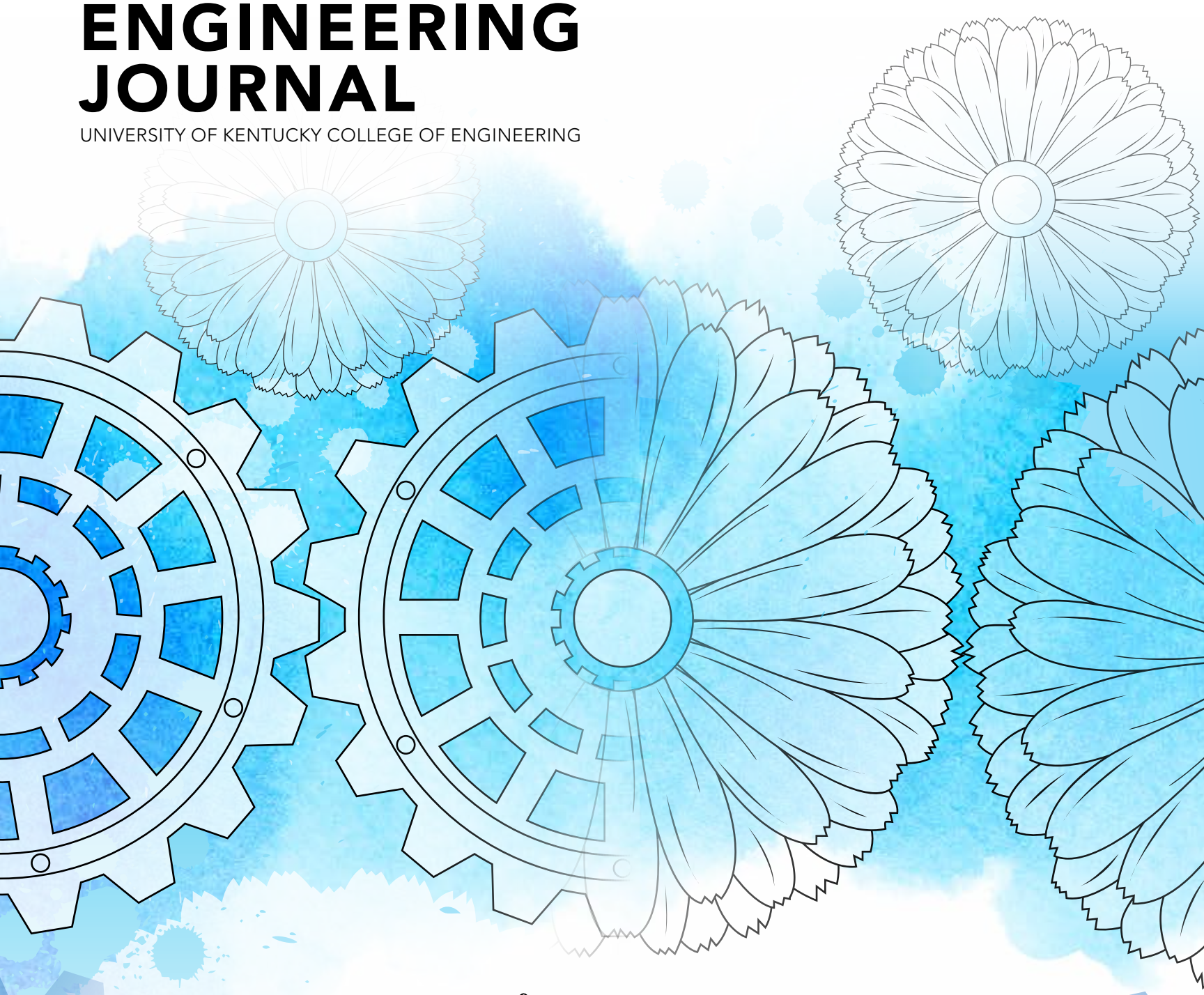
Spring 2018

KENTUCKY ENGINEERING JOURNAL

UNIVERSITY OF KENTUCKY COLLEGE OF ENGINEERING



The Beauty in

MANUFACTURING

Strengthening Kentucky's Workforce

In October 2017, Toyota Motor Engineering North America announced a partnership with the University of Kentucky to develop a unique production engineering program and fund it with a five-year, $1.25 million gift. The Automotive Production Engineering Certificate program introduces UK students to automotive manufacturing core processes and gives students access to Toyota's state-of-the-art laboratory and world-class engineers. At the same time, Toyota engineers are able to work closely with faculty and students to develop new ideas for ongoing engineering challenges.

PHOTO: GLINTstudios

> “I BELIEVE THE UK COLLEGE OF ENGINEERING IS IN A POSITION OF STRENGTH.”

MESSAGE FROM THE DEAN

This spring issue of *Kentucky Engineering Journal* gives me the opportunity to say farewell as dean of the UK College of Engineering. It has been a privilege to serve as interim dean these past two years, and I am profoundly grateful for the journey.

I have been at UK since 1991. In my 27 years, I have met outstanding students, faculty, staff and alumni. In my role as dean, I have had the opportunity to interact more broadly with our entire community, and this has helped me see the college in new ways. I appreciate the many wonderful individuals who made my experience as dean meaningful and productive.

I believe the UK College of Engineering is in a position of strength. We continue to graduate a high number of engineers who find rewarding careers. Our faculty members produce high-level research that impacts lives. Incoming students are welcomed into a tested plan for academic success that prepares them for meaningful careers. The college is positively impacting our communities through our students and our research, and we are on a path to grow that impact significantly. These are just a few of the reasons we can be proud of our college.

As you will read in this issue, the UK College of Engineering plays an important role in Kentucky’s economic growth. Since we are a college in a land-grant institution, it is gratifying to know that what we do here directly benefits the Commonwealth and its citizens.

We have attracted many outstanding candidates for the next dean; that is no surprise. Whoever the next dean will be, I wish him or her all the encouragement, insight and practical help that I received. This is a truly special place, and because of supporters like you, always will be.

Sincerely,

Larry E. Holloway
Interim Dean

College of Engineering

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STRENGTHENING KENTUCKY'S WORKFORCE

THE UNIVERSITY OF KENTUCKY COLLEGE OF ENGINEERING IS A KEY PARTNER IN THE COMMONWEALTH'S ECONOMIC GROWTH

Larry E. Holloway, Interim Dean

Kentucky has the potential to become a leading force in advanced manufacturing—an industry priority for the Commonwealth and a critical element in our state's future economic growth and prosperity.

However, Kentucky faces key shortages in its workforce, specifically engineers and computer scientists who have the training and ability to develop new products and processes, support manufacturing industries, solve technological problems and lead complex organizations.

In fact, according to a 2013 report prepared in collaboration with the Brookings Institution, only 2.6 percent of Kentucky workers were engaged in STEM occupations—one of the lowest rates in the country.

The Kentucky Cabinet for Education and Workforce Development's June 2016 "Kentucky Occupational Outlook to 2024" projects an average of more than 2,600 job openings per year in disciplines related to engineering and computer science. This means that by 2024 there will be 12,500 new positions for engineers and computer scientists, an 18 percent increase.

Without question, a motivated workforce of imaginative engineers and computer scientists would create an ecosystem for innovation and entrepreneurship and attract high-performing companies to the Commonwealth.

PRIME MANUFACTURING OPPORTUNITIES

Just look at the impact Toyota Motor Manufacturing, Kentucky, Inc. has had on our community.

In 2015, the Center for Automotive Research (CAR) found that Toyota's presence in Kentucky has created an estimated 29,700 direct and indirect jobs. The disposable income these jobs created for our economy is estimated to be $1.3 billion annually.

Last fall, Toyota partnered with UK to develop a unique automotive production engineering program and is funding it through a five-year, $1.25 million gift. This symbiotic relationship will expose our students to constantly evolving manufacturing processes and allow Toyota's engineers to interact with our students.

With several automotive and aerospace manufacturers, suppliers and many other manufacturing companies located within a 100-mile radius of the university, the college is strategically placed to create similar partnerships and promote manufacturing growth in the Commonwealth.

Our faculty's manufacturing research contributes to product and process development that promotes economic growth with an eye toward sustainability. The Institute for Sustainable Manufacturing (ISM) comprises faculty from nearly every engineering department, and its primary objective is to develop and advance sustainable manufacturing principles and practices in Kentucky, the nation and the world.

ISM's predictive modeling tools for total life cycle-based product designs reduce material/energy consumption and develop tools and practices to improve performance at the manufacturing systems and supply chain levels.

Additionally, UK's Center for Applied Energy Research (CAER) also remains committed to advancing Kentucky and the nation's manufacturing industry. CAER is a global leader in next-generation carbon fiber research and home to the largest carbon fiber spinline at any institution in North America. The center also continues its research in low-energy, low-CO2, high-value concrete products.

As for technology development, the Institute of Research for Technology Development (IR4TD) is a unique engineering research center dedicated to research, education, outreach and service. IR4TD believes companies want more than mere survival in today's economy; they want to prosper and grow. IR4TD's Lean Systems program, developed in partnership with Toyota, helps companies move toward "True Lean," for increased productivity, improved quality and reduced waste. The program helps over 100 companies a year by training more than 3,200 participants.

The college also is home to KIAC, the Kentucky Industrial Assessment Center. This program, supported through the U.S. Department of Energy, provides free energy assessments to small and medium-sized manufacturers. A team of faculty and trained students evaluates the energy use of manufacturing facilities and provides the companies with analyses and recommendations to improve energy use and reduce expenses.

No matter how the world changes, the need for high-quality, sustainable, advanced manufacturing persists. The UK College of Engineering looks forward to partnering with industry and government to make Kentucky a world leader in this vital area.

ENGINEERING EDUCATION FOR TOMORROW'S WORKFORCE

Kentucky's higher education leaders must increase their engagement with industry to produce better prepared and more experienced graduates to address our industry's technical and business problems.

THE UNIVERSITY OF KENTUCKY COLLEGE OF ENGINEERING IS DOING ITS PART BY

INCREASING ENGINEERING & COMPUTER SCIENCE **GRADUATES 65%**

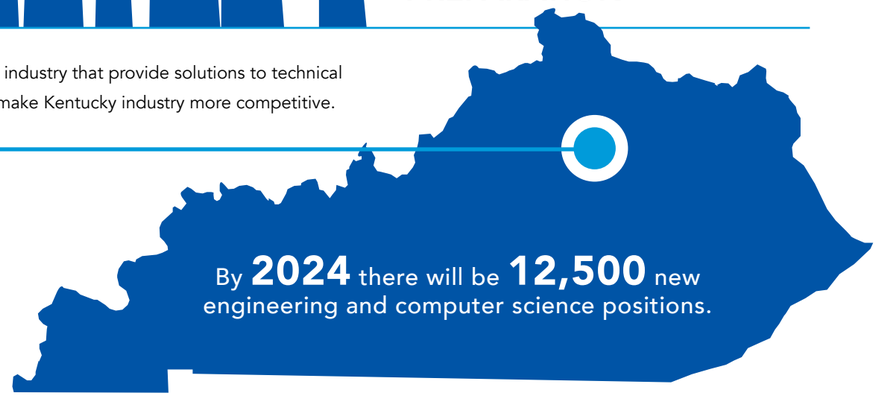
Working to increase the number of bachelor's degrees awarded in engineering and computer science by 65 percent, from 631 graduates per year (2017) to more than 1,050 graduates per year (2024). This plan for growth includes increasing the number of bachelor's degrees awarded from both our Lexington and Paducah campuses.

ACADEMIC ENHANCEMENTS

Increasing the quality of the workforce for industry through new Scholars Programs in Entrepreneurship and Leadership, as well as technical specializations such as certificates in aerospace engineering, power engineering, production engineering, environmental engineering and biopharmaceutical engineering

DEEPENING INDUSTRY-UNIVERSITY ENGAGEMENT TO IMPROVE STUDENT PREPARATION

Expanding partnerships with industry that provide solutions to technical and business problems and make Kentucky industry more competitive.



OUR INVESTMENT

We know this kind of investment will work.

A national study identified 41 potential factors in business relocation or expansion. Four of the top nine factors related to the availability of a skilled workforce with managerial and technical ability.

A 2016 report by the Centre for Economics and Business Research for the Royal Academy of Engineering found there "is evidence to suggest that a country seeking to improve performance in engineering—through increasing the number of graduates, improving infrastructure or raising employment in engineering fields—is likely to experience wider economic development as well."*

And last but not least, engineering and computer science are the top-paid majors for bachelor's degrees, according to a recent national survey.** By providing an engineering workforce that enables company expansion in Kentucky or relocation to the Commonwealth, we are attracting well-paid jobs that support our state's communities.

Through investment in our universities and smart partnerships between education and industry leaders, we can help Kentucky successfully compete in a global economy. ■

*"Engineering and Economic Growth: A Global View," a report by CEBR for the Royal Academy of Engineering, September 2016.

**NACE Salary Survey Winter 2017, National Association of Colleges and Employers.

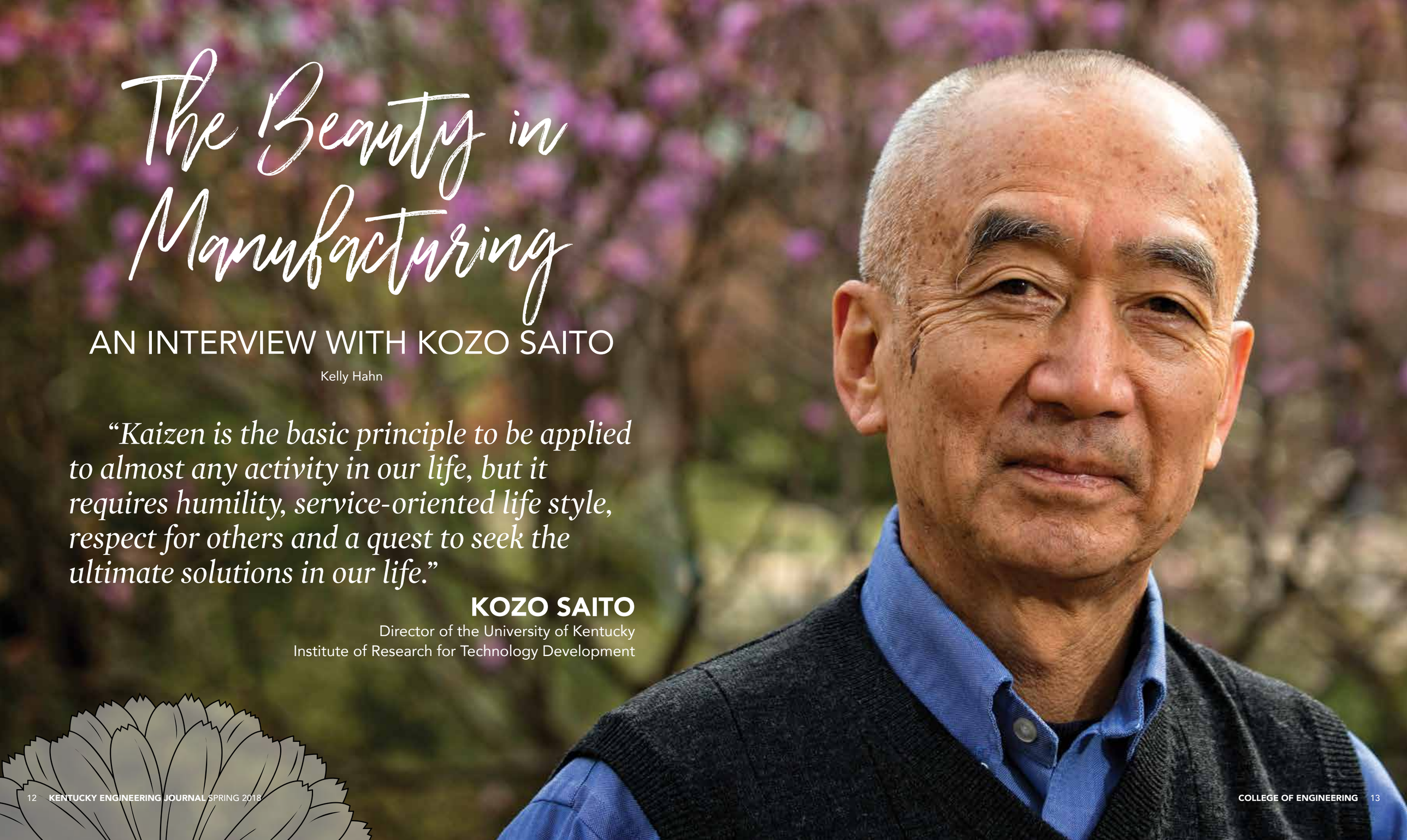
The Beauty in Manufacturing

AN INTERVIEW WITH KOZO SAITO

Kelly Hahn

"Kaizen is the basic principle to be applied to almost any activity in our life, but it requires humility, service-oriented life style, respect for others and a quest to seek the ultimate solutions in our life."

KOZO SAITO
Director of the University of Kentucky
Institute of Research for Technology Development



When it comes to understanding how the University of Kentucky College of Engineering intersects with Kentucky's manufacturing potential, Kozo Saito offers a unique perspective.

The Tennessee Valley Authority Professor in Mechanical Engineering and director of the Institute of Research for Technology Development (IR4TD) helped connect UK with Toyota Motor Manufacturing of Kentucky in the early 1990s. The result was a Lean Systems Program that continues to train hundreds of manufacturing representatives from across the country and the world every year. And, as the automotive production engineering certificate program detailed in the previous article demonstrates, the partnership between UK and Toyota is expanding.

Saito's intimate knowledge of the Toyota Production System (TPS) led him and Akinori Saito, president of the Toyota Production Systems Support Center, to collaborate on a book about Toyota and the guiding principles of TPS. In 2012, "Seeds of Collaboration: Seeking the Essence of the Toyota Production System" became the first Toyota-sanctioned book on TPS. The book contains a brief history of TPS, a collection of "Goroku"—sayings given at various times by the three founders of TPS—and interviews with UK lean systems instructors.

With UK strategically positioned to make significant contributions to manufacturing in the Commonwealth, we sat down with Saito to discuss the human side of manufacturing—cultivating creativity, finding the root cause of problems, embracing struggle, developing a mindset for improvement and more.

The word "manufacturing" tends to communicate something industrial and impersonal. But the Japanese word *monozukuri* means "manufacturing with craftsmanship, pride, zeal, history, spirit, joy and more." How is manufacturing more people-oriented than machine-oriented?

KS: The point is, who is going to make the products? People are. People decide what we make, how we make it and why we make it at all. Successful manufacturing requires teamwork. A single individual, no matter how talented and smart, can't cover all the work needed to complete the final product. So we need highly motivated and well-trained people who are given the decision-making authority to make every process and system better for the benefit of the company, his/her life and beyond.

Is it possible, then, to say that manufacturing can be beautiful?

KS: Yes, it is possible. A highly developed manufacturing system is similar to nature's way of producing things. Nature has the highest efficiency to produce things, refined by millions of years' trials. Harmony is one of the lessons that we learn from nature as the key operating principle. So if we seek a highly efficient manufacturing system, it will naturally follow nature's way of making things. As nature is beautiful and resilient, so are the harmonized activities of many individuals to achieve a final product in manufacturing.

How can manufacturing serve as an outlet for human potential?

KS: Fujio Cho, chairman of the board of Toyota Headquarters in Japan, once said, "We contribute to society by making good products in an honest, steadfast and uncompromising manner. If companies can't provide service to society, they have no reason to exist." Why does he stress the process of making products but not the final product? The answer is, a high-quality product is a by-product of the honest, uncompromising hard work done by people. The company needs to recognize and acknowledge the unlimited potential of people's talent, which can only flourish within a healthy corporate culture and supportive work environment. The company that wants to make the highest quality products must invest in people by providing continuous education and training, job security and opportunities for their career development.

One of the TPS founders, Kikuo Suzumura, stated, "When we have enough money, we tend to buy expensive high-end machines to produce high-quality products. But when we have no money, we must rely on our creative ideas to raise productivity, improve quality and reduce cost. This difficult condition makes us strong, but easy money will spoil us." How can companies emphasize thrift and creativity when their employees know they could just throw money at problems?

KS: When we have plenty of money, we tend not to think how to spend it. This often creates waste. If our budget is limited, then we will be careful of spending it and not wasting any of it. That requires a careful plan to identify the priority and assess the effectiveness. This planning and assessment is the heart of *kaizen* [continuous improvement] known as PDCA [Plan, Do, Check and Act] cycle. So having no money can make a company strong. At times in my 25 years of collaboration with Toyota, I have seen leaders intentionally reduce budgets even when the company had increased its profits.

TPS relies on recognizing problems when they happen and immediately doing something about it. That sounds simple enough, but if that were the case, everyone would do it. What allows problems to remain unaddressed?

KS: The major reason is American culture. Our culture is robust, competitive, logical, black and white, etc. Problems in our culture are received as negative, and saying, "No problem" is positive. So people are generally afraid of bringing up problems in connection to a negative performance. But in TPS, identifying the problem is the first step for *kaizen. Kaizen* seeks the root cause of the problem in order to find the solution to cure it so that the same problem never comes back again. So as you see, people who identify the problem actually help the company using TPS. Can we change such a culture? Yes, but it will take a significant effort over a long time.

Mr. Suzumura also said, "There is a clear difference between professional and amateur. When a professional suffers from a slump, he or she will go back to serious training in the basics, while an amateur will rest and seek an easy way out." What is the right attitude toward struggle?

KS: In our culture, struggle is negative. This is unfortunate. But in TPS, struggle is the necessary first step in *kaizen*. If we can do things so easily, we are not learning. When we face problems and learn how to overcome them, then we are learning. Our culture does not support this simple logic because we do not allow people to fail.

In TPS, there are four different steps of learning. Knowing something is the first step, then a real understanding will come through *genchi-genbutsu* [hands-on practice], which is followed by application of that knowledge to solve different problems. Finally, teaching what you learned to others completes that learning cycle. I think we can apply this learning cycle to educating our students.

Is *kaizen* strictly for manufacturing, or is it something one can use in everyday life?

KS: *Kaizen* is the basic principle to be applied to almost any activity in our lives, but it requires humility, service-oriented lifestyle, respect for others and a quest to seek the ultimate solutions in our life.

One must find the guiding principle of his or her life, which will give clear guidelines to follow. When one drifts from that principle, activities will become wasteful.

If we are comfortable in the current situation, there is no need for *kaizen. Kaizen* only becomes possible under a healthy degree of urgency to continuously seek a better way of doing things. ■

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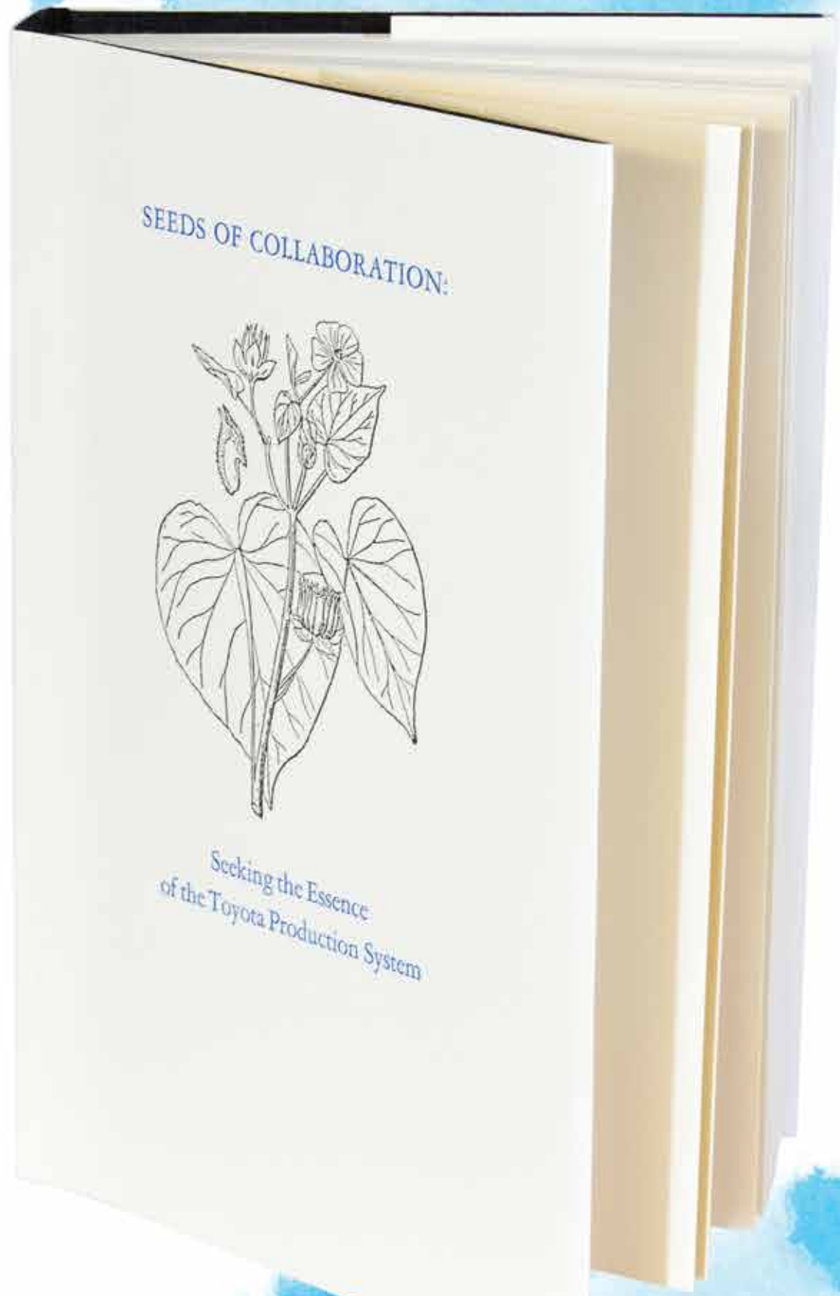
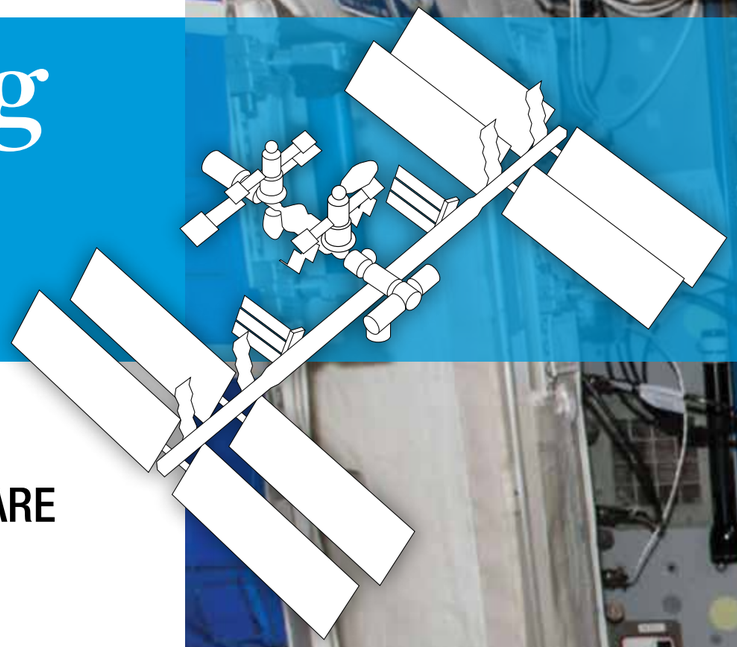


Changing the Context



TO IMPROVE LIFE ON EARTH, TWO UK ENGINEERING ALUMNI ARE FOCUSED ON SPACE

Kelly Hahn

Located in downtown Lexington, Kentucky, aerospace startup Space Tango describes itself as "a full-service solution to microgravity research and manufacturing."

What, exactly, does that mean? CEO and University of Kentucky alumnus Twyman Clements ('09, '11) provides this explanation:

"We design project architectures and experiments specifically for a microgravity—which is close to zero gravity—setting. We want to see how that unique environment affects bacteria, insects, seeds, viruses, pharmaceuticals, materials and more. What we learn in space will enable us to make life better on this planet."

And where does microgravity research take place? On the International Space Station—a three-day rocket ride from Earth. Thanks to a Space Act Agreement, Space Tango is able to use the ISS for commercial purposes.

"One of the great things about working with NASA is that they are very accommodating for small companies. Without that, we wouldn't be anywhere," says Clements.

Clements co-founded Space Tango in July 2014. The company has been moving at breakneck speed ever since.

PHOTO: NASA

After being unpacked from the SpaceX Dragon, a Space Tango CubeLab floats in the International Space Station, awaiting installation in the TangoLab.

TWYMAN CLEMENTS

To understand Clements' entrepreneurial spirit, one needs to look no further than his upbringing. Clements and his three brothers—all of them UK engineering graduates—learned what life should look like on a cattle farm outside Bardstown, Kentucky.

"My parents are among my biggest influences. They are good people, and they instilled that in me and my brothers," Clements describes. "Plus, they are entrepreneurs themselves. While working in agricultural sales, my father started businesses in real estate and insurance. My mother opened a clothing store."

Despite earning bachelor's and master's degrees in mechanical engineering from the University of Kentucky, Clements insists he is not much of a classroom learner.

"I need to know the problem I'm solving before I learn the tools needed to solve it," he explains.

That's how Clements, as an undergraduate student, ended up working in the Kentucky Space Systems lab operated by another of his mentors, electrical and computer engineering professor Jim Lumpp. At its peak capacity, the lab contained anywhere from 10-15 students huddled before a bank of computer monitors, interacting with Space Shuttle launches and the International Space Station.

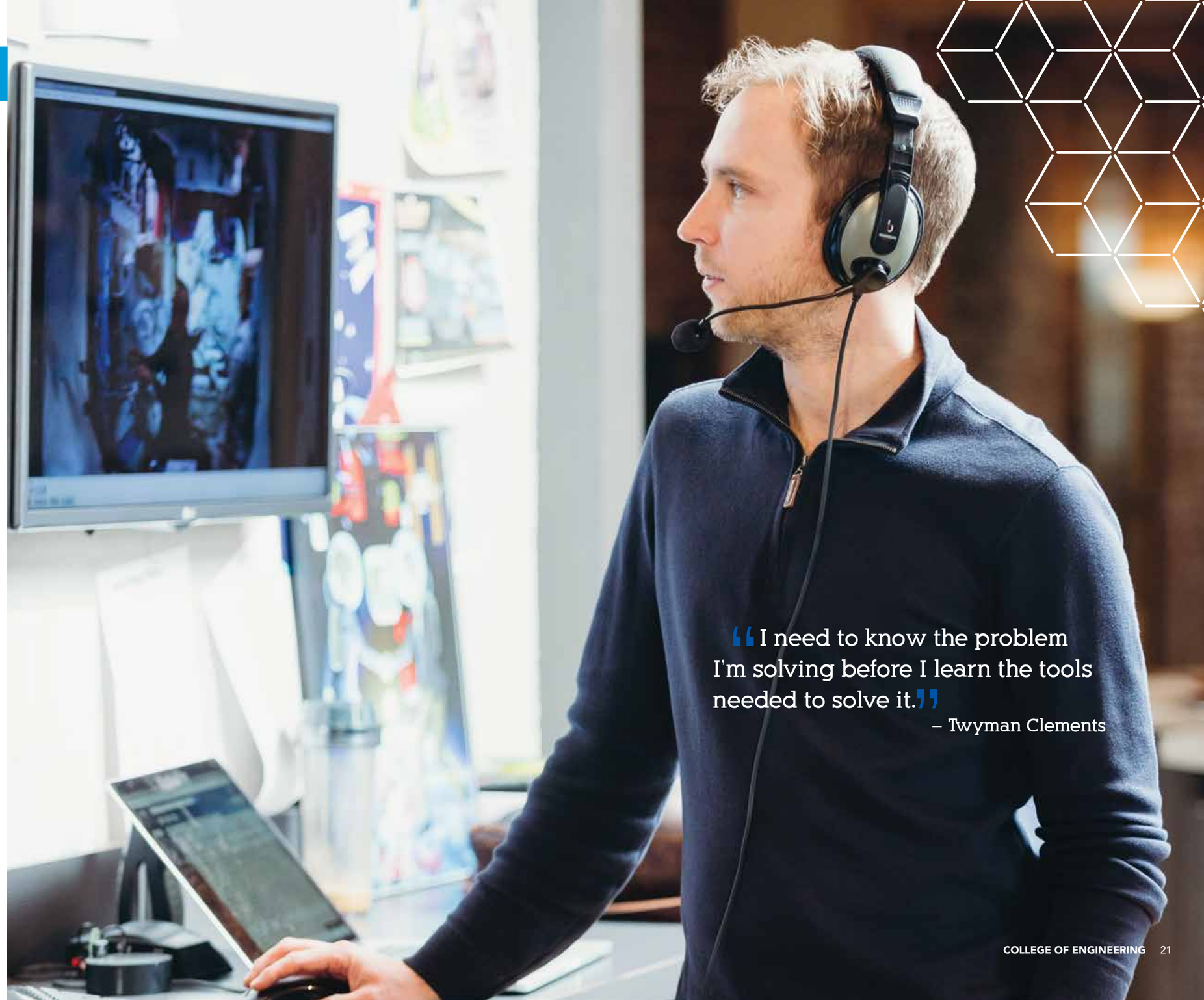
"UK helped me the most by giving me an opportunity to work in a lab as an undergraduate," he affirms.

Clements remains connected to the space program at his alma mater. Space Tango is currently engaged with NASA and UK faculty on an $850,000 NASA EPSCoR grant involving small-satellite swarms. Mechanical engineering associate professor Michael Seigler is the project investigator.

"I had Dr. Seigler when I was a student, and we kept in touch. We had worked on grant proposals together before, but this was the first to be awarded," says Clements.

While Clements primarily honed his education outside the classroom, he says one class continues to pay dividends in his work at Space Tango: EGR 599, otherwise known as the "Dean's Leadership Class."

"That class was a real game changer because I learned how people with technical backgrounds operated in positions of leadership. I don't need to know all the details of our daily work, but I do need to know what changes as I go higher and higher up the decision tree."



OPERATIONS

"Our first operational launch was in February 2017," Clements recounts. "Since then, we have had four more launches and shipped 35 total payloads."

Because most biological experiments only need about seven days, many can ride back on the same capsule that took them into space.

"Having a high throughput has really helped us," says Clements. "We have significantly expanded our capabilities in terms of our process, technology, institutional knowledge and overall design."

Months—even years—prior to a launch, Clements and his team work with researchers to design experiments that leverage the unique environment of microgravity. Of course, the experiments have to survive transit first. Power constraints aboard the rocket require the team to figure out how to keep experiments alive for the trip.

"We are constantly changing stuff," says Gentry Barnett ('06, '08), biomedical engineer at Space Tango. "The designs are never static. We put the experiments together and predict how they could fail in the unpredictable microgravity environment. That's the engineering challenge we have to work with."

Clements hopes new standardized kits will not only reduce the need to start from scratch each time but also ensure minimum variance from one experiment to the next.

Two "Tango-Labs" aboard the ISS can house up to 42 units, although some experiments require multiple units. More space may be available if Space Tango can show demand.

Many of the experiments designed by Space Tango belong to a booming area of research called "exomedicine." Barnett describes it as moving medical research into microgravity.

"We want to see if we can find information in a microgravity environment that may lead to breakthroughs on earth. For example, there may be some real advantages to manufacturing pharmaceuticals in space."

GENTRY BARNETT

When Gentry Barnett visited the University of Kentucky College of Engineering as a high school student, she was disappointed to discover it only offered biomedical engineering at the graduate level. Torn between medicine and engineering, Barnett had considered biomedical engineering an attractive combination.

Rather than go elsewhere, Barnett decided to pursue an undergraduate degree in electrical engineering as a path toward her graduate work in biomedical engineering.

"It's not a common route," offers Barnett, since many biomedical engineering students major in mechanical, chemical or materials engineering as undergraduates. "But something about electrical engineering challenged me, so I made it my choice."

> "Space Tango is like a family—for us and for our customers."
>
> – Gentry Barnett

As a graduate student, Barnett studied biomechanics with professor David Pienkowski. For her final project, she designed an electronic tourniquet with a digital timer and the ability to direct and control pressure. She received a provisional patent for the project, in addition to earning her master's degree.

After working for Versailles-based customKYnetics for several years, Barnett contacted Clements about applying her electrical and biomedical engineering background at Space Tango. She became a full-time employee in 2016.

"Space Tango is like a family—for us and for our customers," she says. "When we meet up for a launch, we're like friends reconnecting with friends rather than a customer meeting a supplier. Realizing that we're all on this journey together really makes it all worth it."

OUTLOOK

Space Tango's future is bright—and busy. A glance at the next few months reveals launches in April, May and June, plus two in November that will add about 30 more payloads to their tally.

"We've already started feasibility testing for the experiments going up in June and functional prototypes for the ones going sooner," says Barnett.

While Space Tango strives to perfect its technical competency, it is also creating more ways to improve customer experience—especially in the area of social media. Clements says perpetual change is baked into the company's culture.

"We're in an industry that has defined processes for safety. So we need to have a culture of process. But we also need to maintain an entrepreneurial culture. That's a balance that we constantly battle. It's our advantage and our challenge."

A bias for change means, other than safety protocols, Space Tango isn't locked into much of anything. Constrained by its current facilities, the company is exploring options for expansion. Looking further down the road, Clements gives a tantalizing hint that suggests he is looking toward a post-ISS world.

"Our main goal is expanding our footprint in microgravity—whatever vessel that may be on." ■

How to Make Swords and Get Into Medical School

THE POWER OF INVOLVEMENT

Juliana Palomino

"When I graduate, I'm going to be prepared."

Isn't that the goal of every college student—to be able to say those words confidently? For University of Kentucky senior Hannah Goldstein, that confidence is a reality. As a materials engineering major, Hannah sees involvement in student organizations as the catalyst for her preparation and growth.

Hannah serves as president of Material Advantage, a national organization for materials engineering undergraduate students. She became involved during her freshman year, attracted by its many opportunities: automatic membership to several nationwide professional organizations, tours of local engineering industries and the chance to volunteer at educational events such as the College of Engineering's annual E-Day.

Hannah's biggest involvement with Material Advantage, however, has been with the Bladesmithing team, a student organization within Material Advantage that does exactly what it sounds like—make swords.

Among the many student organizations she heard about during her freshman year, the Bladesmithing team stood out with its promise of teaching students to forge, weld and make a sword in preparation for an annual national convention. When she arrived for her first meeting, however, disillusionment struck.

It was the club's first year in existence, and as Hannah laughs, "Nobody knew what they were doing. We maybe made a sword, but I don't think that it even had a handle."

The following year, the seniors in charge of the club graduated, leaving Hannah as president with sparse information and no veteran students. With little to guide her, Hannah used her engineering problem-solving skills and turned to the best tool she knew.

"I used a lot of Google," she admits.

From learning how to purchase steel to maneuvering logistical roadblocks such as broken forges, Hannah developed strong crisis and project management skills. Her team made headway in preparing a sword to present at the national conference during the spring of Hannah's junior year.

They completed the sword on time, but she realized at the last moment they also needed to submit a metallography report. Turning to desperate measures, she sent out a mass email to a large group of engineering students and ended up with a workforce of almost entirely freshmen without any lab experience.

She remembers feeling extremely concerned at first, but she ended up thriving. She supervised the freshmen, teaching them

> "My engineering education has prepared me really well; engineering gives you a level of problem-solving that nothing else does."
>
> – Hannah Goldstein

how to mount slides on a microscope and look at steel samples. Many students, seeing steel magnified for the first time, shared Hannah's fascination.

"I loved that not only did I get the work done, but I also got to teach people," she says.

The whirlwind experience culminated in victory. Her group completed the project, and Hannah traveled to San Diego to represent her team and its sword at a national conference.

Through her ongoing involvement, Hannah has developed strong communication and teaching skills she is already putting to good use. Over the course of two undergraduate internships, she has presented to large teams of experienced engineers.

"Because I had so much experience leading bladesmithing and working with Material Advantage, it felt familiar, and it didn't worry me," Hannah remembers.

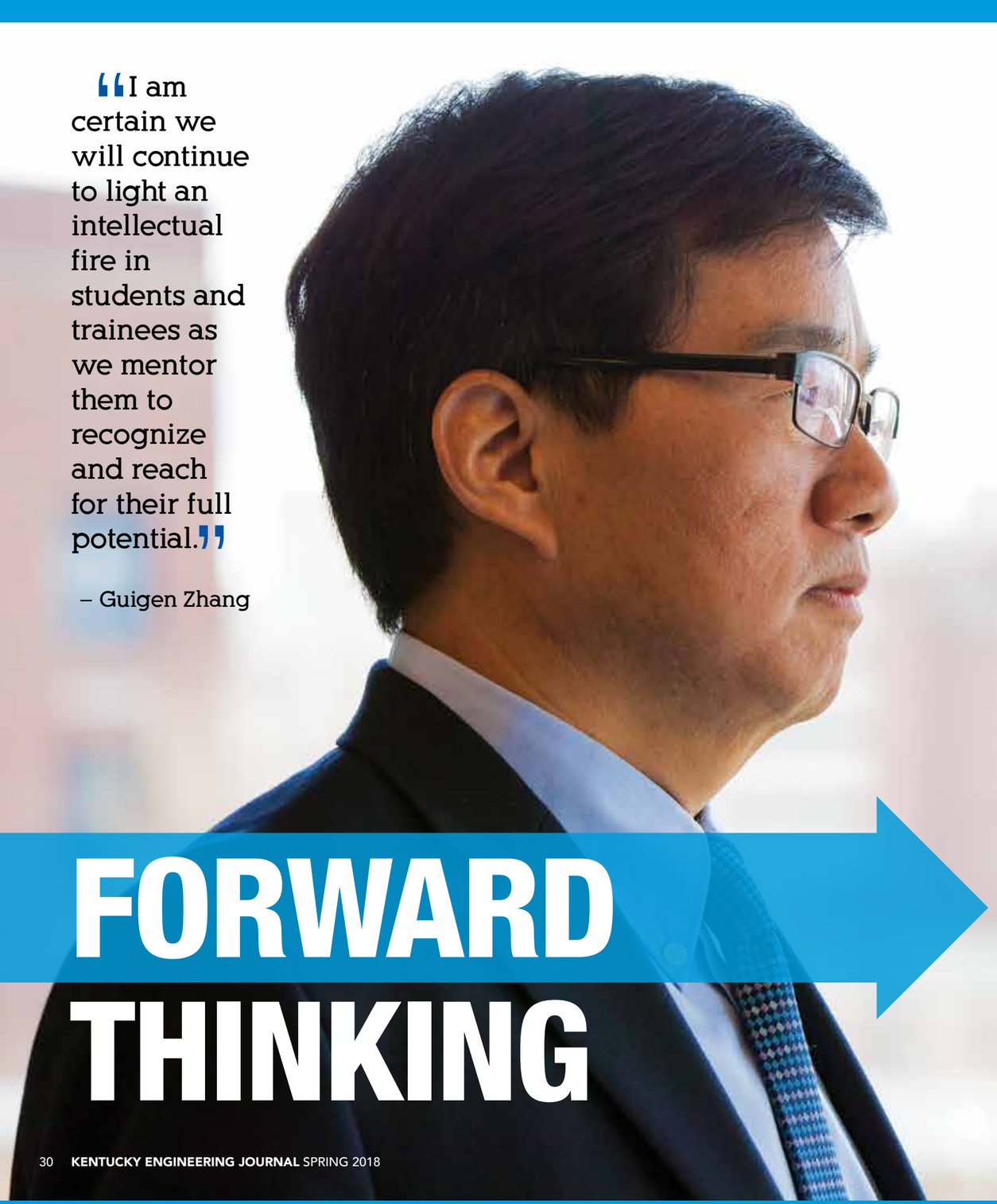
Where will Hannah be taking all of these skills after graduation?

She is currently applying to medical school, and she will know within the next few months where she will attend. Through her engineering major, she has most enjoyed learning how the world works and sharing that knowledge with others.

"Being a doctor will take my engineering skills and apply them to people's bodies and illnesses. My engineering education has prepared me really well; engineering gives you a level of problem-solving that nothing else does."

From forging swords to training new students to speaking at national conferences, Hannah's involvement has given her an invaluable sense of confidence as she approaches life after graduation. She has written a dozen essays on how bladesmithing has prepared her for medical school, and she firmly believes any student organization will prepare students for the future.

"When you get to a job, they will show you the machine and which buttons to press. The point of school is to prepare you in what to do if a button doesn't work—how you're going to fix it and how you're going to convince others that your solution is the correct one. Because of my student involvement, I feel enormously prepared in that way." ■



> “I am certain we will continue to light an intellectual fire in students and trainees as we mentor them to recognize and reach for their full potential.”
>
> – Guigen Zhang

FORWARD THINKING

Guigen Zhang’s Vision for Biomedical Engineering at UK Informs and Inspires

Kelly Hahn

When Guigen Zhang elucidates the future of the F. Joseph Halcomb III, M.D. Department of Biomedical Engineering, he begins with the past.

“The biomedical engineering program [BME] at UK has a long history of personal mentoring and care that professors have imparted to the students and trainees,” says Zhang, department chair and F. Joseph Halcomb III, M.D. Endowed Chair in Biomedical Engineering. “The support and guidance Dr. Halcomb received from professors helped him combine his interests in engineering and medicine, which later resulted in his generous gift to the BME department. That makes for a powerful culture.”

Until last August, Zhang served as professor and associate chair of the Department of Bioengineering at Clemson University. When considering a move to Lexington, Zhang says he noted not only the culture but also the collaborative opportunities uniquely available at the University of Kentucky.

“UK has the whole package—Colleges of Engineering, Medicine, Dentistry, Pharmacy, Health Sciences, Public Health, Nursing, Design, Fine Arts, Communication, Business, Arts and Sciences, Law, Education, Social Work, Diplomacy and International Commerce, and Agriculture on a single campus. Why does this matter? It matters because it provides a transdisciplinary environment that is crucial if we are going to advance science and technology and promote economic growth in a timely and socially relevant way.”

While biomedical engineering research at UK stretches back to the 1950s, it wasn’t until 2013 that biomedical engineering formally became one of the College of Engineering’s eight departments. Although degrees are only available at the graduate level, the department began offering a minor to undergraduate students a couple of years ago to meet the rising interest in biomedical engineering. Zhang believes offering an undergraduate degree in BME at UK would meet growing student interest and build an intellectual hub for the region to engineer health care-driven economic developments—and that UK has the whole-package advantage to create such a program from the ground up.

“UK’s entire academic structure is valuable and crucial for us to develop BME programs powered by design thinking to equip students with critical skills necessary to thrive in the real world. These skills include the ability to communicate empathetically with people from all walks of life; the ability to prototype, build, test and refine your engineering designs to meet the users’ needs; and the ability to frame right problems and solve them, rather than applying your engineering skills to solve problems that may have been wrongly framed by others.”

Zhang’s insistence upon expanding one’s horizon rather than narrowing into increasing specialization exemplifies what he calls “integrative engineering.” Last year, he published “Introduction to Integrative Engineering” with CRC Press Taylor & Francis Group. In the book, he explains how the metaphor of “connecting the dots” represents the kind of integrative thinking students need to succeed.

“Before connecting the dots, you will need to collect them [which involves] the acquisition of information and known theories and principles. Connecting the dots is the integrative process in which the acquired facts and rules are processed and integrated into interconnected knowledge, insight and wisdom. Do not be satisfied by just collecting the dots; nothing much will happen if you do not connect them.”

It is this new way of thinking that Zhang hopes to communicate to current and future biomedical engineering students—a comprehensive vision that not only informs but also inspires.

“It is said, ‘Education is not the filling of a pail, but the lighting of a fire,’” says Zhang. “I am certain we will continue to light an intellectual fire in students and trainees as we mentor them to recognize and reach their full potential.” ■

GROUND BREAKING!

Since August, UK's Department of Mining Engineering has received $10 million in new grants

Kelly Hahn and Whitney Harder

The University of Kentucky Department of Mining Engineering is one of only 13 mining engineering schools in the United States. UK offered its first organized course in mining engineering in 1895 and established a department in 1901. Like most academic departments, it has experienced good times and bad times, often due to external factors outside of its control.

These are good times.

Although the department has only eight full-time faculty members, it has received an astonishing $10 million in new grant funding since August 2017.

"The large amount of research funding recently awarded to our department indicates the national recognition for the quality and talent of our faculty," states Tom Novak, chair of the department.

In August, the U.S. Department of Energy (DOE) selected a pilot-scale project led by mining engineering professor Rick Honaker to move on to a second phase of research in an effort to recover rare earth elements (REE) from coal and coal byproducts. DOE is investing $6 million in Honaker's project, and project partners will contribute an additional $1.5 million over two and a half years for a total of $7.5 million.

REEs are a series of 17 chemical elements found in the Earth's crust. Due to their unique chemical properties, REEs are essential components of technologies spanning a range of applications, including electronics, computer and communication systems, transportation, health care and national defense. The demand for REEs has grown significantly in recent years, stimulating an interest in economically feasible approaches for domestic REE recovery.

In November, Honaker's team announced a pioneering accomplishment: nearly pure rare earth concentrates from Kentucky coal using an environmentally conscious and cost-effective process.

"As far as I know, our team is the first in the world to have provided a 98 percent pure rare earth concentrate from a coal source," says Honaker. "The primary objective for our project was to produce a concentrate containing a minimum of two percent rare earth elements. We have far exceeded this objective."

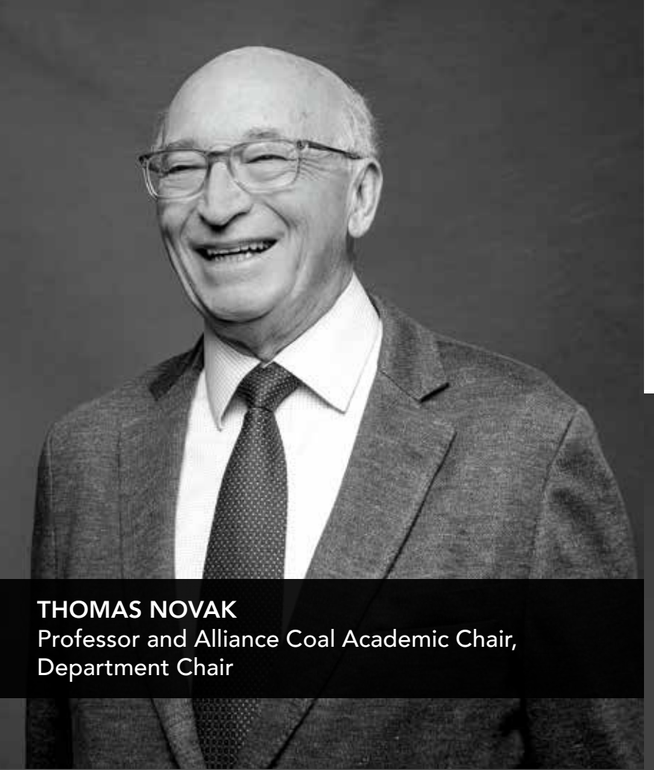
The process recovered more than 80 percent of the REEs present in the feed sources. The concentrates consisted of more than 80 percent total REEs on a dry whole mass basis and more than 98 percent rare earth oxides. More importantly, critical elements such as neodymium and yttrium—used in national defense technologies and the high-tech and renewable energy industries—represented over 45 percent of the total concentrate, and scandium—a highly valued rare earth element used for aerospace, lighting and other applications—was efficiently separated from the other rare elements and concentrated as a separate product from the circuit. A pilot-scale facility opened this spring.

In addition to Honaker's prodigious work, in October department faculty members Zach Agioutantis, Steven Schafrik and Joe Sottile received a four-year, $2.19 million grant from the Alpha Foundation for the Improvement of Mine Safety and Health to integrate autonomous shuttle cars into existing underground coal mine infrastructure.

Underground coal mines are tight spaces that limit mobility and visibility. These factors create difficulty for equipment operators and introduce serious risks for workers around haulage vehicles, such as the shuttle car. In addition to limited visibility, shuttle car operators are also subjected to dust and vibration. Autonomous vehicle technology may provide the key to safer underground coal mines. In addition, these advancements can also be extended to other types of underground mining.

"The purpose of this work is to bring human factors research to automated equipment working in confined areas and around people," explains Schafrik. "This is about improving the miner health and safety."

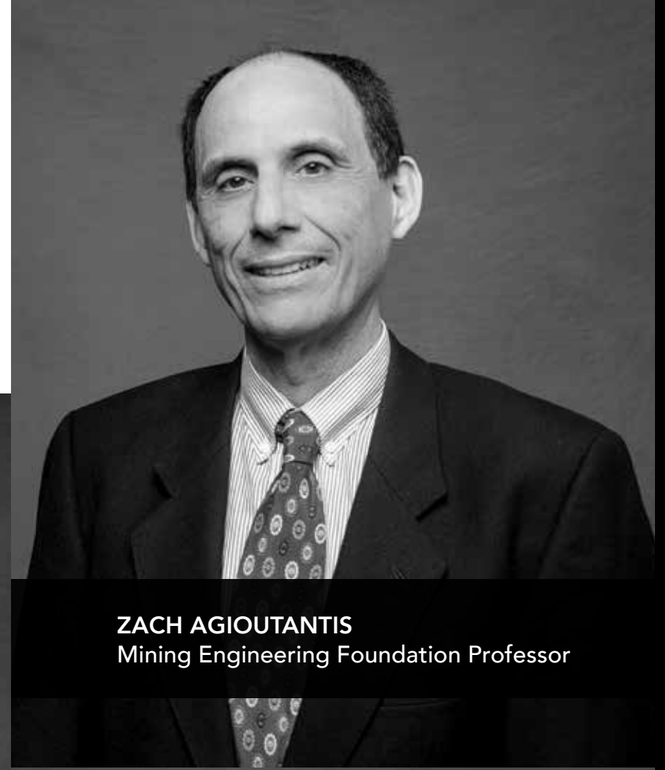
Schafrik adds that the intent of the project is not to replace the human operator but to give him or her different responsibilities. Instead of operating the shuttle car, the worker would oversee the shuttle car movements and could override them if necessary.



THOMAS NOVAK
Professor and Alliance Coal Academic Chair, Department Chair

> “Research funding of this magnitude is a remarkable achievement for a small department.”
>
> – Thomas Novak

STEVEN SCHAFRIK
Associate Professor



ZACH AGIOUTANTIS
Mining Engineering Foundation Professor

RICK HONAKER
Professor

> “The purpose of this research is to bring human factors work to automated equipment working in confined areas and around people.”
>
> – Steven Schafrik

JOE SOTTILE
Professor

Because the cars are already electrically tethered, autonomous replacements could use the current infrastructure. The research team is partnering with Alliance Coal and conducting research at the company’s mines near Evansville, Indiana.

“A lot of the prototyping can be done on the UK campus, but the research pertaining to how humans interact with the technology will take place at the mines so researchers can investigate the impact of autonomous shuttle cars on the underground mines,” summarizes Sottile.

The professors have a threefold goal for the project: develop the framework for an accurate and reliable underground navigation system and methodology, evaluate the human factors involved in using an autonomous shuttle and develop a functional prototype of the autonomous shuttle car.

Agioutantis characterizes it as “a holistic project.”

“We not only have mining engineers involved, but also researchers in the Virginia Tech Transportation Institute who are recognized as world leaders in automated vehicles research,” he says.

Autonomous vehicles are commonly available on the surface, but they only are sparsely available in underground mines and only in specialized applications. The UK research team’s innovation would provide the first autonomous shuttle to be used underground.

The above grants are not the totality of what the department has received during this fruitful fiscal year. Combined, however, they demonstrate the relevance of mining engineering to our nation’s energy, critical material supply and safety concerns. In an era where grant money is more competitive than ever, $10 million in new grant money in such a short time is evidence that UK’s mining engineering faculty are engaged in important endeavors.

“Research funding of this magnitude is a remarkable achievement for a small department,” says Novak. “I’m very proud of the mining engineering faculty and our students who significantly contribute to the academic reputation of the University of Kentucky.” ■

Congratulations to Y.T. Cheng on his induction into the National Academy of Inventors!

Election to NAI Fellow status is the highest professional accolade bestowed solely to academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development and welfare of society.

Those elected to the rank of NAI Fellow are named inventors on U.S. patents and were nominated by their peers for outstanding contributions to innovation in areas such as patents and licensing, innovative discovery and technology, significant impact on society and support and enhancement of innovation.

With the election of the 2017 class, there are now 912 NAI Fellows, representing over 250 research universities and governmental and nonprofit research institutes.

Y.T. Cheng's inclusion is certainly deserved. Prior to joining UK in the fall of 2008, the Frank J. Derbyshire Professor of Materials Science spent 20 years at the General Motors R&D Center, during which he was promoted to the highest technical rank as a GM Technical Fellow and served as a laboratory group manager for engineered surfaces and functional materials. Several of Cheng's patents have been utilized by General Motors.

Cheng's connections to the automotive industry have put him in a unique position to advance battery technology for electric vehicles. Cheng's research group is working on decreasing the amount of time needed to charge batteries, lowering the cost of battery manufacturing and increasing the energy and power density of batteries.

LABOR *of* LOVE

ACTIVE RESEARCHER, TEAM CAPTAIN, FULL-TIME BIOSYSTEMS ENGINEERING STUDENT: YOU'D BETTER BELIEVE **ERIC VANZANT** EMBRACES THE FARMER'S WORK ETHIC

Juliana Palomino

Where do sheep, research, farm life and engineering come together? Eric Vanzant has found the perfect combination through a major in biosystems engineering.

A junior from Versailles, Kentucky, Eric has lived on a farm his entire life, and his father currently manages the University of Kentucky beef research facility in Woodford County. This guided his footsteps when he came to college.

"While I like math and science, I love being outside and enjoying the great outdoors. The biosystems major was a good marriage of my interests and passions," Eric says.

For the past four years, Eric has worked on UK's sheep farm, full-time over the summer and part-time during the school year. UK manages a large flock for research purposes, as well as for educational outreach programs where students and producers come to learn flock management techniques. With a flock of about 200 ewes and a busy lambing season each January, April and October, he stays busy feeding and caring for the sheep. He lives in his own apartment on the sheep farm.

Eric also helps with research on the farm. His team keeps careful track of breeding pairs and offspring in order to trace each animal's pedigree. The team also tracks the weights of different groups and experiments with various diet formulations and supplement and forage ratios to maximize weight gain and, ultimately, profits.

Eric thrives on this blend of research and farm work.

“Ag is my background, what I’ve grown up with, and now I’m incorporating that into engineering.”

How does Eric balance laborious farm work with an engineering student’s course load? He intentionally prioritizes his time. He lives out in Woodford County in his own apartment on the sheep farm. During lambing season, he rises at 6 a.m. to check sheep and then leaves for campus about an hour before class, usually at 7:30 a.m.

“When I’m in class, that’s the most important thing that I could be doing. I don’t have time to relearn the material outside of class, so I do my best to really focus,” he explains.

Especially during lambing season, farm work can become a heavy load. However, Eric sees the farm as a unique opportunity worth all the time he puts into it. He seeks to be “an active participant, both inside and outside the classroom” throughout his time in college.

How does Eric stay involved in UK activities outside the classroom? He has found yet another way to tap into his passion for farming through the tractor team, a student organization within the Department of Biosystems and Agricultural Engineering. This team designs and builds a quarter-scale pulling tractor about the size of a lawnmower. They work on it throughout the school year, completing it by June for an international competition held by the American Society of Agricultural and Biological Engineers.

This was the first student organization with which Eric became involved. He attended a meeting his first semester of freshman year.

“It was technical and over my head, and I decided, ‘Hey, that’s cool,’ and I didn’t go back,” he says.

However, after a professor suggested he join the tractor team to gain experience with computer systems and technical design, Eric gave it another try. This time, he stuck around. Gradually he became more and more involved, eventually accepting the role of captain this year.

In this leadership position, Eric ensures that team members remain on schedule and meet design deadlines throughout the year. As they work on the tractor, they design with the goal of maximizing pulling power, maneuverability and endurance to be tested at the competition.

“There are a lot of different design criteria to take into account,” says Eric.

All of Eric’s experiences have given him insight into his future. Though he is still determining the exact field he wants to work in, Eric says he loves the blend of manual labor and engineering’s technicalities and will take the future one opportunity at a time.

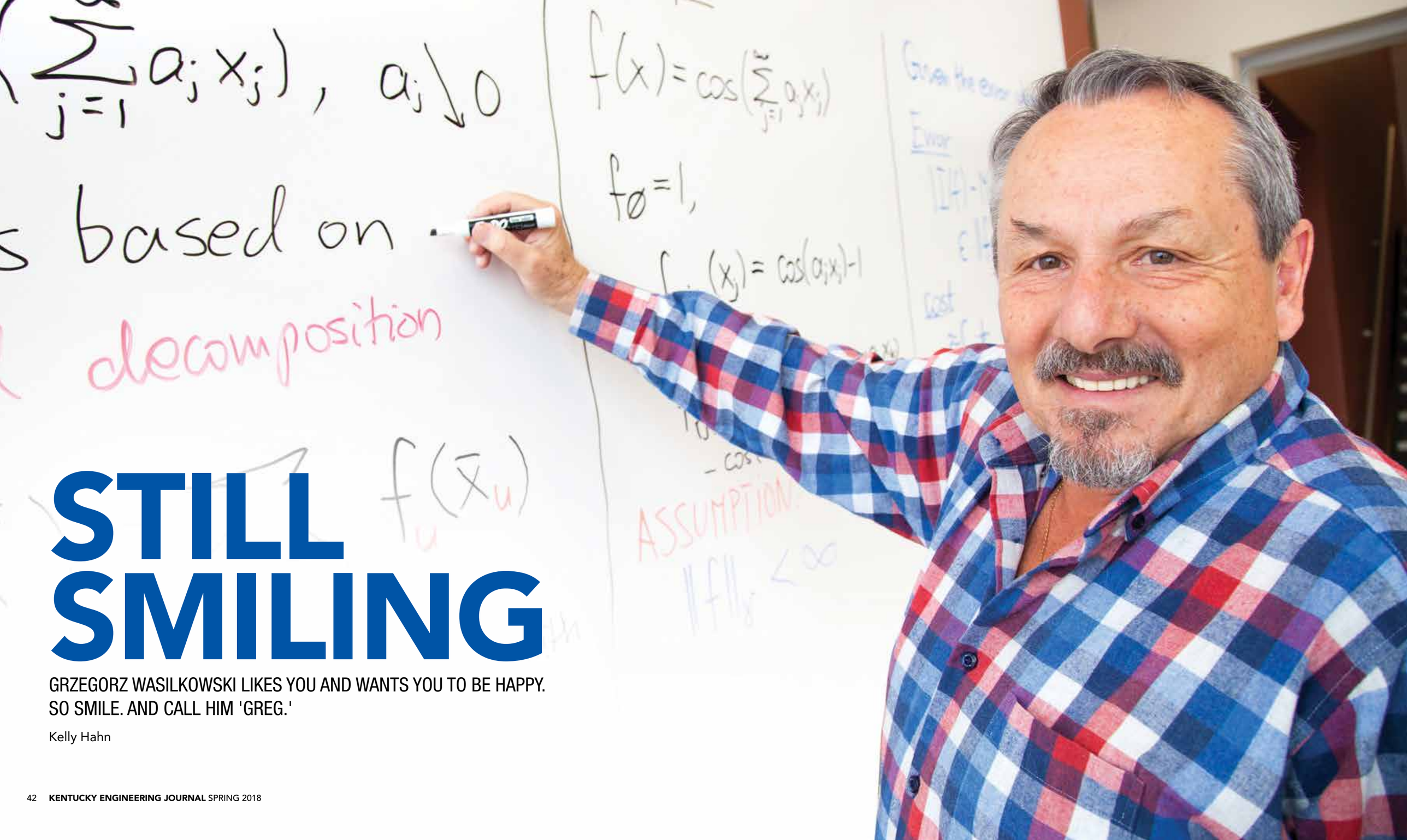
“I tend to say yes to an opportunity instead of no.” ■

> “While I like math and science, I love being outside and enjoying the great outdoors. The biosystems major was a good marriage of my interests and passions.”
>
> – Eric Vanzant

STILL SMILING

GRZEGORZ WASILKOWSKI LIKES YOU AND WANTS YOU TO BE HAPPY. SO SMILE. AND CALL HIM 'GREG.'

Kelly Hahn



> “I want students to not be afraid. I want them to see that mathematics may be tough, but it can also be enjoyable.”
>
> – Greg Wasilkowski

Ask computer science professor Greg Wasilkowski what he does for fun, and he quickly answers, “Mathematics.”

Ask him what he is constantly thinking about, and he replies, “Mathematics.”

Ask him what he likes to read, and he says, “Poetry.”

Oh, that’s different. Why?

“Because it is a lot like mathematics.”

An expert in computational mathematics and numerical analysis, Greg’s primary field of research is called computational complexity.

“Classical methods of numerical analysis can handle functions with no more than three or four variables. But there is a host of problems in engineering, physics, chemistry, financial mathematics and other fields that have *infinitely* many variables,” Greg explains. “These cannot be solved on a piece of paper. They have to be solved primarily by using computers. My colleagues and I have been quite fortunate to find methods that can easily handle multi-dimensional problems, whereas the classical methods collapse.”

By “colleagues,” Greg is referring to researchers at other institutions, since he is the only one at UK laboring in this particular field. He has ongoing relationships with mathematicians at the University of New South Wales in Sydney, Australia; Johannes Kepler University in Linz, Austria and the University of Warsaw, Poland. He is invited to spend a few weeks in Australia every other year.

“Being able to visit for a long period of time is important, because then we can sit down and start talking,” says Greg. “If you start talking, you exchange ideas, change your own ideas and start building something.”

The complexity field is relatively new. In the mid-1980s, Greg was an associate professor at Columbia University, on the ground floor of a new field called information-based complexity.

“Initially, there were only a few of us working in this area,” Greg recalls. “Many numerical analysts hated us. They didn’t like what we were doing.”

Then, in 1987, two of Greg’s former colleagues from the University of Warsaw in Poland, Jurek Jaromczyk and Victor Marek, encouraged him to join the fast-growing computer science faculty at the University of Kentucky. The idea of bringing information-based complexity to a new institution intrigued Greg. After visiting Lexington, he was sold.

“I didn’t like New York City, and my wife and I felt like Lexington would be a good place to raise our sons,” says Greg, and adds with a grin, “And we could finally have dogs.”

During the course of one 75-minute “Discrete Mathematics” class period, Greg covered three large whiteboards with numbers, letters and symbols, and when he finally ran out of real estate, he erased it all.

This happened three times.

“Every semester, Greg is presented with one of the most challenging teaching assignments in the department—theoretical and mathematical foundations of computing,” says Brent Seales, professor and chair of the Department of Computer Science. “Despite the difficulty of the material and the potential conflict of expectations, Greg is repeatedly lauded by students as an outstanding teacher.”

Greg’s enthusiasm for teaching is palpable.

“I want students to not be afraid. I want them to see that mathematics may be tough, but it can also be enjoyable. I want them to see the beauty and elegance that excites me. It’s not some dead area.”

Greg has discovered numerous ways to help students succeed in his classes. He starts with easy problems and makes sure everyone understands its components before moving to harder problems. He awards bonus points for good questions and good answers. He tells jokes—some that relate to the concepts under discussion and many that don’t. But Greg says one of the most important strategies he employs is that he presents proofs.

“Unfortunately, in many calculus classes, the material is presented but not proofs. But once students see the proof and understand it, the rest is simple. The proofs are what make mathematics so special—they are beautiful! You have a formal way to verify whether a claim is true or not. Everything can be verified objectively.”

As “proof” that he knows both sides of his craft, one of his Greg’s papers received a 2011 Best Paper Award from the “Journal of Complexity” and the 2014 College of Engineering’s Henry Mason Lutes Award for Excellence in Engineering Education—a prestigious honor that celebrates the art of teaching.

“I think students like me, and I’m happy with that,” he says, smiling.

On Greg’s research page, there are three photos: one of him after he arrived at UK in 1987, a faculty head shot taken in 2010 and one taken recently. Naturally, they show the inevitable signs of aging over 31 years. At the bottom, however, is a single phrase: “*Still smiling!*”

“I want people to know that I’ve had a good time in my 30-plus years here,” he explains. “I like people and want people to be happy. Smiling is a sign they are. When I lived in Poland, people were very formal. Nobody smiled. When I came to the United States, I was amazed that people were smiling, and I loved it. When people smile they are relaxed, and I want my students to smile because when you are relaxed you are better able to grasp concepts.”

For someone who lives in a world of complexity, Greg’s philosophy of life is reassuringly simple. ■

UNIVERSITY OF KENTUCKY
COLLEGE OF ENGINEERING

Hall of Distinction

John Wesley Gunn, Class of 1890, earned the first engineering degree awarded by what eventually became the University of Kentucky. Since that modest beginning over 125 years ago, more than 25,000 individuals have followed his example and received degrees in engineering and computer science. Through their extraordinary achievements, our alumni have established a lasting legacy of excellence. Initiated in 1992, the Hall of Distinction recognizes and honors those alumni who have demonstrated distinguished professional accomplishments, outstanding character and commitment to community service. This recognition serves to encourage exemplary achievements by current students and others. It is a symbol of the respect and admiration held by the University of Kentucky College of Engineering for these esteemed individuals. Below are the 2018 inductees.

David J. Burianek

B.S. in Computer Science, 1986

After 15 years with GE and GE Capital, Burianek took his Six Sigma and IT background to an entirely different field—health care—when Humana recruited him to join its consulting practice. While at Humana, he held leadership roles in several departments: consulting practice, clinical services, operations including claims/critical inquiry/correspondence/grievance and appeals units, and clinical quality. His work as the vice president of clinical quality led to Humana being recognized as a leader in Medicare quality designated by the Centers for Medicare and Medicaid stars program. In 2016, Burianek was recruited to be Anthem's vice president of corporate clinical quality management. He identifies the most rewarding part of this role as helping others improve their health. Anthem has over 40 million customers within its family of health plans.

Eric J. Cremers

B.S. in Mechanical Engineering, 1984

Eric Cremers is president and chief operating officer of Potlatch Corporation, a $4 billion diversified forest products company headquartered in Spokane, Washington. He joined the company in 2007 as chief financial officer and was immediately faced with designing and executing a major restructuring plan. In his current role, Cremers has profit and loss responsibility for the company's three business units, which earn a combined $325 million per year. In 2017 he led the acquisition of Deltic Timber, a $1.2 billion forest products company headquartered in Arkansas. Cremers began his career with Exxon and later held positions advising senior management, as well as the board of directors, on corporate strategy and mergers and acquisitions for Cooper Industries, General Signal, Engelhard, Pillsbury, Piper Jaffray and Albertsons.

Michael D. Day

B.S. in Mining Engineering, 1993

Michael Day is president and chief executive officer for ArcelorMittal Princeton Operations, a position he has held since 2017. A third-generation coal miner, Day's career began with Leeco in London, Kentucky. He moved to Arch Coal in 1995, where he served as production supervisor, superintendent, manager of engineering, director of process improvement and mine manager. He joined Magnum Coal in 2006 as general manager of its Logan County operation and was promoted to director of operations one year later. Hired by Patriot Coal in 2008, Day held a number of senior-level positions including executive vice president of operations and chief operating officer. Prior to accepting his current position, Day served as senior vice president of WV Technical Services Blackhawk Mining.

Kevin L. Hobbs

B.S. in Chemical Engineering, 1988

In 1988, recently graduated Kevin Hobbs began his 30-year career with Exxon as a process design engineer at its Baytown Refinery. Today, he is midstream director of ExxonMobil Fuels and Lubricants Company, where he leads about 8,000 employees and contractors operating in nearly 30 countries around the world. Hobbs' management career began in 1997, and in 2005, he moved to ExxonMobil Corporate headquarters in Irving, Texas, as a senior advisor and investor relations advisor for the Downstream ExxonMobil business. In 2007, he became the refinery manager for ExxonMobil's Fawley Refinery in the southwest of England. Upon returning to the U.S. in 2010, Hobbs became global logistic optimization manager for ExxonMobil Refining and Supply. He was promoted to his current position in 2013.

Thomas E. Jenkins, Sr.

B.S. in Electrical Engineering, 1954

Throughout his 33-year career at GE, Thomas Jenkins strove to increase the standard and quality of living through constant productivity increases, creativity and commitment. He specialized in dishwasher and refrigerator project management, developing six major projects that required several hundred million dollars to implement, as well as over 55 patents for GE. Jenkins' innovations reduced consumer cost and energy consumption and helped GE become a leader in the marketplace. Among Jenkins' honors, he received five managerial awards and two Inventor of the Year awards. In addition, he received the prestigious Steinmetz Award, which is given biennially to six engineers from among GE's entire engineering workforce. As a result of all he accomplished, Jenkins was inducted into the GE Inventor Hall of Fame.

Benjamin T. Quinn, Sr.

B.S. in Civil Engineering, 1966

Ben Quinn is CEO of American Engineers Inc., a company he founded in 1983. Throughout his 50-year career, Quinn's goal has been to improve transportation in Kentucky and the Southeast. As CEO, Quinn is involved with strategic growth and financial affairs pertaining to the business. AEI has four offices, 42 registered engineers and over 125 employees with offices in Glasgow, Kentucky; Louisville, Kentucky; Owensboro, Kentucky; and Kennesaw, Georgia. In addition to growing AEI, Quinn has had many opportunities to be partner, owner and founder of several other business entities. These include commercial and residential development as well as a solar farm in California that serves San Diego State University. He is also sole owner of AEI Marketing, Inc., a company serving the marketing world.

CLASS NOTES

Andy Barber, BSCE 2001, was named state highway engineer for the Kentucky Department of Highways. Prior to being named state highway engineer, Barber served as the Department of Highway's deputy state highway engineer for project delivery and preservation.

Patty Dunaway, BSCE 1994, has joined Michael Baker International, a global leader in engineering, planning and consulting services, as office executive. Dunaway will be responsible for developing, overseeing and managing the company's growth throughout Kentucky, including oversight of several high-profile projects within the state and region.

Josh Evans, BSME 2011, has been named to the position of engineering manager. He has been employed with Continental Fan as a project engineer at its Dayton, Ohio, location since 2011.

Colleen Frazer, BSMAT 1997; Ph.D. MAT 2004, has joined Covalent Metrology as director of X-ray Diffractometry (XRD) and X-ray Reflectometry (XRR) Services. Before working for Covalent Metrology, Frazer was an XRD/XRR senior scientist at EAG Laboratories.

J. Steven Gardner, BSAE 1975, MSMNG 1991, received the Erskine Ramsay Medal at the SME Conference & Expo in Minneapolis. The award is presented to "for substantial technical contributions to sustainable mining practices, outstanding service provided to his professional society, and invaluable leadership in educating the public on the importance of the mining industry." Gardner has served as president and CEO of ECSI, LLC for 35 years.

Mark E. Hall, BSMET 1982, was named field manager for the Black Rock Field Office of the Bureau of Land Management, Winnemucca District Office, Winnemucca, Nevada. Hall had previously been assistant field manager for the Black Rock Field Office and had been the acting field manager since February 2017. He has been with BLM in the Winnemucca District since January 2010.

R.D. James, BSCE 1971, has been confirmed by the U.S. Senate as assistant secretary of the U.S. Army for Civil Works (head of the U.S. Army Corps of Engineers). James most recently served as a civilian member and engineer on the Mississippi River Commission. He was originally appointed by President Ronald Reagan in 1981.

Paul Looney, BSCE 1996, was named deputy secretary for the Office of the Secretary, Kentucky Transportation Cabinet. Looney spent 16 years in the Division of Highway Design as a pavement engineer and later became pavement branch manager.

Kim H. Oatman, BSCE 1988, has been hired as the assistant vice president for facilities at Morehead State University. Oatman is a former assistant vice president at the University of Louisville and chief facilities officer at Murray State University.

L. Stanley Pigman, BSMNG 1981, received an Honorary Degree of Humane Letters from the University of Kentucky. After working with Sierra Coal, a subsidiary of General Electric, Pigman joined with two colleagues to form Sugar Camp Coal and, eventually, his own company, Pigman Coal Sales.

Marco M. Rajkovich Jr., BSCE 1978, was nominated by President Donald Trump to be a member and chairman of the Federal Mine Safety and Health Review Commission for the remainder of a six-year term expiring August 30, 2022. Rajkovich is a member of the law firm of Rajkovich, Williams, Kilpatrick & True, PLLC, and has practiced for more than 30 years in mine safety and health law.

Richard Shultz, BSAE 1988, was named vice president of engineering at Link-Belt Cranes in November. He had previously been director of quality at the company. Shultz joined Link-Belt in 1990.

John Tapp, BSCE 1968; MSCE 1970; Ph.D. AE 1981, was named committee vice chair of the U.S. Department of Energy's Oak Ridge Site Specific Advisory Board (ORSSAB) for the 2018 fiscal year.

Sidney Thompson, Ph.D. AE 1981, was named new founding chair of the University of Georgia College of Engineering School of Environmental, Civil, Agricultural and Mechanical Engineering. Thompson has been working with UGA for 37 years and teaches courses in structural engineering and engineering design fundamentals.

Alex Thomasson, Ph.D. AE 1997, has been appointed to the Endowed Chair in Cotton Engineering, Ginning and Mechanization in the department of biological and agricultural engineering at Texas A&M University in College Station. Thomasson previously held positions at the U.S. Cotton Ginning Laboratory of the U.S. Department of Agriculture-Agricultural Research Service and Mississippi State University.

ALUMNUS, UK PROFESSOR GABRIEL DADI WINS GREAT TEACHER AWARD

Enveloped by a sea of blue during a timeout in the midst of a University of Kentucky men's basketball home game against Vanderbilt, civil engineering assistant professor Gabriel Dadi and five other faculty members were honored at half-court as 2018 UK Alumni Association "Great Teachers." The student-nominated award is the longest-running University of Kentucky award that recognizes teaching.

"That was one of the—if not the—greatest honors of my career," says Dadi. "The evening of the acknowledgement, a lot of my colleagues and family were there. It was special to share that with people who have helped me get to this point."

Dadi studied civil engineering at UK and completed an MBA through the college's BS/MBA dual-degree program in 2008. He earned his Ph.D. from UK in 2013 and joined the civil engineering faculty the same year. His primary research area is construction safety.

"If you're not aware that people learn in diverse ways, it can be easy to deliver content only in the way you like to receive it," says Dadi. "Then you're missing out on the majority of your students because that's not how they learn."

In Memoriam

Billy L. Patton	Electrical Engineering	1943	**Kenneth H. Darnell**	Electrical Engineering	1958
Frank L. Milburn	Mechanical Engineering	1947	**Dr. Gary R. Wallace**	Metallurgical Engineering	1960
Dr. R.H. Ritchie	Electrical Engineering	1947	**John H. Salyer**	Electrical Engineering	1962
Leonard I. Chambliss	Mechanical Engineering	1950	**Arthur T. Foster**	Mechanical Engineering	1963
John H. Word	Civil Engineering	1950	**Charles R. Scroggin**	Civil Engineering	1970, 1972
Bobby B. McClain	Mining Engineering	1951	**James Mueller**	Computer Science	1972
Sherman T. Dozier	Electrical Engineering	1956	**Mike Gerteisen**	Computer Science	1974

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NOTES:

pp. 2-3: Thanks to Ashley Chatham at Toyota Motor North America for sending us fantastic photography from inside Toyota. Another photo appears on pp. 14-15.

p. 4: We appreciate Larry Holloway's service as interim dean these past two years, as well as his participation on the *Kentucky Engineering Journal* editorial board for the past four issues.

pp. 7-11: Portions of this essay originally appeared in an op-ed co-authored by Larry Hollway and former UK provost Tim Tracy.

pp. 12-13: Kozo Saito's photo was taken outside Maxwell Place, home of University of Kentucky President Eli Capilouto and his wife, Dr. Mary Lynne Capilouto.

pp. 18-19: Thanks to Twyman Clements for supplying photos from the International Space Station.

p. 23: Space Tango employee Jason Rexroat (pictured) graduated from UK with bachelor's degrees in electrical and computer engineering in 2013 and a master's degree in electrical engineering in 2015.

pp. 30-31: It's faint, but you can see a blurred UK Albert B. Chandler Hospital in the background.

pp. 38-41: Photos were taken at UK's C. Oran Little Research Center's 110-acre sheep research unit located in Versailles, Kentucky.

pp. 38-39: "Awww...." We know. We got that reaction every time someone wandered into our office and saw the lamb on graphic designer Aaron Camenisch's screen.

pp. 42-43: We don't really have any idea what anything on the board means, but Greg assures us it means something.

pp. 46-47: The Hall of Distinction induction ceremony took place April 13, 2018.

p. 48: Got a class note you would like to pass along? Email alumni@engr.uky.edu.

p. 49: By his own admission, Dr. Dadi has a terrible history with UK basketball—as in when he attends games, the Cats lose. After the mid-court celebration of Great Teacher Award, UK found itself down six at halftime. Dadi decided the best way he could help the Cats was to go home, so he did. UK won 83-81.

p. 51: Y.T. Cheng's lab (pp. 36-37) is located in the S.J. "Sam" Whalen Building on Limestone Street. The building opened in 1968 as the on-campus location of the Kentucky Transportation Center and was renamed in Whalen's honor in 1998.

GIVING BACK

S. J. "Sam" and Mildred Whalen

S. J. "Sam" Whalen received a Bachelor of Science degree in metallurgical engineering from the University of Kentucky in 1949. He founded Aerobraze Corporation in 1955, which specialized in the fabrication of jet-engine components, primarily utilizing brazing and welding techniques. He was president and CEO of Aerobraze until October of 1989.

A faithful supporter of the UK College of Engineering, Whalen and his wife, Mildred, created graduate fellowships and included the Department of Chemical and Materials Engineering in their estate. A portion of their legacy gift enabled the department to renovate 4,500 square feet of space in F. Paul Anderson Tower for new chemical engineering and materials engineering undergraduate instructional laboratories.

For more information about supporting engineering education through estate planning, contact Matthew Briggs, director of development, at (859) 218-3506 or matthew.briggs@uky.edu.

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