J.B. Pritzker said. "That begins with the successful effort last year to keep campuses open to the more than 90,000 students enrolled at U of I System universities. But it extends to the tens of thousands of people who found access to life-saving vaccines in the Chicago area, students at universities and community colleges who have been protected by the SHIELD test and this fall to students at more than 1,000 K-12 schools around the state who will be protected by access to SHIELD. I am deeply grateful to the leaders being honored here today and to the thousands of others who have been part of the U of I System's aggressive and ongoing response to the pandemic."

The Presidential Medallion is given to recognize individuals who support and bring distinction to the U of I system, enhancing and accelerating its ability to deliver on its mission in profound ways. The award is bestowed solely at the discretion of the president. ●

JEFF SHAMMA RECOGNIZED AS THE JERRY S. DOBROVOLNY CHAIR

WILLIAM GILLESPIE

On October 13, 2022, Jeff Shamma was formally recognized as the Jerry S. Dobrovolny Chair in a warm investiture ceremony attended by faculty, staff, and family.

Shamma joined the ISE faculty as professor and department head in January 2021, but the pandemic and other urgent matters caused the ceremony to be delayed until this year.

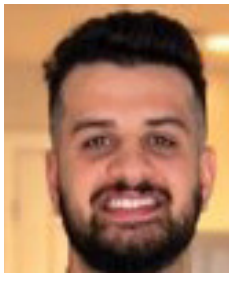
Speakers included Dean of The Grainger College of Engineering Rashid Bashir, Interim Vice Chancellor for Academic Affairs and Provost Designate William Bernhard, and Associate Dean for Undergraduate Programs for The Grainger College of Engineering Jonathan Makela.

Also present were Jerry Dobrovolny's children, James and Janet. Janet Dobrovolny gave a detailed speech that provided a touching overview of her father's legacy.

The Jerry S. Dobrovolny Chair was established in 2016 to continue Jerry's legacy at ISE. Jerry Dobrovolny received an MS in Mechanical Engineering in 1948, and secured an academic position in General Engineering Drawing, overseeing its transition to the Department of General engineering in 1953. Jerry served as General Engineering Department Head from 1959 to 1987. His achievements as Department Head are myriad. In 1960, Dobrovolny created a Summer Science Training Program (SSTP) for high school students that had finished their junior year. SSTP was a six-week summer institute of Illinois for 40 outstanding high school students. He launched the ISE Senior Engineering Program in 1961. This program was possibly the first senior engineering program ever implemented, since emulated by engineering schools across the country. In 1969, Dobrovolny started the first Minority Introduction to Engineering (MITE) program, a two-week program aimed at preparing minority high school students for college. MITE served as a model for colleges throughout the United States. Dobrovolny chaired a number of senate committees, including the Military Education Council, for seven years. From 1986 to 1992, he served on the NROTC Association of Schools and Colleges Executive Committee which advised the admiral overseeing the NROTC program. Throughout his career, he accumulated over 90 engineering awards.

Shamma's prior academic appointments include faculty positions at the King Abdullah University of Science and Technology (KAUST), where he is an Adjunct Professor of Electrical and Computer Engineering, and the Georgia Institute of technology, where he was the Julian T. Hightower Chair in Systems and Controls. ●

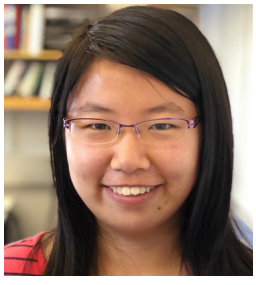
NEW ISE FACULTY



Yatharth Dubey

Avinash Gupta

Grani Hanasusanto



Yingying Li

James Rehg

ISE is delighted to have five new faculty members (so far) joining in 2023.

YATHARTH DUBEY

Yatharth Dubey will join ISE in Summer 2023. He is currently a postdoctoral researcher in the Tepper School of Business in Carnegie Mellon University.

Yatharth received his PhD in Operations Research from Georgia Tech in 2022. His research area is Large Scale Discrete Decisions, or, in Dubey's words, "strengthening our understanding of the algorithms that allow us to make large-scale discrete decisions—in particular, the algorithms underlying state-of-the-art mixed-integer linear programming (MILP) solvers."

Dubey's recent honors include the INFORMS George Nicholson Student Paper Prize Finalist (for "Branch-and-Bound Solves Random Binary IPs in Polytime"), the Alice and John Jarvis Student Paper Prize Winner (department-wide), and an ARC-TRIAD Fellowship.

AVINASH GUPTA

We are excited to welcome Specialized Teaching Assistant Professor Avinash Gupta to Illinois, ISE, and The Grainger College of Engineering. Avinash specializes in AR/VR for smart healthcare and surgical training. He will be supporting the MS in Health Technology (a joint effort between ISE and our friends in Applied Health Sciences), and collaborating with the Health Care Engineering Systems Center. Professor Gupta brings experience in industry as well as a doctorate from Oklahoma State. About his publications, Gupta says: "My research focused on the exploration of HCI-based approaches in designing simulators in the healthcare context (surgical training and covid nurse training). I have also served as a part of research teams involved in the design of cyber-physical approaches where the virtual environment serves as a link between collaborative distributed cyber and physical components (for domains including autism, advanced manufacturing, and NASA deep space exploration)."

GRANI HANASUSANTO

Grani Hanasusanto has just arrived on campus. Before joining UIUC, he was an Assistant Professor at The University of Texas at Austin and a Postdoctoral Scholar at the College of Management of Technology at École Polytechnique Fédérale de Lausanne. He holds a PhD degree in Operations Research from Imperial College London and an MSc degree in Financial Engineering from the National University of Singapore. He is the recipient of the 2018 NSF CAREER Award. His research focuses on the design and analysis of tractable solution schemes for decision-making problems under uncertainty, with applications in operations management, energy systems, finance, machine learning and data analytics.

YINGYING LI

Yingying Li will begin at ISE in Fall of 2023, with affiliations with the Department of Electrical and Computer Engineering and the Coordinated Science Laboratory. She is currently a postdoctoral researcher in the Computing and Mathematical Sciences Department at the California Institute of Technology.

Yingying received her PhD from Harvard in 2021 in Applied Math. Her research interests include online optimal control, safe learning-based control, online convex optimization, reinforcement learning, multi-armed bandit, decentralized control, and mechanism design, with applications in smart grids, smart cities, and robotics.

JAMES REHG

James Rehg will be joining Illinois in 2023 as the new director of the Health Care Systems Engineering Center (HCESC) and Founder Professor in the Grainger College of Engineering, with joint faculty appointments in the Departments of Computer Science and Industrial and Enterprise Systems Engineering.

James is currently a professor in the School of Interactive Computing at Georgia Institute of Technology, where he also serves as co-director of the Center for Health Analytics and Informatics. His research interests include computer vision and machine learning for developmental and social psychology, autism, and robots. ●


TEAM ISE

FEELING THE BURN: PAUL COUSTON AND ASCENT INTEGRATED TECHNOLOGY

WILLIAM GILLESPIE

For about a year, Paul Couston's mom was concerned that he wasn't going to finish his Systems Engineering degree. Paul's undergraduate education had been interrupted by his having co-created a start-up, Optivolt, that was so successful he had to leave school to co-manage his venture. This alone was already a remarkable story of how the ISE curriculum, the U of I entrepreneurship ecosystem, The Grainger College of Engineering, and determined college students succeeded at business. Optivolt, with its other co-founder, Rohit Kalyanpur, a graduate of ECE, is still growing and adapting.

But the story continues. Paul left Optivolt, returned to campus to finish his degree, and, after processing the successes and failures of his time at Optivolt, applied the lessons learned to a new idea. Chief among his lessons of how to succeed at business was his revelation that the U of I entrepreneurial ecosystem is world-class, the alumni network is successful and generous with their knowledge, and there just may be no better place in the world for a student to start a business than at the University of Illinois. In addition to the invaluable mentorship he received throughout the process of building the company, Paul also gets to stock his staff with the world's best new engineers and interns. He's hired 15 Grainger engineers so far. Tommy Kaufman, now their lead software engineer, entered the business while Paul's fellow ISE student.

Paul says, "University of Illinois engineers are some of the best damn engineers out there mainly because the curriculum is so draining. It hazes you. Literally it puts you in your place as an engineer... Your ego gets checked at the door.... You get used to failing. A lot. And you get used to not being right. A lot. So it forces you to iterate—a lot... And it might not teach you everything there is to know about engineering, but it teaches you how to solve problems."

He also emphasizes that in addition to problem-solving, business, and communication, at ISE he learned teamwork, in part out of necessity. "Even when I was in school, I learned to build that dream team.... Especially with the ISE curriculum, because you get a broad exposure to all the engineering disciplines, it kind of forces you to get really good at building teams." He learned to solve problems, and the best way to solve problems is collaboratively.

Now, Paul's second student company, Ascent Integrated Technology, is leaving Champaign-Urbana, but isn't happy about leaving the community and its resources behind, but, while the U of I might be the best place in the world to have started Ascent, Chicago may be a better place to *scale* it. Chicago, for example, has major airports.

Another important lesson Paul learned from his time at Optivolt, this one about what *not* to do, pertains to the importance of what might be called "design thinking" or "user-centered design". It doesn't really matter what you call it, you could even call it "common sense," but the idea is to make the end-user a participant in the design process in order to optimize the product for those who will use it. The alternative is *designer-centered design*, which might be lead to a really good idea, or legit revolutionary tech, but unless it's useful, comfortable, accessible and affordable to the user, it won't succeed.

"If customers and end-users are not involved in that development process, it's not a development process," says Paul. "We were really smart engineers who built really cool stuff, but we didn't really leave the lab to go talk to the customer."

During his second shift as an undergrad, Paul was already at work on his next venture. Working for the iVenture Acceleration Program, mentoring his fellow undergrads, Paul met fellow mentor and entrepreneur Alex Gorsuch. Alex was also an entrepreneur looking for a new venture. The two bonded over their mutual desire to start a second company, their familiarity with the very helpful Small Business Innovative Research (SBIR) program, and their experiences doing business with the Department of Defense. Alex was an expert in defense tech and LowSWPC (Low Size Weight Power and Cost Sensor Integration); his previous businesses involved miniaturizing sensors and making them strong enough to withstand hostile (or "austere") environments with low cost and power requirements.

And so they formed Ascent Integrated Technology. Ascent Integrated Tech, Couston's second undergraduate start-up, aims to update the bunker gear firefighters and emergency first responders have worn for decades — including a fire-resistant hood, breathing apparatus and two-way radio — with reliable, heat-resistant sensors and GPS—specifically Simultaneous Localization and Mapping (SLaM) which will show the firefighter's location as well as altitude (which floor they're on). At the core of Ascent's endeavor is a centralized display screen that allows the on-site commander to monitor the location, safety and activities of the firefighting team in real time.

They call themselves Ascent Integrated Tech because core to their plan is that this monitor be platform-agnostic, such that their control display can integrate

Paul Couston, a University of Illinois alumnus whose company is working on creating the next generation of masks and safety sensors for emergency first responders, helps a firefighter don protective gear and Ascent sensors.

and share data with fire-fighting technology already widely in use by established manufacturers such as Motorola, Scott, MSA, Kenwood, etc.

You might consider a team of firefighters as a system of elements ordered by a controller or commander to work together to extinguish a blaze. Paul is a systems engineer, and sensors are vital to systems, so Ascent is a natural idea from a systems engineering perspective. Also, as a student in ISE, Paul had opportunities to integrate business principles into his engineering through classes such as Computer-Aided Product Realization and Engineering Law.

This upgrade to the traditional fireman's low-tech headgear may seem overdue. It may be that part of the reason sensors have not previously been implemented, beyond the problem of the temperatures they'd be exposed to, is a general reluctance of the firefighting community to fix what “ain't broke”. Because their existing protective gear does protect their lives, firefighters may have a very healthy reluctance to switch it up. And if the Ascent tech doesn't work as intended, the results could be catastrophic.

If there is resistance, uncertainty, or even distrust among firefighters about deploying new tech, Paul and Alex are meeting it head-on. (There is a quote from the industry: “The only thing firefighters hate worse than change is the way things are”.) And so, to prove their product's viability, and to talk to its users and learn their needs, Alex, Paul, and team have been visiting fire departments across Illinois, demonstrating their designs, and participating in practice burns, deploying their gear in real (controlled) fires, going so far as to enter the burning buildings themselves using the lifeline of their tech, proving their commitment to their product's safety through a real-life trial-by-fire. During these tests they provide barbecue and spend time with the firefighters, really trying to listen to what they need.

A key partner in this process has been the University of Illinois's Illinois Fire Service Institute. IFSI has a great training facility not far from the Research Park where Ascent was headquartered. IFSI has a spectacular burn site (though it is unfortunately off limits to gawkers) and provided much assistance to Ascent in testing and perfecting their product.

A firefighter's helmet carries the prototype set of front facing sensors as the team tests out their equipment.

An Ascent engineer and fire fighter monitor the situation inside the burning building.

The Shield software displays real-time data so that incident commanders can access an event real-time, tracking when an operator is in distress.

Paul Couston, co-founder and CEO of Ascent Integrated Tech, far right, explains their mission and plan to Charleston Firefighters before the test session.

Ascent has even included IFSI on federal contracts.

So far, Ascent is on track for sustainable success. The company is growing. Seven fire departments have adopted their system for a total of 100 firefighters on the platform. They've completed two rounds of financing. Ascent also recently negotiated a seven-figure contract with an Air Force fire department in Florida, the 96th Civil Engineering Squad, a deal that is promising for future contracts with firefighters, the military, and other emergency responders.

In other good news, this year Paul Couston married his classmate, ISE alumna Josie Stawinoga (now Josie Couston), turning an ISE success story into an ISE love story as well. While Paul makes a go of it as an entrepreneur, Josie is stably employed, rising through the ranks as a Program Manager at Change Heath Care. They are taking it slow, driving the same cars they did in college (Paul's 2007 Corolla has visited over 100 fire departments), and cautiously considering a future dog. Ready for marriage, they first learned to collaborate as one of Paul's aforementioned dream teams, when Josie was helping Paul stay on top of his homework while he was distracted by business.

Thanks to the U. of I.—including student groups such as Zero2One Venture Incubator, the IFSI, The Research Park, the Technology Entrepreneur Center (TEC) inckuding the iVenture Accelerator and Cozad Competition, the Gies School of Business, the Bradley Mottier Innovation Competition in Systems Engineering and the entire Illinois entrepreneurial ecosystem and alumni network—Couston, Gorsuch and team have a foothold in launching their dream, succeeding at business and maybe, just maybe, helping save lives in the process.

(With thanks to Diana Yates, UIUC) •

STUDENT ENTREPRENEUR RESOURCES AT UIUC

TECHNOLOGY ENTREPRENEURSHIP CENTER

- For all things startups. Excellent classes, people, events, and programs

COZAD NEW VENTURE COMPETITION

- An excellent pitch competition that has three months of workshopping leading to a big event with $200k worth of cash and prizes

IVENTURE ACCELERATOR

- Best accelerator program on campus for student startups—helps students go full-time over the summer to build the company over summer break and then continues over the school year

ENTERPRISEWORKS AND RESEARCH PARK

- Offer office space, events, speakers, entrepreneurs in residence, and complementary resources to help scale your venture

ILLINOIS FIRE SERVICE INSTITUTE

- Very specific to Ascent, but there are many incredible research groups at UIUC

ILLINOIS VENTURES

- Friendly team of VCs trying to help university tech startups with their first few rounds of funding

MOTTIER INNOVATION COMPETITION IN SYSTEMS ENGINEERING

- Win up to $5000 to support your business idea

GIES COLLEGE OF BUSINESS AND THE GRAINGER COLLEGE OF ENGINEERING

- Incredible student talent for interns

GOLDSTEIN'S RENAISSANCE ENGINEERING SUMMER CAMP

Teaching Assistant Professor Molly Goldstein

ELIZABETH INNES AND GARIMA SHARMA

Lorena Escamilla, Jesus Zavala, and Molly Goldstein

According to Industrial and Enterprise Systems Engineering (ISE) Teaching Assistant Professor Molly Goldstein, the idea for the brand new WYSE (Worldwide Youth in Science and Engineering) camp for 25 middle school students — Renaissance Engineering: Art, Design, and Mechatronics — came from a cardboard box. From that humble beginning, she and a pair of undergraduate students, Lorena Escamilla and Jesus Zavala, designed a virtual camp centered around two fun, hands-on, paper mechatronics activities sure to intrigue the younger students. Their goal was to pique participating middle schoolers' interest in STEM. The hope was to firmly entrench the younger students, who are at a critical age, in the STEM pipeline. Here's the story behind the story.

Because she has little kids at home, Goldstein had signed them up for an innovation camp for the summer of 2020, which hadn't happened because of the pandemic. "They mailed us this kit — this box of wonderful, wonderful, cool things. And it sat there taunting me," she admits.

Her kids, of course were frustrated, because that tempting box was just sitting there unopened. It's not that Goldstein and her husband didn't have the skills — her Bachelor's and PhD are in engineering; her husband also has an engineering degree. "We should have been able to do that," she admits. "We had no time — having three kids at home and having work. It was sitting there taunting me. And I thought, 'If we can't do this — and we love STEM activities, and we have the background for it — and we're having a hard time!'"

Their plight opened her eyes to the dilemma countless families were doubt-

lessly also experiencing. Brainstorming about it with a friend at the University of Buffalo, she predicted, “We're going to lose kids. This year is going to impact so many families who don't have time, don't have resources.” So, they started looking for ways to get kids involved in STEM, despite the pandemic. Goldstein envisioned a summer day camp, one of whose components was her mentoring undergrads who would serve as near-peer mentors to the younger students and facilitate STEM activities. “Cool undergrads, right? For so many students, our undergrads are really just role models for them to look up to.”

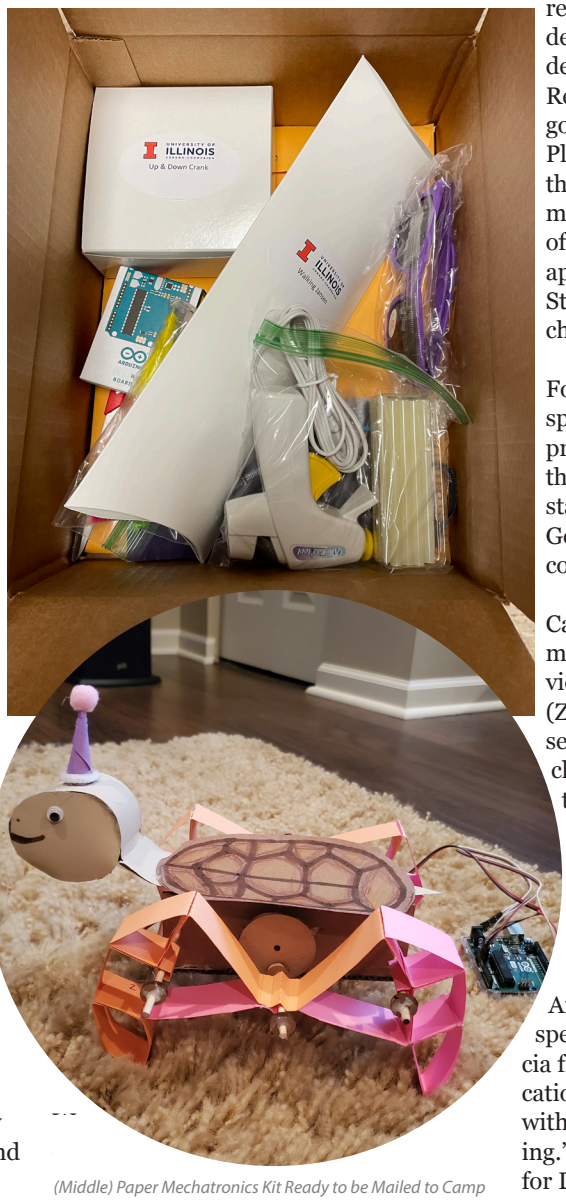
ISE rising senior Jesus Zavala shows off a finished up-and-down crank.

Goldstein, guided by passion for STEM education and a desire to inculcate her students with a love for engineering and STEM education research, decided it could be a win-win for everyone involved.

But why target middle school students? According to Goldstein, middle school literature says it's a really crucial age for a lot of underserved students, especially females. “That's an important age that we might miss them,” she explains.

So in summer 2021 from June 27 to July 1, Goldstein and her undergrads piloted an ISE camp for middle school students called Renaissance Engineering: Art, Design, and Mechatronics. And, of course, extremely apropos, the kit of materials students at home would need to build the camp’s two fun paper mechatronics gadgets arrived in a tempting, taunting cardboard box.

Regarding Renaissance Engineering, isn’t the term somewhat of a dichotomy? The two seem worlds apart. Renaissance was mankind’s emergence from the Dark Ages; engineering is the modern application of science and math to design or make things in order to solve problems. Vis-à-vis the disconnect, Goldstein would say, “No.” Embracing the concept, she says its multidisciplinary emphasis, including the arts, is something she really loves about her department: “This is kind of the Renaissance engineering major.



(Middle) Paper Mechatronics Kit Ready to be Mailed to Camp Participants. (Bottom) PaperMech Walking Jansen Turtle, a mascot for camp participant as she “came out of her shell” during the school year

sketching still. We do some programming. We have understanding and a really broad background in engineering.” She goes on to cite the perennial Renaissance man, Leonardo DaVinci, whose still relevant groundbreaking designs exemplify the notion.

The camp’s main focus on paper mechatronics involved two main hands-on activities. Students built devices comprised of gears and moving mechanisms cut out of cardboard: 1) an Up-and-Down Crank (which as its name suggests, moves up and down) and 2) a Walking Janssen, which Goldstein describes as “kind of like a crab, if you think about it. They're really feasible for middle school students,” she claims regarding their two devices. “They're not scary.”
Re the up and down crank, students got to see how the parts fit together. Plus, two Arduinos were paired with them. “So, they're learning programming,” she boasts," learning a little bit of computer science and the Procreate app, with some storytelling with it.” Students were to create their favorite characters with these mechanisms.

Following an initial lesson on perspective sketching, students began the process by drawing a design, “Because that's how the Renaissance artists started — sketching their idea…” Goldstein explains. “It's one way to communicate design ideas.”

Camp activities took place via three main platforms: 1) live sessions using video conferencing or webinar tools (Zoom); 2) “At-Your-Convenience” sessions comprised of videos, articles, and labs that students accessed through a password-protected website; and 3) Community Chat (e.g., GroupMe, Discord, Slack), accessible for any-time communication between campers, counselors, and course instructors.

Another program component included special speakers: Dr. Nidia Ruedas-Gracia from the College of Education’s Educational Psychology Department shared with students about a “Sense of Belonging.” Personnel from the Siebel Center for Design presented about storytelling

and design. Plus, Meredith Blumthal, Director for International Programs in Engineering (IPENG) shared about international travel and engineering.

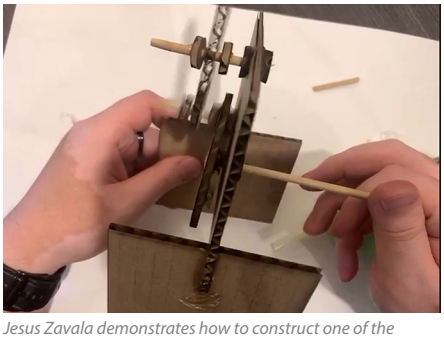
However, according to Goldstein, the camp was really driven by the undergrad students, who not only took charge of the workshops, but also provided mentorship to the students. And, while the middle school students ultimately benefitted from this learning experience, Goldstein claims the undergraduates definitely reaped rewards from the experience as well. “It's a good opportunity for the undergrad students to be doing service and in a meaningful way to them,” she explains, “which also helps them have a sense of belonging, contributing to their feeling like this is the right major for them, and that they're making big contributions.”

Goldstein’s undergrad team was comprised of two students who had taken a course with her previously. One team member was Jesus Zavala, a rising senior in ISE. Zavala signed up for the project because he had been looking for an opportunity to expand his interests a little bit — dive deeper into design. Having taken Goldstein's class a couple of years ago, even working with fellow camp instructor Lorena Escamilla on a final project there, he admits:

“I just really, really enjoyed everything that we did there, and I knew I wanted to work again with the professor. And once I found out that the research that she was doing was based on both engineering education and design, I knew I had to get involved.” According to Zavala, Goldstein’s research is a perfect meld incorporating his past experiences working with students with multi-disciplinary engineering.

Plus, Zavala hoped to expose the middle schoolers to engineering — the same kind of exposure that had given him the impetus to study engineering himself. As a kid, first, he’d wanted to be a scientist, which evolved into his wanting to be an inventor…until middle school, when he says, “I learned that I could do both, and engineering was an actual thing…That's when I centered my interests into what I potentially wanted my career to be.”

Regarding the fact that their outreach is for middle schoolers, Jesus acknowledges, “I think it's incredibly important, particularly for me, just because I was in their position at one point. I didn't really know the capabilities or the range of what engineering held, and for them to be able to express a curiosity through a physical, tangible thing is super important.” He admits that in the midst of this outreach, he’d started picturing himself in their shoes — seeing himself as a kid again and had known that he would have appreciated the opportunity just as much as the kids did. “So being able to provide it is even, honestly, more rewarding,” he adds.



Jesus Zavala demonstrates how to construct one of the mechatronics projects during a Zoom session.

Zavala’s hope for the younger students, besides learning some engineering principles through the two activities, was that they would understand the range of engineering, whether it be code design, aerospace-related things, or how machines work. “There's just so much that engineering can encompass,” he admits, and his goal was to help the students “just sort of see that it can be simplified down to electronic toys, for example. So, I think just make them feel comfortable within the space and just really express a curiosity through a variety of ways.” Adding that he was really excited to work with students in the classroom space, which COVID had put a halt on, he says it was really great to “re-immerse myself in that again.”

As might be expected, given his passion for working with younger students, his dream job is related to his two passions: engineering or possibly engineering education: “I'm kind of torn between either working for a company that designs aeronautical parts like NASA, but also, I've been around the educational space a lot ever since I was a kid,” he admits. “I think working within a maker space in Chicago, where I'm able to still work with kids and sort of stay within that kid's spirit, just sort of building up the curiosity that I also had as a kid within the STEM field would be something that I would really like to stay at. So, I still wanna be involved with that in the future.”

Lorena Escamilla exhibits the second paper mechatronic project: the Walking Janssen.

The second undergrad was rising ISE senior in Systems Engineering and Design, Lorena Escamilla, whose dream job is to be a product design engineer working with prototypes out on the west coast. The rising senior shares how she ended up in engineering. Recalling that although she was good at math and science in grade school and middle school, she claims she wasn't exposed to engineering until high school, when she started taking engineering classes. “That's why I like what I'm doing now under Professor Goldstein,” she says about the opportunity to work with younger students and teach them. “I wish I had had that exposure when I was their age.” •

ILLINIBOX WASTE-FREE FOOD CONTAINER FOR COMMERCIAL USE

JUSTIN HOLDING

During the Fall 2020 semester at the University of Illinois, University Dining Services discarded millions of containers. All of which went straight to the landfill. Every meal, students were given a plastic bag, plastic bottle, plastic clamshells, plastic utensils, and paper containers. The only thing that students might have recycled was the plastic bottle—University Recycling would not accept anything else.

This is a major problem happening all around the world. Single-Use items are used once and then discarded. 300 Million Tons of plastic is produced each year worldwide, half of which is for single-use items. 91% of all plastic isn't recycled at all.

This problem has grown exponentially due to the COVID-19 Pandemic. All meals at restaurants and at the university are packed for take-away. At the University of Illinois,8,446students were served meals every day—5,236in university housing, 1,628in Greek houses,and1,582in private certified housing. Combined, this led to over 5 Million single-use items thrown in the garbage during the Fall 2020 semester alone.

In September 2019, I discovered a solution —Reusable Containers. Reusable containers can be used up to 1,000 times and reduce the environmental impact by 96%. They are economical and a superior alternative to single-use containers. Throughout the summer, I contacted 10 other universities to research their reusable container systems. I also learned about the circular economy —where items are continuously reused instead of discarded. This all led me to start Illini Box, a strategic implementation and consulting company focused on reusable containers.

Justin Holding

Illini Box has been working to give food service providers, like university dining, an implementation plan that provides all the necessary materials and knowledge to easily start a reusable container program. By using reusable containers, dining facilities are able to cut costs and use sustainable materials. The students get a high-quality container that is leakproof and can be microwaved. It's a great solution for everyone.

During the Fall 2020 semester, I began to improve upon and grow Illini Box. I met with Alums, other entrepreneurs, and competed in competitions. I also grew my team and gained support from other students. My team first competed in 3 Day Startup, a social entrepreneurship weekend. We worked with mentors and crafted our pitch. We learned a lot and won 2ndPlace! We also participated in the Mottier Innovation Challenge. We spent months researching and finalizing our business plan. We worked with RSOs, Greek houses, and dining halls to learn how they have adapted during COVID-19. We discovered how they are providing meal service and reducing expenses to make up for lost revenue. The biggest surprise was that they all had a huge increase in trash disposal costs. This was because of the thousands of containers being discarded every single day.

After crafting a business model and having a final presentation, we placed 3rd in the Mottier Competition. We got great feedback from all the judges and mentors. Working through the COVID-19 pandemic was not easy but we utilized many resources and are ready to test our idea. Next semester, Spring 2021, we will be piloting our reusable container system in two Greek houses. We also hope to test our containers at various restaurants as well.

Identifying this problem, diving into solutions, and working to implement a solution during this semester has been an interesting challenge. I am so thankful for all the help I have received along the way. The Hoeft Technology and Management Seminar provided me many opportunities to network, learn about technology and sustainability, and get advice. I enjoyed hearing from the industry professionals that spoke about their journeys and how their companies are innovating and staying profitable. BP and Anheuser-Busch both talked about the importance of sustainability and the impact it has on their communities. I am so appreciative of the T&M Seminar and the amazing opportunities it has provided. I cannot wait to continue to grow Illini Box and eliminate single-use waste. from the U of I community, including student researchers, the Institute for Sustainability, Energy and Environment (iSEE), and the Student Sustainability Committee (SSC), among others. Holding now continues to invest time into researching the circular economy, which aims to use materials over again and eliminate waste in any way possible. •

HUMAN FACTORS AND ERGONOMICS SOCIETY STUDENT CHAPTER GETS GOLD

The Department of Industrial and Enterprise Systems Engineering (ISE) in The Grainger College of Engineering has partnered with the Department of Kinesiology and Community Health (KCH) in the College of Applied Health Sciences to form a student chapter of the Human Factors and Ergonomics Society (HFES). Congratulations to the University of Illinois Urbana-Champaign Student Chapter of the Human Factors and Ergonomics Society, recipient of the Gold Outstanding Chapter Award. •

From left to right: Megan Bayles, Tina Nie, Mimi Trinh, Maurita Harris, Prof. Wendy Rogers, Prof. Abigail Wooldridge, Kaitlyn Hale-Lopez, Carolina Carvalho Manhães Leite, Adviye Irem Yuceel.

JAMES ALLISON TAPPED FOR CONSORTIUM TO DESIGN WAVE ENERGY SYSTEMS

WILLIAM GILLESPIE

Wave Energy is renewable energy derived from oscillation of ocean waves. Like wind or solar energy, wave energy does not produce carbon emissions or greenhouse gases, and uses natural resources already in abundance.

Designing generators powered by wave energy may even have some similarities to designing for other sources of renewable energy — such as the need to provide steady output from a generator subject to the whims of the weather — but the engineering challenges for capturing wave energy are largely unique, even compared to hydro-kinetic energy derived from currents that move in a single direction, such as turbines in dams. Although techniques have been developed throughout history to design structures exposed to ocean waves, such as bridges or ships, established techniques may not apply to engineering a device meant not to resist or divert the power of waves, but instead to capture it.

Over time, the power of waves turns boulders to sand, and salt water is corrosive even at rest. How does one design a turbine that can convert the explosive, corrosive, and unpredictable oscillations of the ocean into a smooth flow of electricity?

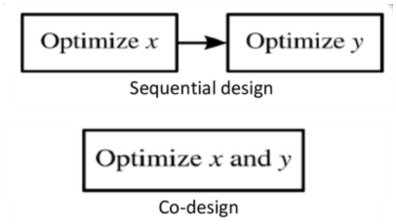
When these challenges are overcome, wave energy has very attractive potential. According to Brittanica.com, “estimates of the annual wave energy potential along the continental shelf of the U.S. coasts range between 1,170 and 2,640 terrawatt-hours, equivalent to 33–65 percent of U.S. electricity demand in 2015.” The total annual potential of wave power is estimated to be 3.7 terawatts, almost double current world energy consumption.

It's also the case that other renewable energy sources, such as wind and solar, have reached maximum capacity in some regions, underscoring the need for alternative sources. Wave energy has been shown to be non-redundant with wind and solar, making it a nice addition to a clean energy portfolio.

Designing technology for sustained wave energy collection is a challenge that has proven too daunting for investors, but the greatest minds in the world are now being brought in. Professor James Allison has been tapped by world wave energy expert Professor John Ringwood of Maynooth University, Ireland, to be part of SeaChange: an elite, international consortium of investigators tasked with designing wave energy systems that maximize the Levelised Cost of Energy (LCoE) of wave energy, which can be thought of as cost over kilowatt hours, calculated over the lifetime of the project.

The project is called SeaChange, a name that does not understate the potential importance of this renewable energy technology. It is a five-year, $860,000 project funded by Science Foundation Ireland, starting December 2022. SeaChange will employ four new Ph.D. students and one senior post-doc.

Collaborators include Dr. Jorgen Hals Todalshaug, CorPower Ocean, Sweden; Dr. Jochem Weber, National Renewable Energy Laboratory, USA; Professor Mogens Blanke, Technical University of Denmark; and ISE's Professor James Allison.



Control Co-Design.

Professor Allison has worked on ocean-based wind turbines — another unique engineering challenge in renewable energy — as well as river turbines, and is a leading proponent of the “control co-design” methodology. Control co-design is a revolutionary systems design philosophy that has emerged in the past two decades. Previously, the interface between application technologists and control engineers has been sequential: application specialists design the fundamental system dynamics, with the system then passed to the control engineers for control design. Control co-design allows the engineers creating the control system to participate fully in overall design to optimize the positioning of the control system and its relation to other systems in the design.

ISE applauds the investigators of SeaChange in their efforts to “catch a wave” and harness the wild energy of ocean currents to create a more orderly, sustainable energy system. •

EMERGING TECHNOLOGIES FOR OLDER ADULTS

COURTESY OF APPLIED HEALTH SCIENCES

The University of Illinois is part of a consortium that has been awarded a five-year, $14.7 million grant from the National Institute on Aging (National Institutes of Health) for the Center for Research and Education on Aging and Technology Enhancement (CREATE).

University of Illinois Professor Wendy Rogers — of the Dept. of Kinesiology and Community Health within the College of Applied Health Sciences — is the principal investigator for the Illinois site. Co-investigators include Raksha Mudar of the Dept. of Speech and Hearing Science, Dan Llano of the Dept. of Molecular & Integrative Physiology, and Avinash Gupta and RS Sreenivas, both of the Dept. of Industrial & Enterprise Systems Engineering. "One of the most exciting aspects of the Illinois engagement is the breadth of our involvement, representing four departments across three colleges," Dr. Rogers said. "Such interdisciplinarity is critical for advancement in technology designed to support older adults."

Weill Cornell Medicine, Florida State University, and Illinois are the lead universities on CREATE, a multi-institutional, interdisciplinary center. The research will focus on employing emerging and existing technologies to promote wellbeing, quality of life and independence for diverse populations of older adults, and to provide support for older adults with cognitive impairments.

Initially funded in 1999, the goal of CREATE is to ensure that older adults can use and realize the benefits of technology for improving daily living. Through the four previous funding cycles of CREATE, the landscape of aging and technology has changed dramatically.

"We've matured and have a greater understanding of the issues and the nature of the populations we're working with," said CREATE Director Dr. Sara Czaja, professor of gerontology in medicine at Weill Cornell Medicine. "Technology is increasingly being considered as a solution for the support needs of aging adults, and more technology products are marketed to seniors."

R.S. Sreenivas

Avinash Gupta

Given that age is a significant risk factor for cognitive impairments such as mild cognitive impairment (MCI) and Alzheimer's Disease/Alzheimer's Disease Related Dementias, CREATE V will expand its target populations to include older adults with MCI and involve three integrated cross-site projects. With a focus on enhancing cognitive health, social engagement and preventing cognitive impairment, the first study will look at how virtual reality technology can be used to foster cognitive and social engagement among aging adults.

"The large, multi-site study is unique because it will involve older adults using virtual reality in their home environments," Dr. Czaja said. It will be one of the largest randomized controlled trials of virtual reality in home settings. Preliminary development and testing will be conducted at the McKechnie Family LIFE Home on the Illinois campus.

The second CREATE V project will focus on providing support for adults with MCI, using innovative technologies to assess further cognitive decline, such as conversion to Alzheimer's disease or related dementias. "We will be collaborating with the IBM Watson Research Center to develop a speech analysis software support tool that will engage older adults in storytelling," Dr. Czaja said. The aim of the tool will be to help detect changes in cognitive status.

The third research project will focus on developing digital assistant tools to help older adults with cognitive impairments make decisions in three domains: accessing support services, managing healthcare finances, and using the health-management tools provided by Medicare.gov.

All three large-scale research projects will be conducted across sites in New York, Florida, and Illinois to collect data from a diverse population of older adults with varying characteristics. CREATE V will also include an expanded pilot research program to support new research for junior investigators.

To enhance the collective understanding of aging adults and technology interactions, Dr. Czaja and her team plan to broadly disseminate the findings, protocols and tools of CREATE V to a worldwide audience, including the research, business and design communities.

"Our specific aims are to understand how we can harness the power of technology to maintain, support and foster the emotional, cognitive and physical health of aging adults, to ultimately enhance their independence, wellbeing and quality of life," Dr. Czaja said. "These are complex issues, but it's very exciting." •

TEAM USES DIGITAL CAMERAS, MACHINE LEARNING TO PREDICT NEUROLOGICAL DISEASE

DIANA YATES

In an effort to streamline the process of diagnosing patients with multiple sclerosis and Parkinson's disease, researchers used digital cameras to capture changes in gait — a symptom of these diseases — and developed a machine-learning algorithm that can differentiate those with MS and PD from people without those neurological conditions.

Their findings are reported in the IEEE Journal of Biomedical and Health Informatics.

The goal of the research was to make the process of diagnosing these diseases more accessible, said Manuel Hernandez, a University of Illinois Urbana-Champaign professor of kinesiology and community health who led the work with graduate student Rachneet Kaur and industrial and enterprise systems engineering and mathematics professor Richard Sowers.

Currently, patients must wait — sometimes for years — to get an appointment with a neurologist to make a diagnosis, Hernandez said. And people in rural communities often must travel long distances to a facility where their condition can be assessed. To be able to gather gait information using nothing more than a digital camera and have that data assessed online could allow clinicians to do a quick screening that sends to a specialist only those deemed likely to have a neurological condition.

To conduct the study, the team videotaped adults with and without MS or Parkinson's disease as they walked on a treadmill, focusing the digital cameras on participants' hips and lower limbs. Those without the neurological conditions were age-, weight- and gender-matched with participants with MS and PD. The walking exercise also included trials in which participants walked while reciting every-other letter of the alphabet in sequence. This added task was designed to mimic the real-world challenges of walking while engaging in other potentially mentally distracting tasks, Sowers said. ●

READ THE FULL ARTICLE ONLINE:
https://news.illinois.edu/view/6367/715352095

Researchers Manuel Hernandez, left, Rachneet Kaur and Richard Sowers

MAPPING FUTURE CLIMATE COSTS FOR AIRLINES, PASSENGERS

Grainger Engineer Lavanya Marla helps build a mathematical model to calculate how much it will cost airlines to cope with rising temperatures.

When Phoenix temperatures topped 120 F in June 2017, American Airlines canceled dozens of flights at a local airport because the airplanes could not take off safely in the extreme heat. Scenarios like this are likely to become more common as a result of climate change, scientists say, but the operational costs to airlines and passengers are largely unknown.

To fill this gap in knowledge, Professor Lavanya Marla, her Ph.D. student Jane Lee and University of Michigan Professor Parth Vaishnav built a mathematical model to calculate how much it will cost airlines to cope with rising temperatures. The model incorporated historical schedule and traffic data; present-day airport design; and airline fleet composition, scheduling, and troubleshooting protocols. It used these data in conjunction with future climate projections to calculate the relative costs of different methods of responding to flight disruptions caused by higher temperatures in a warming climate.

Reported in the journal Transportation Research Part D: Transport and Environment, the model predicted substantial heat-related expenditures for airlines in 2035 and 2050, the two years analyzed. The researchers used a climate model known as RCP 8.5 in their calculations, determining the added costs for mild, moderate, and severe climate projections.

"The impact of climate change on the recoverability of airline networks"

"Lots of people over the last 15 years have looked at how aviation affects climate, but what about the reverse? What is the impact of climate on airline operations?" Marla said. "Our study found that the total aircraft and passenger costs that airlines experience today can increase, on average, anywhere from 29 percent to 49 percent."

Lavanya Marla

Hot air is less dense than cool air. Extremely hot temperatures — typically above 118 F — can affect an airplane's ability to generate enough lift to get off the ground. Smaller aircraft, in particular, may lack sufficient power to overcome this limitation and may have to offload some passengers or cargo to lessen their loads, Marla said. Airlines may switch passengers to larger aircraft or delay takeoff until conditions improve. Shorter runways also cause difficulty in generating enough lift, and airports may consider lengthening them.

Every choice can lead to further disruptions — delayed takeoffs and late arrivals, airplanes idling on the tarmac, inconvenience to passengers and crews, for example — each of which has associated costs.

"Instead of assuming a fixed capacity for an aircraft — that is, the total number of seats — we calculated how that capacity changes based on temperature and which airport you're departing from," Marla said. "And we found that passengers and airlines will be severely impacted as the climate changes."

The new model will allow airlines and airports to determine how their climate-related operational costs will compare with the cost of making strategic investments to adapt to climate change — by building longer runways, for example, or investing in more powerful airplanes, Marla said.

"We wanted to emphasize that adaptation, to some extent, will be needed," she said. "We also wanted to better understand the costs of not doing so." •

THE ISE-TO-LAW PIPELINE: STORIES AND ADVICE FROM ALUMNI

ZACK FISHMAN

The Department of Industrial and Systems Engineering prepares its students for more than engineering careers — so say a number of alumni who earned law degrees and hold various leadership positions across public and private sectors.

Carrie Zalewski

Today, Carrie Zalewski (BSGE 2001) leads Illinois' public utility regulator as the chairman of the Illinois Commerce Commission. But when she was a prospective University of Illinois student, Zalewski, who said she has "always wanted to go into law," wanted to study engineering as an undergraduate and sought advice from then-Associate Dean of the Department of General Engineering Michael Pleck. (The general engineering program is now named Systems Engineering and Design.)

"I said, 'I wanted to go to law school.' And he said, 'Well, then the obvious choice, really, is general engineering,'" Zalewski said. "And the reason is because you have a core curriculum, but then you have the ability to take an engineering and law class, and you also have the ability to take some more writing classes, knowing that I have to write a lot in law school."

After graduating in 2001, Zalewski went on to earn her law degree at the Illinois Institute of Technology's Chicago-Kent College of Law. In 2019, lllinois Gov. J.B. Pritzker appointed her to her current chairman position, a role that oversees electricity, natural gas, other utilities in the state as well as some types of transportation. Her addition to the Illinois Commerce Commission came as Pritzker was focusing on efforts to transition Illinois' electric grid to renewable energy through the Climate and Equitable Jobs Act, which passed in 2021.

Zalewski promoted engineering as a useful undergraduate degree that has granted her strong analytical skilled helped her stand out during interviews.

"When I go into interviews for various positions in my legal career, I often spend more time talking about the fact that I went to school for engineering, because that's different," she said, noting that an undergraduate engineering degree demonstrates an ability to work hard and study technical issues.

The Department of Engineering continues to offer classes and other resources for students considering a future in law. The Engineering Law class [1] (SE 400) Zalewski took is taught today by College of Law Adjunct Professor Joseph Barich, a licensed intellectual property attorney. The class, which receives high ratings from students, covers subjects ranging from contracts to labor law, environmental law, and intellectual property. And since 2014, Barich has also collaborated with the Technology Entrepreneur Center to develop and teach the class Start-ups: Incorporation, Funding, Contracts, and Intellectual Property (TE 450), which teaches students how legal tools can be used when starting and operating a business.

ISE in particular provides students with flexible curriculums and robust experience with business systems, which allows those pursuing law school to take more coursework relevant to their chosen career path.

Divya Mehta

One person who took advantage of ISE's offerings was Divya Mehta (BSGE 1999), who leads the legal department at the North American division of Finnish elevator and escalator company KONE. Mehta, who said she knew she wouldn't become an engineer but still saw value in an engineering degree, majored in general engineering and added a concentration in business administration. After working in marketing, Mehta attended law school at the University of Minnesota, Twin Cities, held jobs at and joined KONE in 2013.

"Prior to being in this role, I worked in various roles in technology and product and codes, and so it was a good combination of my technical skills and legal skills," said Mehta, who was promoted to senior vice president and legal counsel in 2020. "I found that in every single legal role that I've had is that I've used my engineering degree in some way, shape, or form by being able to understand things and how they work, and then be able to translate that into — for lack of a better word — layman's terms for people that don't have that technical degree."

Mehta advised college students that it's okay to not immediately know their career path, something that took her more time to figure out. She also recommended law school as a viable next step for some ISE students, where they can stand out among other law students with their technical background.

"No matter what you do [in law school], having an engineering degree and having that technical background helps you think differently than the masses of other students that are going to law school, which then sets you apart," Mehta said.

Another ISE alumnus, Ryan Schermerhorn (BSGE 2007), took his engineering experience and a law degree from DePaul University into the field of intellectual property (IP) law. As a partner at the IP law firm Marshall, Gerstein & Borun,

Ryan Schermerhorn

Schermerhorn primarily works in patent prosecution, in which he engages with patent offices to obtain patent rights for mechanical, medical, electrical and other kinds of inventions. Among his past clients is LuminAID, a solar-powered inflatable lantern featured on the television show Shark Tank and backed by billionaire businessman Mark Cuban.

Schermerhorn said he entered general engineering because of the broad education and the many career options it provided, and he called engineering degrees "a great stepping stone to whatever you want to do next."

"I think that an engineering degree is just a phenomenal starting point for anyone, regardless of really what you ultimately want to do, because it opens so many doors," Schermerhorn said. "Particularly the ISE program, because it has such a broad-based curriculum. … The secondary field options allow you to take classes in really anything that you're interested in." •

PHIL RYAN (BSIE 1978) HAS WON THE 2022 ALUMNI AWARD FOR DISTINGUISHED SERVICE

WILLIAM GILLESPIE

Phil Ryan (BSIE 1978) is a recipient of the 2022 Alumni Award for Distinguished Service as given by the Grainger College of Engineering. He is also the recipient of the 2019 ISE Distinguished Alumni Award.

When Phil Ryan came to the University of Illinois from Columbus, Indiana, around 1974, student life was a little different. For example, out-of-state students like Ryan were in a very slim minority. With fewer international students in attendance at that time, the student population was almost entirely Illinoisian. But Phil didn't want to go to Purdue: "I wanted to do something different."

His student experience started off on the wrong foot. He had been slow in applying for housing. At that time, the students who were too late to get a dorm room were assigned to a lounge in the dormitory. The lounge was filled with bunk beds, like an army barracks. As students with dorm rooms dropped out or changed housing, the students sleeping in the lounge were, one by one, allocated the empty beds.

Perhaps it was in part due to this rugged introduction to dormitory living that Phil embraced his next housing opportunity. According to Phil, in addition to his engineering education, the other "jewel" of his undergraduate career was life in the fraternity Alpha Delta Phi. He found his house to be a great place to live, and a successful model of "self-governance." Some of his fraternity brothers remain his closest friends to this day.

Phil had chosen Industrial Engineering as a major naturally. The origins of IE are closely tied to manufacturing, and IE in the 1970s had a "heavy manufacturing focus," according to Ryan. Phil's dad was an industrialist, and Phil grew up among conversations about industrial processes and factory visits. At that time, IE and General Engineering had yet to merge to form ISE, and IE was located in the MechSE building next door—the Transportation Building still housed the now-defunct Department of Railway Engineering. In the IE Department, Phil worked with Dick Devor and L.C. Pigage, two of the original leaders of IE at UIUC.

Despite some differences in student life, most of Phil Ryan's experiences may ring

Phil and Elizabeth Ryan

familiar to today's students. He frequented a place called Kam's (then on Daniels Street, next door to Dooleys, with a pizza place on the corner). And as an IE student, he learned engineering across disciplines, taking courses from the other major engineering departments. Ryan learned civil, mechanical, and industrial engineering—as well as problem-solving, math, and physics—and endured coursework that, later, would make the analytical part of his MBA pretty easy.

Upon graduation, Ryan worked for three years as a quality assurance engineer in the nuclear power industry. During that time, Phil got a call from a former fraternity brother who was working on Wall Street. "He said, 'I think you should look into this—I think this is something you would really get a kick out of'", Phil recalls. Intrigued, Phil went to New York City, after a stop in his home state to pick up his MBA from Kelley School of Business at Indiana University.

While at IU, Phil met his wife Elizabeth. As they resolved to become a family, they also resolved to spend some time working abroad. This stint became a 16-year odyssey in London, Zurich, and Montreal.

While managing their new, rewarding career, Phil and Elizabeth raised three kids abroad, graduating them from high schools in England and Switzerland.

For more than 23 years, Phillip held various positions with Credit Suisse, a global financial services Company domiciled in Switzerland.

He had a great time, and great timing: Ryan says, "I was there at the start of the twenty-year great bull market, and the start of the great deregulation of Wall Street… The growth was just explosive. And all kinds of things we talk about today—derivatives, swaps, merger and acquisition tactics, and parts of the capital markets (like high yield debt) didn't exist when I started"

Phil attributes his skill at finance to his engineering background. He says, "A lot of the work is like engineering. It's methodical, it's data-based, it's very pedagogical, very focused on problem solving…. I've always felt to this day that my engineering background was more important than my MBA…. [at IU]".

When his position at Credit Suisse began to feel more like sales than engineering, Ryan made the move to become CFO, where he could use his ISE education again. "With a CFO, you're back to engineering. It's processes, people, problem-solving, organization, communication… I loved it."

When he felt the time had come to stop working full time, Ryan built a portfolio of board and governance-related work and philanthropic activities. Ryan was elected Chairman of the Board of Directors of Swiss Re America Holding Corporation in October 2012. He also joined the Board of Directors of Swiss Re Ltd, the parent company of the Swiss Re Group, in April 2015, and is Chairman of the Finance and Risk Committee. Ryan was also an executive in residence at NYU Stern School of Business, and is a member of the Smithsonian National Board.

Here at Illinois, Phil is a member of the Campaign Cabinet. The Ryan fellowship in ISE, established in 2019, continues to assist multiple ISE graduate students. With the pandemic receding, Phil is pleased to finally be able to meet the fellowship recipients in person.

Above all, Phil is grateful. "I just feel exceptionally fortunate. Whether it's Illinois, being around for the twenty-year bull market, or having married a fantastic woman and had three fantastic children. I'm just a very fortunate person, and Illinois is part of that." •

READ THE FULL ARTICLE ONLINE:

ise.illinois.edu/newsroom/phil-ryan

ALUMNI IN THE NEWS

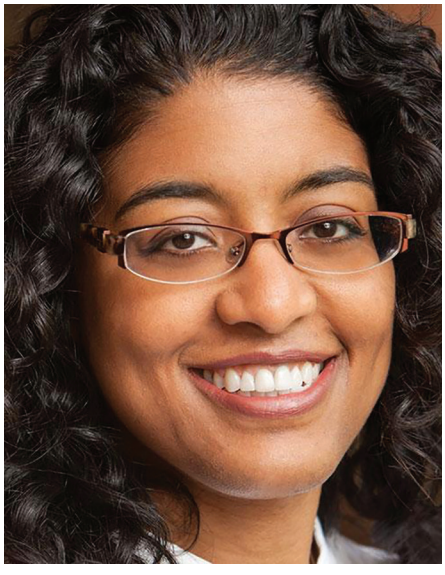
Laura Albert (PhDIE 2006), University of Wisconsin-Madison Industrial & Systems Engineering Chair, was elected president-elect of INFORMS.

Amy Doroff (BSGE 2015) received the Women in Manufacturing STEP Ahead Award from The Manufacturing Institute.

Fiona Kalensky (BSSED 2018) and Angelica Czarnecka (BSSED 2019) are both featured by mHUB as women changing the face of product development in Chicago.

ISE Alumni Board President Maria Lupo (BSSED 2009) named one of the top 25 women in technology by Mission Critical.

Joi Mondisa received the Institute for Industrial and Systems Engineering UPS Minority Advancement Award.



A documentary about Tracey Meares (BSGE 1988) has been covered by the *Washington Post*, among others.

RICHARD SYKES (BSGE 1981)

WILLIAM GILLESPIE

Empathy, compassion, the desire to listen: these things make us better citizens of the universe, but can they make us better employees, managers, or engineers? Richard Sykes (BSGE 1981) thinks these virtues may have a role to play in success as well as citizenship.

Sykes is also sure his ISE degree, with its foundation in problem-solving, had a role to play in his success as well.

In fact, some of Sykes' best memories of his undergraduate curriculum are of the foundational General Engineering 103 class. At the time, this class was taught by Professor Michael Pleck. Pleck would prove instrumental in bringing computer-aided drawing to ISE, and was working on the problem as early as 1968. However, during Sykes's time on campus in the late 1970s, to create a computer graphic you needed to walk stacks of punch cards across campus, and, according to then-Department Head Jerry Dobrovolny, another drawback was "the need to sometimes wait several days to get the graphic output generated from line drawing instructions."

Pleck taught a disciplined approach to problem solving that, by its description, was as tight as an algebraic proof. The problem-solving methodology taught by Pleck helped Sykes with his career going forward, as an engineer with Eli Lilly, and, especially, as a business consultant with AT Kearney and McKinsey and Company, Inc.

Of Pleck, Sykes recalls, "He taught us how to problem solve, and how to think logically.... taught us the discipline of writing a problem statement, writing down the information you already had, writing down what you think you needed — the analyses you needed to do or information needed to gather. And then a section to show your work, and a place to draw your conclusion. And that discipline of how you break a problem down, how you structure a problem, how you attack a problem — I remember to this day. It was certainly helpful for engineering things, but enormously helpful in the field that I eventually went into, management consulting, where that's what you do: you solve problems."

Pleck also taught Sykes and his undergraduate colleagues to draw. Sykes remembers the General Engineering students could always be identified walking across campus: "You could always tell the engineering students who would walk from the 'six pack' [Peabody Drive Residence Halls]... because we all had our T-squares hanging off the backs of our backpacks like the nerds that we were."

Beyond simple drafting, Pleck was teaching communications. He taught "how to represent things, how to actually take care with how you communicate things in written form, so it's legible, neat, concise... that was all part of it as well. It was it was a phenomenal foundational class, might have been my most influential class as an engineer."

Today, GE101 is Systems Engineering (SE) 101, taught by Molly Goldstein. Although mastering CAD software takes center stage, hand-drawing is still taught, in keeping with research that suggests hand-sketching "has cognitive benefits that cannot easily be replaced by computational tools". (Gabriela Goldschmidt) Sykes has no complaints at missing out on the CAD revolution, as he did not take to the user-unfriendly computers of the time.

Sykes also fondly remembers Professor Thomas Conry, who would serve as Dobrovolny's successor as Department Head. While Conry was Department Head, Sykes was recruiting graduates for Eli Lilly. Sykes remembers calling Conry and asking Conry to identify the best students to recruit. In return, Conry gave Sykes a kind explanation as to why he would not grant this request.

Sykes recalls, "He very patiently educated me on how things work. And he said, 'I'm not going to tell you who the five or six best students are. Because first of all, I don't know what you want them to do. So I don't know if it's a good fit. And second of all, you know, I'm kind of behind all these guys. And third of all, if you want to figure out where the talent is, you guys show up more, spend more time with the kids, do the interviews, all that stuff.' He was very patient about it, nothing nasty, but he took the opportunity to educate me a couple of years after I left the university, about how [recruitment] should work in a little more proper and professional way. And again, he didn't have to do that... he chose to take a moment to educate me even though I was no longer a student. And I appreciate that."

While he was still an undergraduate at ISE, Sykes met another person who would change his life: his future wife Peg. They met at the six-pack, when she was a freshman and he was a sophomore. They ran around with the same group of friends and started dating towards the end of that school year. Peg was studying Special Education, which she would go on to teach. Rich and Peg's oldest son Patrick graduated from Illinois in 2008, and their youngest son Michael in 2014.

Rich and Peg Sykes on the observation deck of the Burj Khalifa in Dubai.
Rich and Peg Sykes on the observation deck of the Burj Khalifa in Dubai.
At ISE, Sykes had chosen business as a secondary field option, and it would ultimately be in business consulting that he applied his problem-solving ISE skills. After seven years in various engineering and management roles at Eli Lilly's Clinton Laboratories operations in Clinton, IN — at the time the largest bulk pharmaceutical plant in the entire world — Sykes felt he had gone as far as he could without a chemistry background.

And so began career part 2. Sykes went back to school. He got his MBA from the University of Chicago's Graduate School of Business, now the University of Chicago Booth School of Business.

After Booth, Sykes started with AT Kearney, a management consultancy based in Chicago. Kearney was sold in 1995, after which he joined McKinsey and Company, Inc. Sykes helped build McKinsey's operations practice, and became Managing Partner of the McKinsey's Midwest Region, where he led over 100 partners.

He retired from McKinsey in 2017 and is now a member of the Board of Directors of Dycom Industries, where he serves as the lead director. Sykes has also sat on the board of World Business Chicago, among many other civic activities.

Rich is a good storyteller, and his list of ten things that matter is worth hearing him talk about in its entirety. The emphasis of Rich's life lessons falls repeatedly on the importance of empathy instead of self-importance, listening instead of talking. These ideas are illustrated through numerous stories, and here's one such tale from his days at Eli Lilly, fresh out of college.

One of the projects was to repipe something from there to here, and it was a quarter mile away, and, you know, lots of flows and bends and 90s and pumps and all that stuff. And so I went to work like holy heck on that thing... designed it all out... And there was a project coordinator, Don, who was the guy who was going to actually install all this stuff... I said "Don, I got the work done. And we need a four-and-a-quarter-horsepower motor, this size pump, 2-3/4-inch pipe..." And he looked at me. And he said, "Sykes, I got a five-horse motor and I got a ten-horse motor. I don't have a four-and-a-quarter, and I'm not gonna go buy one for you. And on pipe, I got two-inch or three-inch. So you tell me which one you want." And it was a great lesson. I was trying to use the skills that I had, thinking that that's why I had been hired — to get this down to the exact answer. And I had never talked to the Project Coordinator until my work was done. I should have talked to him before I started my work, and said, "I gotta go from here to there, you're gonna be the guy to build it. We're working together, you know, here's my thoughts, what're your thoughts?" I didn't do it until the end, and got a very nice lesson in how to work effectively with others.

To our graduates, Rich Sykes says, your career is a rocket — when you leave here, you'll be sitting on a rocket. You've earned a tough degree, you're ready for the challenges that await. Your Illinois education will give you velocity, so it's essential to steer accurately. So have the confidence to listen as you decide where to take your rocket. •

READ THE FULL ARTICLE ONLINE:
ise.illinois.edu/newsroom/richard-sykes

BRAD MOTTIER (MSGE 1981): A LIFE WITH LIFT

WILLIAM GILLESPIE

Brad Mottier is an avid aviator and a U of I alumnus, just like his parents before him. He's been flying on his own since he was an undergrad and owns two small planes that see a lot of use: an Aviat Husky and a Cessna Grand Caravan EX. He has flown (piloted) in every U.S. State except Hawaii, in Mexico, and coast-to-coast in Canada. Mottier has been an active pilot for over 40 years.

Mottier is also President & CEO of GE Aviation Systems, a division of GE Aviation based in Cincinnati, OH.

Mottier's career trajectory has been a continuous climb for decades, sometimes at a pitch attitude difficult to maintain in a regular airplane. Simply put, his first job after graduation was Senior Development Engineer of a small private business and as the company grew, Mottier moved into bigger roles and ultimately senior management, and then business, Unison Industries, was acquired by GE Aviation. Mottier stayed on to help integrate the business into GE, and ultimately became a Corporate Officer, leading and forming several divisions.

Brad has lift.

He also has loyalty, as demonstrated not only by his commitment to his company, but also to family, the University of Illinois, and aviation. The Mottiers are a UIUC legacy. Brad's grandfather Charles, Sr. went to Illinois (BS, Civil Engineering, 1910 and C.E., 1923), followed by his parents Charles, Jr. (BS Civil Engineering, 1947 and MS, Civil Engineering, 1948), and Audrey (BA, Physical Education, 1948), his brother Charles, III (BS, General Engineering, 1978 and Law, 1981), and his daughter Danielle (BA, French Studies, 2005). He also met his wife Jennifer at Illinois (BA, Speech Communications, 1983), who was co-captain of the Illinettes — one of

many true U of I love stories.

From his parents, Mottier took cues for more than his choice of university. His parents were also philanthropists, with his mother endowing the Mottier Family Professorship of Applied Health Sciences at Illinois. Brad Mottier himself funded the Mottier Innovation Challenge in ISE.

And his parents were also aviators.

They both served in World War II — Charles, Jr. was a US Marine in the brutal Pacific theater, and Audrey was a US Navy WAVE. When they returned to civilian life in Illinois they had a wider perspective and perhaps a certain fearlessness. Their desire to live "more broadly" was heightened by the living conditions, on and off campus, for returning vets. Their experiences in the war, especially Charles Jr.'s, did not lend themselves to small talk with other vets, most of whom had not seen combat. They wanted more. So, after graduating and getting married, they bought an airplane, though neither had a pilot's license, committed to living life on a broader scale.

They learned to fly.

Mottier grew up in a flying family and while at UIUC, he earned his pilot's license from the storied Aviation Institute. As a Master's candidate, Mottier designed an innovative angle of attack indicator for general aviation aircraft. When Mottier's graduate advisor, Professor Rodney D. Hugelman told him of

1970 Datsun 240Z Works-Spec Rally Car at Rally Show at Chatsworth House in England.

a possible opportunity at a small aviation component manufacturing company in Rockford, Illinois, Mottier rented a plane and flew to his first interview where he was hired as an engineer.

One wonders how many of the other candidates for the position flew to the interview as a pilot, but, regardless, Mottier made the right first impression.

Mottier quickly became integral to the company, which grew and was acquired by GE. But he never hung up his wings, continues to log hours as a pilot, and last month flew back to campus from Cincinnati to appear at ISE as an Engineer-in-Residence.

Mottier's second hobby is historic automobile rallying, and he's been competing for over two decades, mostly overseas.

Even in his hobby as an aviator, Mottier is a philanthropist. He regularly flies medical or mercy flights for Patient Airlift Services, shuttling cancer patients, wounded vets, and burn patients, among others, to where they can get continued care.

As Mottier is clearly excelling at work, and shows few signs of impending retirement, one might wonder how or why a chief executive chooses such elaborate and immersive hobbies? The answer may be this simple: no matter how many responsibilities you have, you can't worry about work when you are trying to land a plane in dodgy weather, or edge pass another rally car on the two-lane roads of Scotland.

"Have a hobby that requires you to focus. Get your mind off of work and other things," he recommends.
Some cognitive scientists, athletes, artists, and other practitioners refer to this immersive concentration experienced by pilots and others as "flow," or "being in the Zone." It's a state as useful for work as it is for play, and the good news is you don't need to engage in risky, expensive, or otherwise prohibitive activities to experience the benefits.

We thank Brad Mottier for his service, his support, and his wisdom on finding a work-life balance all his own. •

READ THE FULL ARTICLE ONLINE:
ise.illinois.edu/newsroom/brad-mottier-pilot

Cessna Grand Caravan EX, custom executive interior.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THE ISE 100TH ANNIVERSARY MAIN CELEBRATION will be May 3-4, 2024 in Urbana-Champaign!
Visit ISE, see campus, meet old friends, colleagues, professors! Planning is in the works for a full weekend of events. Contact Diane Steinkamp <dmsteinkamp@gmail.com> for details, and add it to your calendar now because you won't want to miss out.

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