MEET THE NEW DEAN

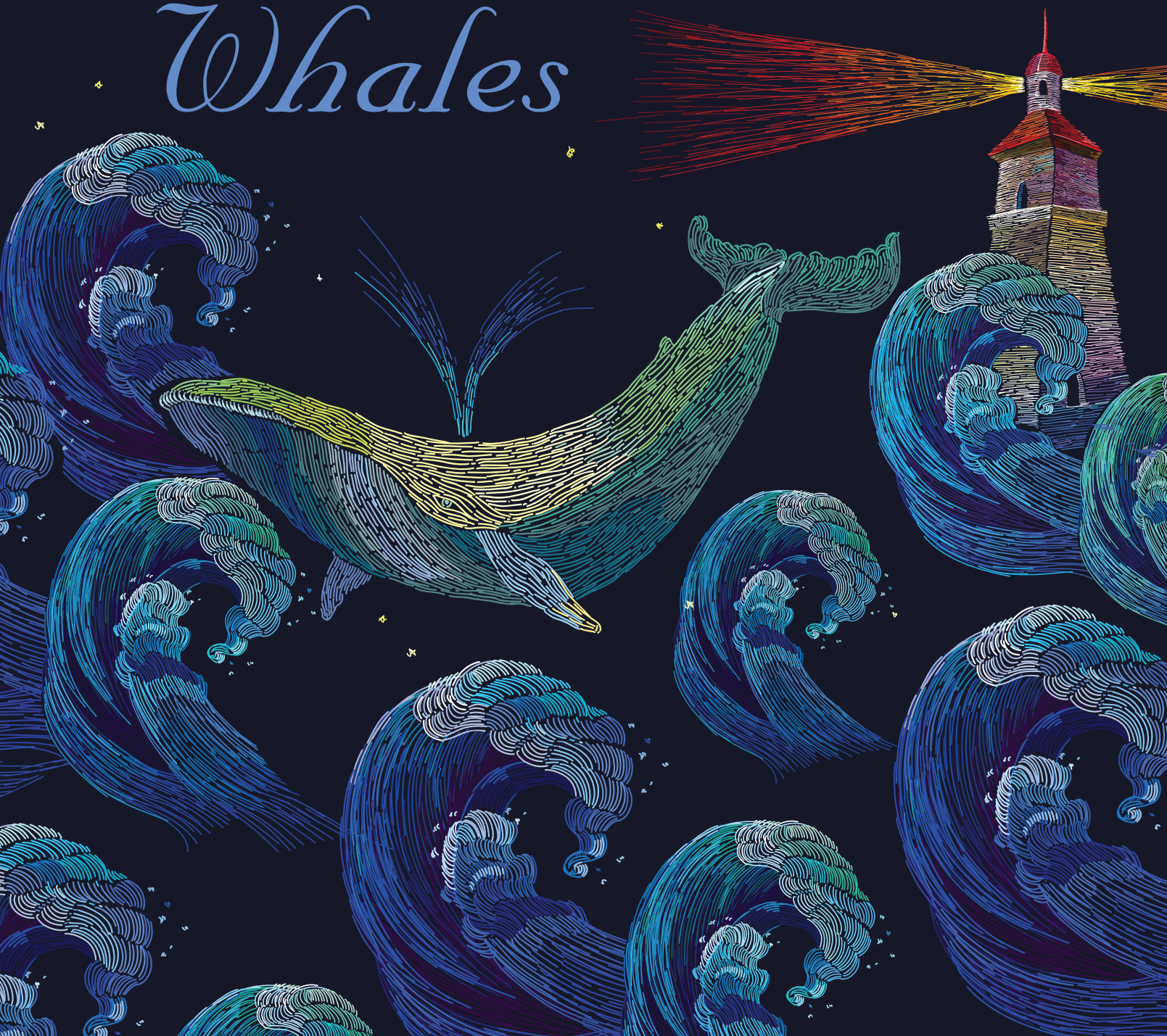
BRIDGING THE GENDER GAP

LISTENING TO THE SCIENCE OF SOUND

CATHOLIC UNIVERSITY | Engineer

Fall 2017

Swimming with *Whales*



CATHOLIC UNIVERSITY | Engineer

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Dean´s Welcome

As you look through the pages of this magazine, you’ll notice many things that are new … starting with the name on the cover! After a decade of publishing as *CUA Engineer*, we’ve introduced a new look and a new title, *Catholic University Engineer*. The changes in the magazine reflect some big changes in the School of Engineering. On June 1, President Garvey appointed me as Dean of Engineering. While I’ve enjoyed working here on the mechanical engineering faculty for the past 13 years, I’m excited to be serving in a new way and beginning a new chapter in the School of Engineering’s story. You can read more about my thoughts on the school’s future and my background in the interview on page 10.

I’m very fortunate to have outstanding people supporting me. Peter Lum, chair of the biomedical engineering department, has stepped into my previous role as associate dean. In February, we were joined by Melvin Williams Jr., vice admiral (retired), U.S. Navy, who brings a wealth of experience, wisdom, and connections to his role of associate dean for external affairs. In April, we welcomed Inés Pezo as assistant to the dean for administration, and this fall we have three new faculty members, Christian Bomela, Jason Davison, and Bradley Taylor. This edition of *Catholic University Engineer* is full of stories about new research, new projects, and new achievements by our students and faculty.

This issue is also a celebration of our past. On page 2, you’ll find a retrospective on the career of my predecessor, Charles Nguyen. After 16 years leading the school, Charlie is now dean emeritus, and continues to work hard on behalf of the school despite being in the midst of a well-earned sabbatical. We’re also highlighting some of our outstanding alumni, with a tribute to Lockheed Martin vice president Vinny Sica, a story of three generations of Burns family engineering graduates, and an article on recent graduate Phu Pham, now on his way to becoming a Franciscan Capuchin friar.

I hope you enjoy the new magazine format; please share your reactions by email at engineering@cua.edu or through our new social media profiles (see back cover). I’m sure that, like me, you’re excited about the school’s future and proud of its past. I’m deeply grateful for the encouragement I’ve received from colleagues, students, and alumni as I begin my new role, and ask for your continued support of the School of Engineering.

John Judge
Dean, School of Engineering
The Catholic Univeristy of America

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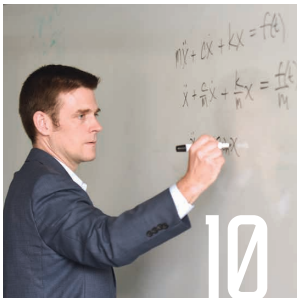

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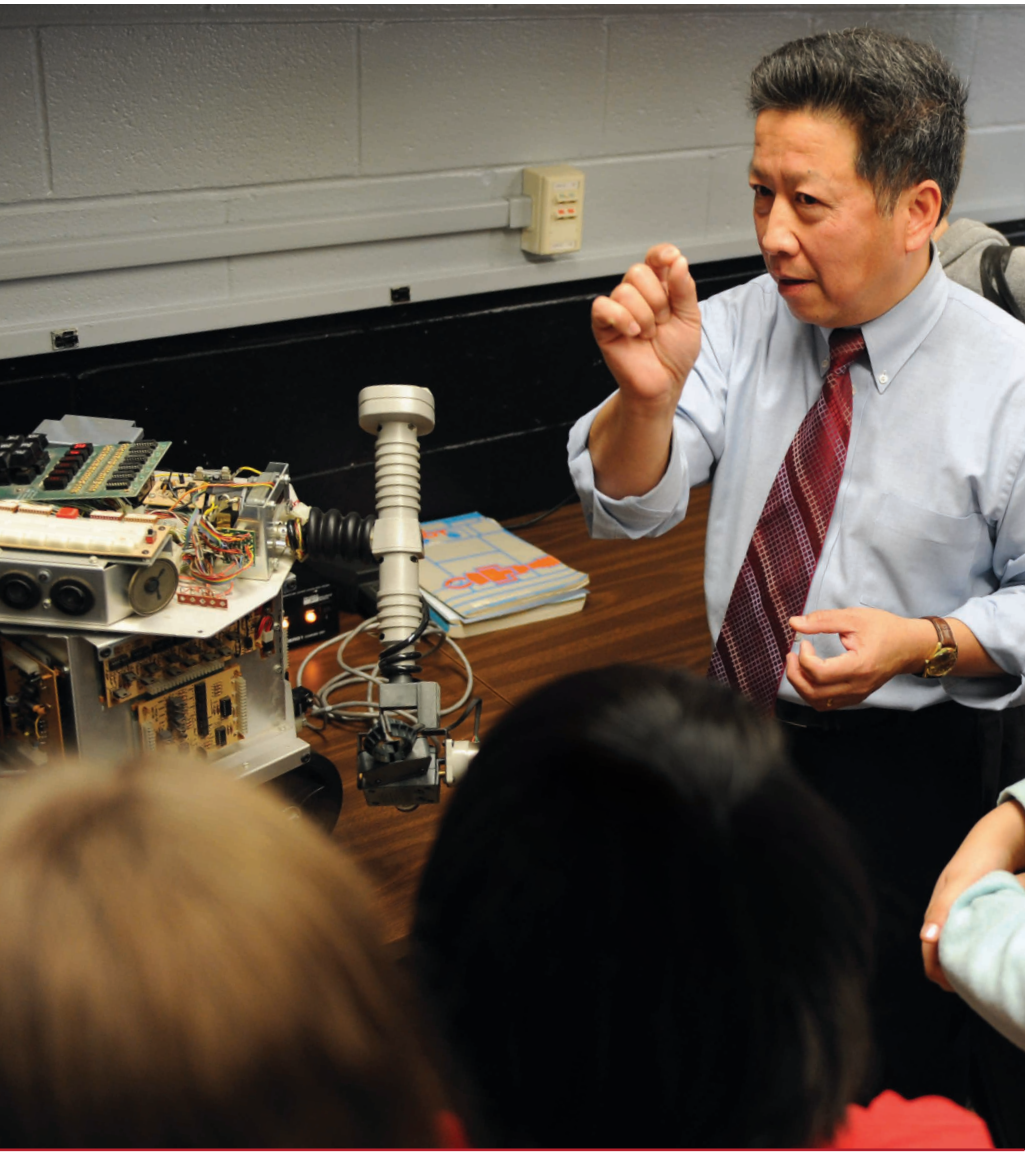
A SPECIAL TRIBUTE

Nguyen Completes 16 Years as Dean of Engineering



The longest-serving dean in the School of Engineering has stepped down from his leadership role after 16 years. Charles C. Nguyen, the school's 13th dean, was appointed in 2001 and spear-headed an era of tremendous growth, reshaping the face of the engineering school. "Charlie has left his unique personal style on every aspect of the school, and we are all grateful for his tireless work on behalf of its faculty, staff, and students," said Gunnar Lucko, professor of civil engineering.

"Charlie has been an outstanding colleague and dean," added Patricia McMullen, dean of the School of Nursing. "Under his leadership, the face of Engineering took on a global perspective. Thanks to Charlie, we have students from Vietnam, China, the Philippines, India, and throughout the U.S. His uncompromising views on the importance of research to advance the profession while serving the greater good has resulted in a number of grants, collaboration with many federal agencies, interface with governments and universities across the globe, and superb internships for budding engineers. We have been so blessed to have him."

Under Nguyen, engineering undergraduate enrollment has quadrupled in size. Offerings at the graduate level have also expanded. His initiatives in developing global collaborations have increased opportunities for study abroad and have also attracted the best and brightest international students to Catholic University. Tirelessly traveling throughout

Asia, Europe, the Middle East, and South America, Dean Nguyen has established over 35 memoranda of understanding with various universities in countries such as Vietnam, China, Taiwan, the Philippines, India, Brazil, and Mexico. In 2007, he established a program with Hong Kong Polytechnic University allowing engineering students to study abroad. Through these efforts, international enrollment has tripled.

Nguyen led academic expansion beyond the traditional programs in mechanical, electrical, and civil engineering. He oversaw the stabilization of the biomedical engineering department and was instrumental in bringing the computer science program from the School of Arts and Sciences to the School of Engineering. He initiated efforts to reinvigorate the engineering management program and launched the master's degree program in materials science and engineering. His tenure as dean also saw the engineering school develop off-campus graduate programs at Naval Surface Warfare Center Carderock, the Army's Night Vision and Electronic Sensors Directorate, and the National Institutes of Health.. Nguyen oversaw three successful ABET accreditation visits — the last in 2013, when the computer science program received accreditation for the first time. In 2015, the engineering school was selected to participate in the National Academy of Engineering's prestigious Grand Challenges Scholars Program. Our University is one of only 42 in the nation and the single one selected in the metropolitan Washington, D.C., area.

Perhaps his lasting legacy is in the quality of faculty he recruited and cultivated. "One of my happiest moments during my tenure as dean was when I rejected a computer scientist from Harvard University to pick someone from the University of Toronto," said Nguyen. Engineering currently counts five National Science Foundation CAREER award recipients among the faculty. During his tenure as dean, he oversaw the hiring of over 50 faculty members, growing the faculty from 22 to 35.

Dean Nguyen established clear criteria for research excellence for faculty and developed the infrastructure to support faculty and student research. He established the New Millennium Scholars Program to fully fund stipends and scholarships for high-achieving doctoral students. He established the inaugural Engineering Executive Development Board, and worked with alumni and the development board to raise funds to recognize and support faculty by establishing the annual Kaman Awards for Excellence in Research and Teaching and the Burns Faculty Fellowship Program, as well as numerous other initiatives.

"I thank Dean Nguyen for his support of junior faculty research programs, including tuition waivers and stipends for graduate students, start-up funds, and international programs to attract quality graduate students," said Christopher Raub, assistant professor in biomedical engineering.

"Charlie has been a boss, a colleague, a mentor and a friend," commented Binh Tran, vice provost for strategic initiatives. "He has had a profound effect on my career development as a faculty, an administrator, and a leader. He has helped me to grow and gave me the freedom to *chase down crazy ideas* and to *think big*. His energy, commitment, and passion for CUA and Engineering is inspiring."

Dean Nguyen will be on sabbatical in 2017–18, after which he will return to the engineering school as a faculty member in electrical engineering and computer science. In honor of his outstanding service, he has been granted the title of dean emeritus. The engineering school's Board of Visitors has established an award in Nguyen's name, to be presented annually to students demonstrating leadership talent.

Faculty and Students Learn Together in `Lean Start-Up' Boot Camp

Even professors go to school! Participating in a "lean start-up" boot camp, faculty members from the engineering and nursing schools were involved in an intense three-week workshop intended to identify and assess whether innovative ideas present sustainable business opportunities.

First formally proposed by Eric Reis in 2008, the lean start-up process seeks to efficiently refine ideas and concepts to launch businesses that meet the needs of the marketplace. Whereas traditional engineering design and development focus on particular technologies and performance specifications, the lean start-up process places more premium on understanding the customer and the marketplace to identify whether a business proposition is likely to succeed.

"Training engineering students to become better leaders demands connecting technical expertise with deep understanding of problems that people face," said Silicon Valley veteran Chris Danek, B.M.E. '89. "The lean launchpad achieves this connection and gives students a lifelong toolkit to successfully frame 'problems that matter.'"

During two lean start-up workshops in April and May, several faculty and graduate students were invited to join researchers at the Army Research Laboratory (ARL) to identify potential commercialization of technologies related to imaging, telecommunications, and biomedical applications. One team, led by biomedical engineering professor Binh Q. Tran and doctoral student Quoc Huynh, evaluated the commercial viability of an in-home fall detection device intended for elderly users. Also involved were clinical experts Jeanne Moore, clinical assistant professor in the School of Nursing; Bill Howie, nurse anesthetist at Johns Hopkins University's Shock Trauma Center; and Danek, serving as entrepreneur mentor for the team.

"What a great example of the power of collaboration," Danek observed. "Having a team with engineers and caregivers enabled the team to refine its product focus and create a powerful commercial strategy."

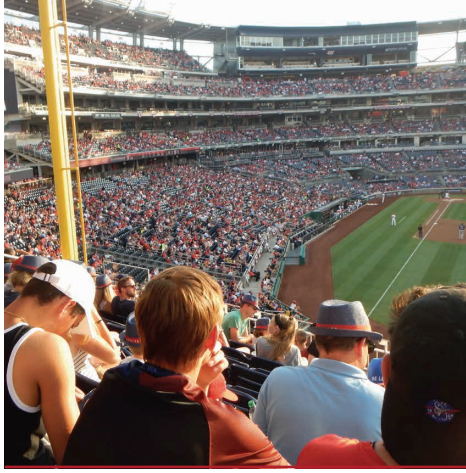
"The lean start-up workshop was extremely valuable to us," said Tran, "and strengthened our confidence in the viability of our technology as a commercial product. By talking to potential customers, and in consultation with our multidisciplinary team, we discovered additional potential opportunities and markets we had not previously considered. Perhaps most important for us was better understanding the difference between developing a *technology* and starting a *business*."

Another team, led by electrical engineering professor George Nehmetallah and doctoral student Thanh Nguyen, assessed the commercial potential of a holographic Imaging system for aerosols, capable of determining the size, shape, chemical composition, and abundance of particles present. Potential applications include the detection of biological aerosols for agricultural and public-health concerns, climate change studies, imaging and tracking, and life sciences.

The workshop was hosted by TechFire, a Maryland incubator program that is part of the Energetics Technology Center (ETC) founded by alumnus Bob Kavetsky, B.M.E. '75, M.M.E. '78, M.S. '80, who also serves on the School of Engineering's Board of Visitors.

"I was really excited about having two CUA-based teams in our lean start-up program," Kavetsky said, "and my ETC staff indicated the CUA participants were the most engaged and productive of all the teams going through the program. My hope is that efforts such as this will show the benefit of multidisciplinary innovation and entrepreneurship activities on campus."

"Perhaps most important for us was better understanding the difference between developing a technology and starting a business."



High School Students Visit Catholic University for Engineering New Frontiers Summer Camp

High school students from around the country explored engineering and sampled living on campus during the "Engineering New Frontiers" camp held July 24–28. Peggy Julian from the Office of Career Services and Greg Behrmann, an assistant professor of biomedical engineering, directed the camp, with support provided by University faculty, staff, and students, local engineering companies, and government laboratories.

Chris Deegan, CEO and president of Gibbs and Cox Maritime Solutions, delivered the opening address. Afterward, participating students were tasked with designing cardboard chairs with very specific requirements. They learned that in most cases in engineering design there is never one exact solution.

In a busy week, the students discussed the various engineering disciplines and worked on complex projects involving computer-controlled robots. They learned to convert universal bitmap files to vector format, allowing the robots to produce detailed drawings of the campers' choosing. Breakout sessions allowed the high schoolers to focus on topics such as women in engineering, origami and material science, and entrepreneurship.

Students also were treated to some excursions away from campus. Officials from Forrester Construction Company hosted them for a behind-the-scenes tour of a large-scale building renovation and addition project. They also visited NASA's Goddard Space Flight Center.

Recreational programs included a tour of Washington, D.C., monuments, a performance of *The King and I* at the John F. Kennedy Center for the Performing Arts, a Washington Nationals game, and other activities.

By all accounts, the week was a resounding success, giving students insight into the engineering profession and college life, as well as the opportunity to have fun and make new friends.

Seminar Series Helps Launch Careers

Engineering students eventually come to a daunting question: How do I land a career? They are often told that getting a job depends on who you know, more than what you know. But where do they start to get to know someone?

The career-oriented seminar series organized by the Department of Mechanical Engineering was intended to boost interaction and strengthen connections with industry for junior and senior students. Alumnus Jude Nitsche, B.S. '63, M.S. '65, serving as the Advisory Board chair in the Department of Mechanical Engineering, mediated a seminar series that brought in speakers with rich industry experience, helpful insights, and career advice.

The first lecture in the series, given by Andy Coon from Systems & Technology Research, had a title that drew immediate attention from students: "Engineering Career for Dummies — Fostering Mastery, Curiosity, Creativity, and Ambition for Long-Term Success: Retrospective Views of an Ongoing Career in Engineering."

"Forty Years of *In Situ* Sensor Development" was presented by Guy Farruggia, from Areté Associates. His talk not only surveyed the underwater sensors and packaging for ocean acoustics applications, but also integrated general career advice. One student began to consider taking an English class as an elective after hearing Farrugia stress the importance of writing well.

Business School faculty member Mark Weber and his business partner at NetApp, Mike Giesler, discussed the role of an engineer who works in sales. Many students who had not previously considered a sales career saw such an option for the first time. The speakers covered the difference between a sales engineer and a sales representative, the important role of a systems engineer in product development, and other topics.

Bongtae Han, Keystone Professor of engineering at the University of Maryland, shared his expertise in high-power light-emitting diodes (HP LEDs). Han introduced the fundamental design parameters and considerations of HP LEDs for general lighting applications, and discussed the optimum design domains of passively cooled, LED-based luminaires for a given light output requirement, considering cost, energy consumption, and reliability.

"Development of a High-Altitude, Solar-Powered Aircraft," the final seminar in the series, was given by Gil Crouse, chief engineer at Aurora Flight Sciences. Crouse discussed an ultralight, solar-powered airplane called the Odysseus, touching on challenges and factors including power collection, energy storage, latitude, altitude, aero-elasticity, and configuration. He provided engineering students with clear information about what solar-powered flight entails, and the barriers that need to be broken to make it possible.

The speakers in this seminar series not only broadened the engineering students' minds with different career perspectives, but also brought in connections to the students with industrial networks, internship opportunities, and real jobs.

Continued Growth and Development in Southeast Asia

During Charles Nguyen's last year as dean, the School of Engineering continued to enhance its presence and reputation in Southeast Asia through various outreach activities.

As part of a grant the school received from the project "Building University-Industry Learning and Development through Innovation and Technology" (BUILD-IT), sponsored by the United States Agency for International Development (USAID), Nguyen traveled to Vietnam and conducted the first workshops on institutional quality assurance (IQA) at the inaugural Developing Quality Systems and Accreditation Training workshop in September 2016 in Ho Chi Minh City and Hanoi. In February 2017, he conducted the second IQA BUILD-IT workshop in Hanoi. The attendees were senior academic leaders and quality assurance officers of Vietnamese universities intending to seek IQA accreditation from regional and international accreditation agencies such as the ASEAN University Network.

During his February trip, Nguyen joined a delegation consisting of Hilda Gigioli, B.S.E 1983, her husband, George Gigioli, B.E.E. '83, and Uyen Nguyen, B.E.E. '90, M.S.E. '95, Ph.D. '02, director of international programs in Asia, in traveling to Manila, the Philippines. The group met with academic officials and students of the Mapua Institute of Science and Technology, De La Salle University, and University of Santo Tomas to follow up on previously signed memoranda of understanding and agreement. They also met with the Archbishop of Manila, Cardinal Luis Antonio Tagle, S.T.L. '87, S.T.D. '92.

The recently established Pope Francis Scholarship Program (PFSP) was inaugurated in Manila, and the PFSP selection committee was officially formed. Committee members include Hilda Gigioli, George Gigioli, former U.S. Ambassador to Venezuela John Maisto, and Uyen Nguyen as members. Cardinal Tagle and former Philippine Ambassador to the U.S., Jose Cuisia, agreed to serve as honorary members, and Hilda Gigioli was appointed chair. The program assists students from the Philippines with engineering studies at Catholic University.

In March, Dean Nguyen traveled back to Vietnam to attend the 2017 STEMCON in Hanoi, where he moderated a panel discussion with senior academic, governmental, and industrial leaders entitled "Technology Innovation Panel: Public-Private Partnerships Driving Rapid Development of S&T Innovation and Research in Vietnam!" During his stay in Hanoi, he met the U.S. Ambassador to Vietnam, Ted Osius, at the ambassador's residence and gave a presentation describing educational opportunities at Catholic University at the Hanoi Architectural University. He also visited the Vietnam National University-Hanoi University of Science (VNU-HUS) and met with academic leaders to explore educational programs and research collaboration between VNU-HUS and Catholic University.

Swimming with *Whales*

University Research May Help a Species Recover

The sounds made by whales are still not fully understood. Whale songs are sometimes mournful, sometimes joyous, but always hauntingly beautiful.

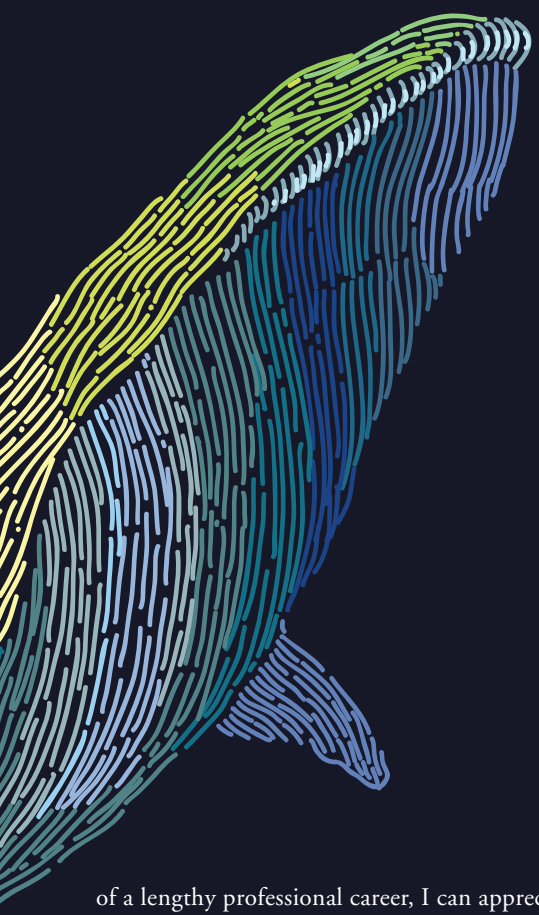
"We may not know yet why the whales make the sounds that they do, but sound could be very helpful to us in studying them and helping the species to successfully recover," said Dave Lechner, a doctoral student in the Department of Mechanical Engineering.

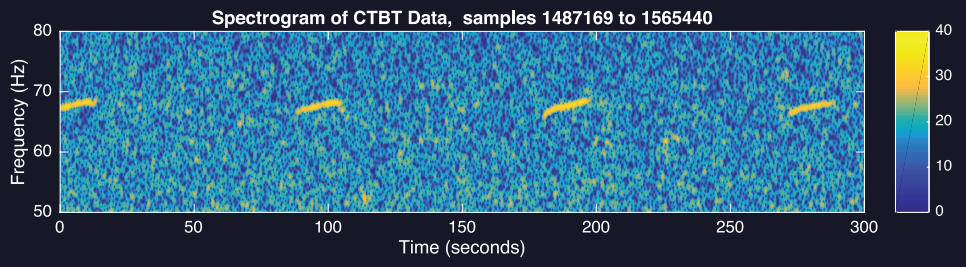
According to estimates from the International Union for Conservation of Nature, there were once about 250,000 blue whales in Antarctica, but that number dwindled to somewhere between 5,000 and 12,000 in 2002, before bouncing back to perhaps as many as 25,000 today. The population of southern right whales, once considered the right (best) whale to catch, has undergone similar fluctuation, with populations estimated at 7,000 in 1999, but at nearly 20,000 today. Lechner's research at the University could help contribute to knowledge about the feeding patterns and migration of the great whales.

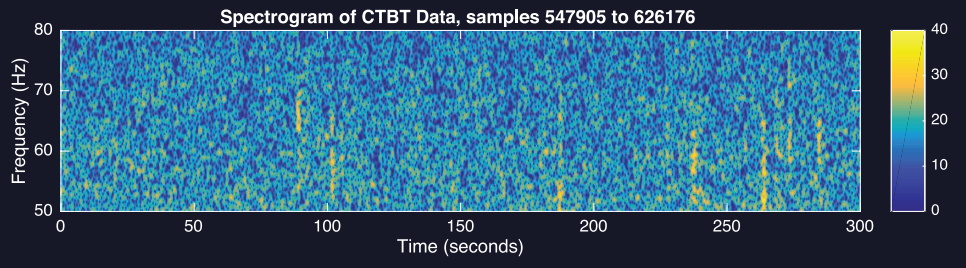
"Like most people in my generation, I watched Jacques Cousteau and his son Philippe following whales," said Lechner. "I grew up in New England, and we visited the Mystic Seaport whaling museum. I built a scale model of the Charles W. Morgan whaling ship, and I even read *Moby-Dick* when I was in eighth grade for the fun of it. So I have to admit that I was always hooked on whales."

Lechner, an engineer with the MITRE Corporation, has over 30 years of engineering and program management experience. He has a B.S.E.E./E.P.P. from Carnegie Mellon University; M.E.Ad. from George Washington University; and an M.S. in Applied Physics from George Mason University. After his older children went off to college, Lechner decided to give up his evenings free of homework and come back to campus.

"It's fun to be learning again," he said, "but now, with the perspective







of a lengthy professional career, I can appreciate the material a lot better. Some things are much easier to understand."

Lechner is studying the use of acoustics to track whales, which are notoriously difficult to track. They can hold their breath for long periods, dive deep, and disappear, only to come up a mile away. And they travel long distances.

"Some researchers camp out on cliffs for months and watch whale behavior with telescopes," Lechner said. "Some rent airplanes, and others attach acoustic devices to the whales with suction-cup guns, but those have batteries that only last a few hours. Others are putting GPS units onto whales that last for seven weeks, then detach, and have to be located and collected to get the data. If we can improve the acoustic tracking methods, that offers a huge data set to researchers."

In a Research Day presentation last April, Lechner pointed to a string of dots overlaid on a map showing the coastline of southern Australia.

"If we combine the results of several calculation methods on this data set," he explained, "we begin to see a pattern of motion, a gentle curving arc, which might be the location of a swimming whale."

The acoustics program at Catholic University has a history of research in ocean acoustics. Robert Urick, a professor in the 1970s, conducted extensive sonar experiments for the United States Navy. More recently, the department has been focusing on machinery noise and vibration and airborne acoustics.

In a marine bioacoustics class taught by Shane Guan of the National Oceanic and Atmospheric Administration (NOAA), Lechner learned about a data set available on the Internet that could be downloaded and used for research. He thought it would be a fairly simple matter to search the data for whale calls.

Unexpectedly, however, he ended up spending a series of late nights reviewing spectrograms, images depicting sound in a visual manner. He started looking at whale watch records, papers on migration patterns, articles on whale activity, and even the dates of YouYube videos to see when whales were active in a given area.

"One of the scientists I talked to said it was actually much harder than finding a needle in a haystack," Lechner said, "and more like finding a needle in a hayfield somewhere in Nebraska. We eventually found some data with a single low note that lasted 17 seconds and repeated every 91 seconds. Then we knew we were getting something. Eventually we found a few days of data, which had this repetitive single note calling and calling, as well as some loud gunshot-like noises. These sounds were typical of calls made by two types of whales."

Testing various algorithms that use the data to track the location of the whales, Lechner explains, is a difficult task.

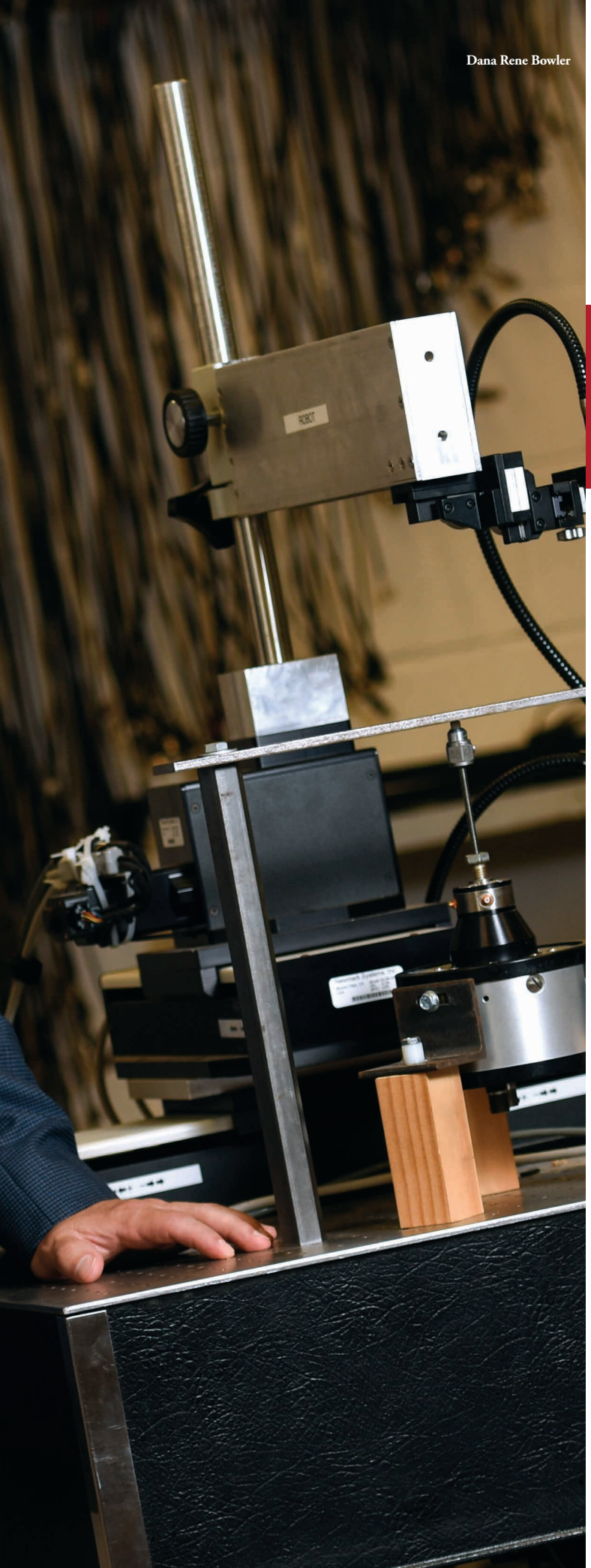
"They move slowly, and swim in curves, and dive up and down. Sometimes the calls are loud; sometimes they are invisible. By comparing the locations we calculate a swim speed, and compare that to how fast the whale can actually swim. That lets us assess whether the motion is realistic, and perhaps differentiate between different individual whales."

The work has already provided some interesting insight into the planet's largest creatures. Data from Australia indicated that the whale that called out over and over is probably a blue whale *(Balaenoptera musculus)*, but it is different from the groups that normally populate that part of the Indian Ocean.

"It resembles a blue whale call, but each group of blues has a distinctive call or song," Lechner said, "which they all 'sing' for years and years. This song is new, so it could either be a new group, or perhaps a whale from the same group that changed its call for some reason."

There is no real consensus, he notes, on why whales sing — whether they are communicating, navigating, seeking mates, or just idly "whistling" to themselves.

"I have spent months studying one hour of data, sort of swimming with this one whale. He's like a friend now, but I didn't give him a name yet."

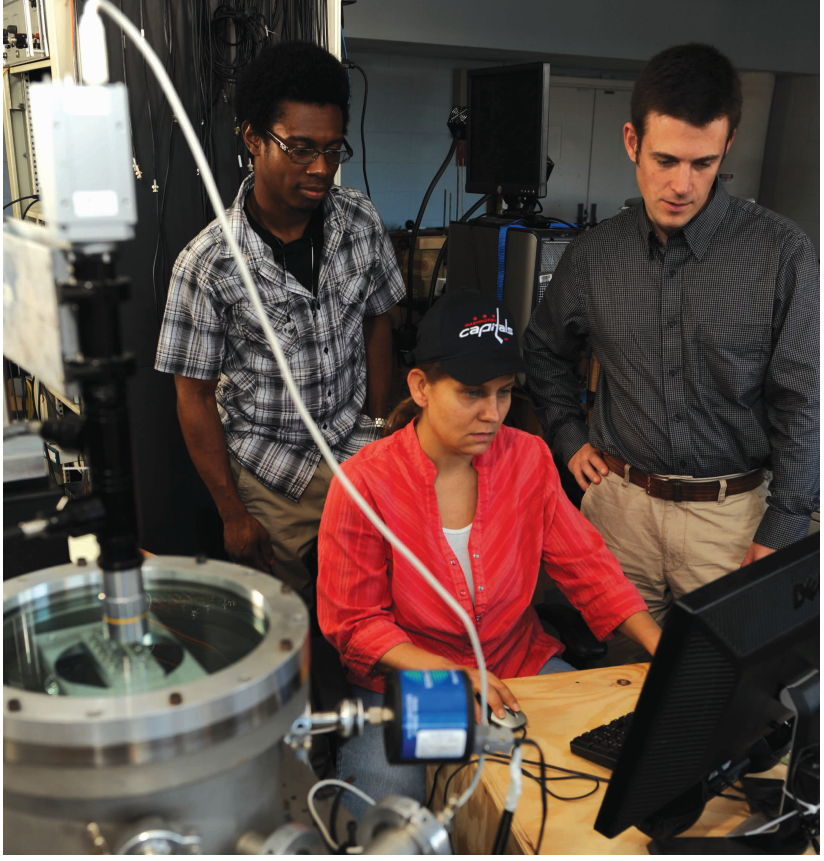


Dana Rene Bowler

Meet the NEW DEAN

John Judge came to Catholic University as an assistant professor of mechanical engineering in 2004. He became associate professor five years later, and began serving as associate dean on June 1, 2016. Judge did his undergraduate work at Cornell and earned his Ph.D. at the University of Michigan, where he focused on vibrations in jet engines. In a postdoctoral fellowship at the U.S. Naval Research Laboratory, he turned to the study of microscale mechanical resonators, with applications in sensing and signal processing. "It's interesting to me that the same physical and mathematical principles that apply in large structures like a jet engine can be used in a completely different application," he says, "on a completely different scale." Judge was appointed dean effective June 1, 2017. He took some time in July to discuss his vision for the school's future and talk about his background. Readers interested in an extended version of his remarks may visit **www.catholic.edu/JudgeInterview**.

There's an interesting amount of overlap between what the National Academy of Engineering is suggesting are the big engineering problems for the 21st century and what Pope Francis is saying are things that we as a society need to do to maintain a healthy relationship with the world that we live in. The overlap between those is a really sweet spot for our school.



WHAT'S YOUR VISION FOR THE ENGINEERING SCHOOL'S FUTURE?

The school has seen a lot of enrollment growth in the last decade, in particular at the undergraduate level. The challenge we have going forward is to maintain the "small school" feel and the amount of personal attention students get.

One of the things we would like to do is grow the faculty. The undergraduate student body, we'd like to keep stable — or if it continues to grow, make sure that it's very measured growth — so we don't outstrip our ability to provide a quality education.

Where we'd like to grow is the master's programs. The typical model for a doctorate in engineering is that it's funded in some way, such as by a faculty member's research grant, whereas the master's is a little bit more like undergraduate degrees, where students are expected to pay tuition. And it pays off — the bump in salary from having a master's degree is worth the extra investment in tuition. In order to be able to maintain a good doctoral program, we need to have a solid base of undergraduate students and master's students.

We have four departments [biomedical engineering, civil engineering, electrical engineering and computer science, and mechanical engineering], and historically they've been pretty siloed. I would like to see a lot more cooperation between the departments. There are areas of interest that cut across different disciplines. Environmental issues cut across different departments, whether it's sustainable building practices and water treatment in civil engineering, or clean energy generation in mechanical engineering, or next-generation photovoltaics and power distribution systems in electrical engineering. These departments have all had their own efforts to address environmental issues, and I'd like to bring that together. Robotics is another area that cuts across many disciplines, and electrical engineering and computer science, mechanical engineering, and biomedical engineering can all contribute.

There's a trend in higher education that I don't like, which is the commodification of degrees, with incoming students asking, 'How is this going to lead to a particular job?' rather than 'How is this going to broaden me as a person?' At the same time, we are educating people for a particular career path, and we need to pay closer attention

to what happens next. How are we placing our students into jobs? How are we placing them into internships while they're still with us? I think we can do a lot more to increase our students' professional preparation and give them the skills they need — not just solving equations, but working in teams and communicating; being able to write well; understanding how what they're doing fits into what their company is trying to do, or how it might lead to a new product or even a new company. We want to educate people who are not just going to be good entry-level people, but who are going to rise to positions of leadership.

HOW DO YOU SEE ACHIEVING THIS GOAL?

One of the things that we've always tried to do, and that we should do more of, is integrating what students learn outside of their engineering courses — in subjects like philosophy and ethics — into the engineering curriculum. Engineers who understand how what they're doing fits into the bigger picture are more likely to wind up in positions where they're in charge of the big picture. Being able to put things in context, being able to think ethically and morally rather than being narrowly focused on a technical solution — that's something I think our school of engineering can provide in a way that's stronger than other engineering programs.

All of our students have a capstone design project in their senior year. It's supposed to tie together their engineering education over the previous three years and draw from things they've learned in all their classes, to put it all together. So one of the things that we need to work into these design projects is these bigger-picture ideas.

The National Academy of Engineering (NAE) has issued a list of 14 "Grand Challenges" for the 21st century. Catholic Univeristy is one of a small number of universities around the country to launch an NAE-approved Grand Challenges Scholars Program. One of the aspects of the program is that students are supposed to be thinking about these big-picture problems, and they work with a faculty mentor to do this, choosing their classes, internships, study-abroad options, and so on. Each student has an individualized plan related to one or more of these big issues, positioning them for a career addressing some of these problems.

Quite a few of the NAE's grand challenges have to do with the environment and the planet and people's relationship to it — finding clean sources of energy, giving the entire world access to clean water. There's an interesting amount of overlap between what the National Academy of Engineering is suggesting are the big engineering problems for the 21st century and what Pope Francis is saying are things that we as a society need to do to maintain a healthy relationship with the world that we live in. The overlap between those is a really sweet spot for our school.

HOW DID YOU GET STARTED IN ENGINEERING?

When I was young, I thought about being an architect. I always liked drawing sketches of things and making plans for things. Somewhere along the line, it occurred to me that in some ways engineering is similar to architecture in that it's designing and planning, but in mechanical engineering you've also got moving parts. I was drawn to mechanical engineering because it's design, but of things that are moving and interacting, and to me that was more interesting than static design.

My doctoral work was on vibration in turbomachinery. If you have a typical jet engine, you've got these rotating fan stages or compressor stages that have a bunch of blades. They're like your desk fan, except for instead of three blades they've got 30 or 60 blades, and they spin at much higher speed. And in principle all of those fan blades are identical, but in practice they're slightly different. It turns out that very small differences between the blades cause huge differences in the way the system behaves. In the normal course of events, you expect if you make a small change here, it leads to a small change there. It's really interesting when a small change here leads to a huge change somewhere else.

The term "butterfly effect" gets used sometimes in these kinds of situations — it's a reference to the idea that a butterfly flapping its wings in one part of the world could affect the course of a hurricane on the other side of the world weeks or months later. This sensitivity to small changes is a common occurrence in nonlinear dynamics, which is another one of my areas of interest and research. It's really cool to study these problems and figure out why changing a little bit over here changes a lot over there. To come at that from a 30,000-foot view, that's where you have leverage to make a difference. If I can understand the system well enough to make just a small change here, and achieve a big outcome with relatively modest changes on the input side, that's a lot of bang for the buck.

IS IT A FORM OF OPTIMISM TO FOCUS ON SMALL TWEAKS LEADING TO BIG CHANGES?

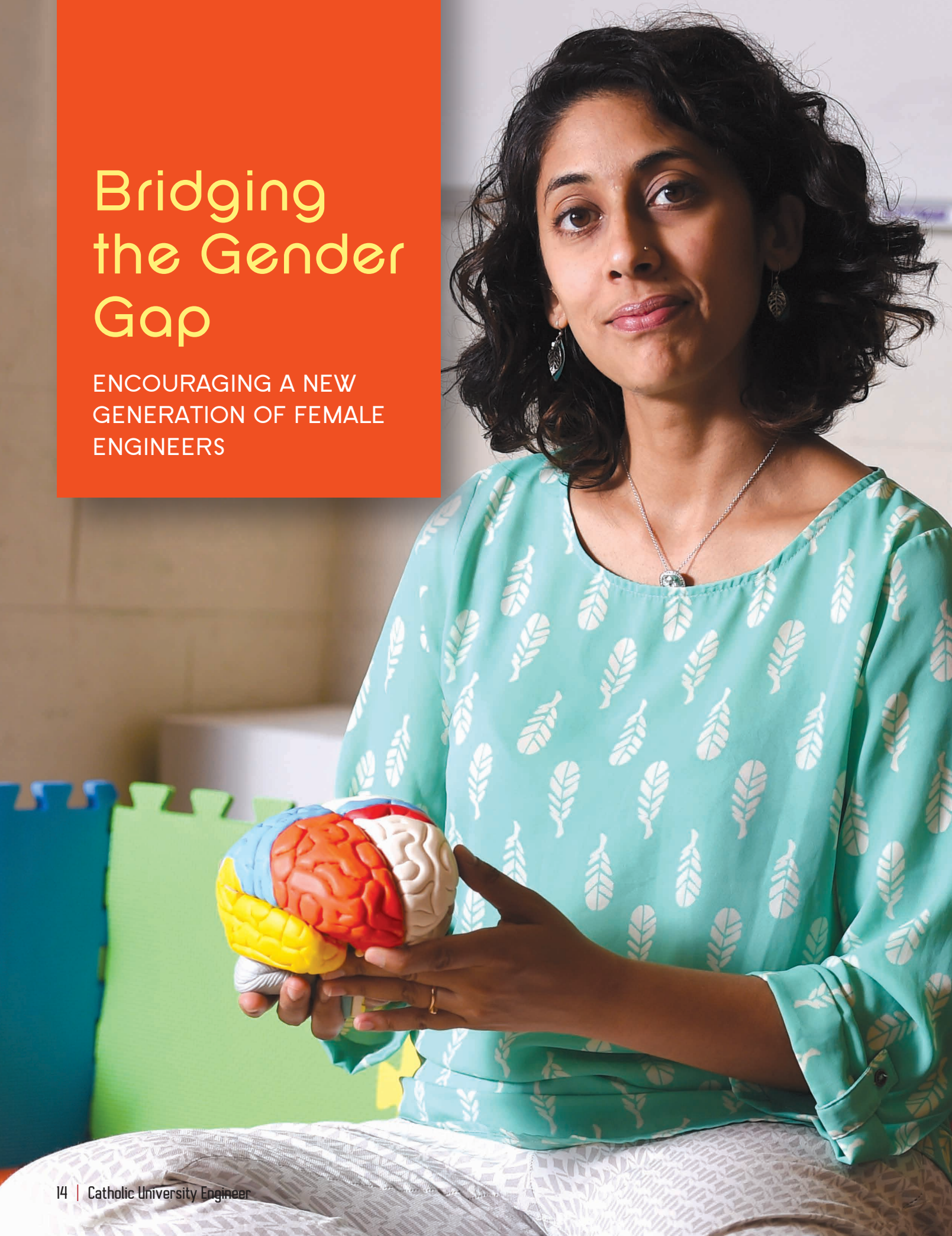
Whatever system you're talking about, whether it's a human-built engineering system like a jet engine, a social system, or a natural system like the weather, optimism comes from the idea that if we can understand how it works, we can find aspects of the system which give us the leverage to have a big effect with a relatively small effort or change. Basically, at some level, that's one of the things that engineering is all about. It's not pure science. Science is understanding how the world works just for the sake of knowing. Engineering is understanding how things work for the sake of being able to change them.

YOUR WIFE IS ALSO AN ENGINEER. DO YOU HAVE PROFESSIONAL DEBATES OVER DINNER?

She teaches at the Naval Academy. We have lovely professional conversations at the dinner table and the kids just roll their eyes. We have three children, one each in high school, middle school, and elementary school. We don't know yet whether they will wind up as engineers or flee, screaming, in another direction.

Bridging the Gender Gap

ENCOURAGING A NEW GENERATION OF FEMALE ENGINEERS



Photos by Dana Rene Bowler

On a Thursday morning in July, Sahana Kukke, an assistant professor of biomedical engineering, was in a classroom, casually chatting with a group of teenage girls. The young women were participants in the Engineering New Frontiers summer camp, a Catholic University program that encourages high school students to learn about careers in engineering. After a week of hands-on projects and scientific demonstrations, Kukke and the students were there to address a topic more personal.

"The goal for today is just to have a good conversation about what your image is of being a woman in engineering," Kukke said. "If there is any issue you want to talk about in terms of balancing a career with having kids or getting married or anything like that, I think it's all possible. You just have to be creative."

Their discussion reflected a real issue in the world of engineering: a persistent gender gap between the numbers of male and female engineers. According to recent statistics from the Society of Women Engineers, only nine percent of the engineering workforce in the United States is female.

During their conversation, Kukke and her students touched on several reasons for the lack of women in engineering, including negative self-perception women may feel about their own engineering abilities, as well as biases from teachers and employers. Kukke also shared some of her own experiences in the field, including what it was like balancing pregnancy and new motherhood with rigorous doctoral and postdoctoral research programs.

Prior to joining the Catholic University faculty in 2014, Kukke received degrees from Northwestern University, Case Western Reserve University, and Stanford University. Often, she recalls, she was one of few female students in her programs.

"There's always been a feeling of being a minority in general," Kukke said, "and that's a feeling I've been very familiar with."

While Kukke said she has experienced some subtle sexism during her career, she has also found great success in her research, which is focused on the sense of touch. Much of her work involves looking at infants to learn more about how the sense of touch and resulting tactile responses develop at a young age.

"We're interested in studying babies because infants who have early brain injuries don't always develop motor control very well," Kukke said. "Our question is whether we can use the sense of touch to get in there to try and trigger movements."

Kukke believes the gender gap is becoming less stark — especially in concentrations like biomedical engineering, which at Catholic University has almost an even split of male and female students — but she would love to see more women enter the field. She attributes much of her own success to her professional network of men and women who have supported her in her field every step of the way. Thanks to their example, Kukke is a big believer in mentorship and networking. Last year, she began making a purposeful effort to take on female mentees of her own.

"I believe mentorship, or even just having a good role model, is so important," she said. "If you can't see people like you doing what you're doing, you can't imagine what it's like. It's really nice to have a diversity of teachers because then you can look up to them and say, 'Oh, how did you get to where you are?'"

What has been your experience as a woman in engineering?

Often, the challenges are internal — pressure I put on myself, doubting my ability or knowledge, etc. Also, as a Catholic, I have thought a lot about how my vocation and career goals in biomedical engineering can coexist and even complement each other. This has definitely been a challenge, as I have often doubted my career path and what I am called to be doing in the world. I have found sometimes I need to be more assertive to get my voice and ideas heard mainly in professional environments. Confidence is key in any field whether you are male or female, but I think as a woman in engineering, confidence can be a little more challenging.

– **Marissa Coene**, *biomedical engineering, Class of 2019*

Although I did not feel marginalized, I sometimes feel like my gender makes male classmates skeptical about my capabilities. There were some instances when I was assigned simple, routine tasks while men had more opportunities to work on challenging problems. When that happens, and it might be just accidental, I always have to ask for extra work and try my best to complete it, as I not only want to face and experience the same amount of challenges as men do but also want to prove myself. My advice for young women entering the field: forget about preconceived notions of what a tech person would look like — if you love doing it, you will do it well. Remember, those perceived barriers in your profession confront many women in all walks of life, so do not give up and do not feel alone. Talk to your female classmates, coworkers, professors, and seek advice from them!

Ruby Huynh, *Ph.D. student, biomedical engineering*

//EYE ON FACULTY

Faculty Members Win Research Awards

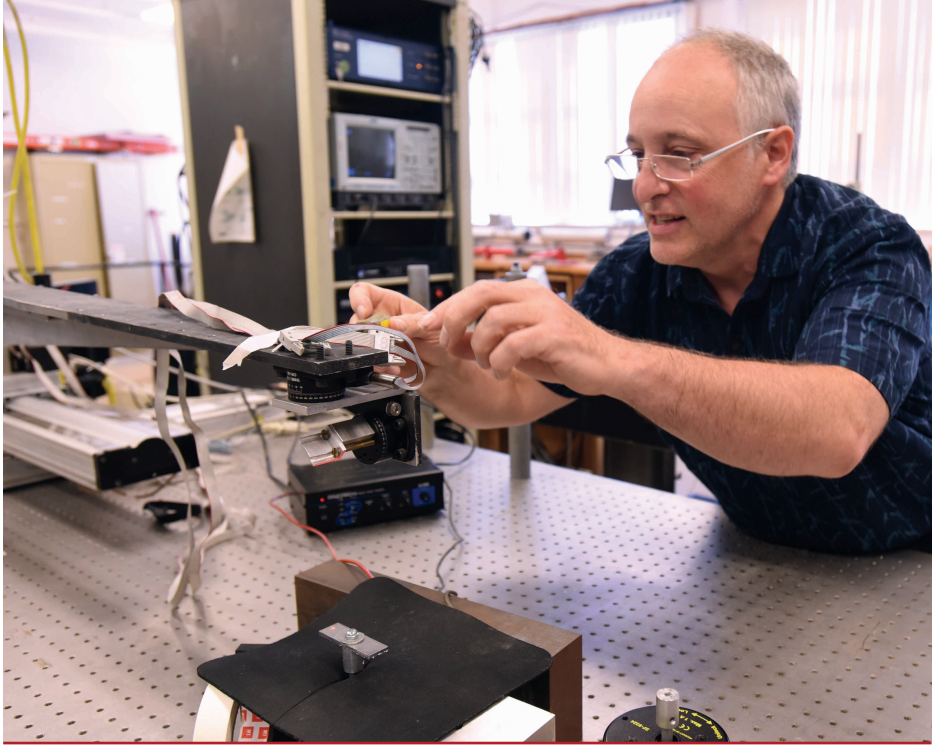
Two engineering faculty members were among the five recipients of University research awards presented by Provost Andrew Abela at Research Day on April 20. Gunnar Lucko, professor of civil engineering, won the award for Achievement in Research, and Xiaolong Luo, associate professor of mechanical engineering, won the Young Faculty Scholar's Award.

The award for Achievement in Research is given to a member of the faculty whose achievements have had significant critical reception and national or international recognition. Lucko is an expert on construction project scheduling, and has conducted seminal work on the use of singularity functions in scheduling, creating a powerful mathematical technique that overcomes limitations of graphical linear schedules and guarantees finding the minimal project duration for any set of input activities. He has extended this work to cover most quantitative aspects of construction project management, including developing cash flow models that consider the time value of money. His work has previously been honored with the Daniel W. Halpin Award from the Construction Institute of the American Society of Civil Engineers. Lucko is a co-author of the forthcoming fifth edition of the classic textbook, *Construction Management*, originally written by Halpin, one of the "founding fathers" of the field. Lucko's work has been funded for nearly a decade by several grants from the National Science Foundation, and he has a diverse network of collaborators across the country and around the globe. He works closely with industry partners, and one of his major scheduling case studies has been the mixed-use development Monroe Street Market adjacent to the University's campus.

The Young Faculty Scholar's Award is given for demonstrated achievement during the first four years of appointment at the rank of assistant professor, with the promise of potentially significant scholarship. (Luo was an assistant professor at the time of the award.) Luo is an expert in microfluidics and biofabrication, working with biopolymers extracted from crab or insect shells and seaweed algae to construct 3-D hydrogels and membranes, assemble biomolecules and living cells, and entrap optically-active nanoparticles in microfluidic networks. He leads a research group currently consisting of two doctoral students, six master's students, and five undergraduates. In the four years since he joined the faculty, he has developed five new graduate and undergraduate courses, published seven archived journal papers, and obtained several significant external research grants, including the prestigious CAREER award from the National Science Foundation. Luo collaborates with biologists, engineers, and chemists, and develops novel Lab-on-a-Chip devices with important applications in protein/metabolic engineering, cellular and molecular biology, *in situ* biosensing, and tissue engineering, which help to expedite novel drug discovery and improve human health.

Ozlem Kilic Receives ACES Meritorious Service Award

Associate Professor Ozlem Kilic, chair of the Department of Electrical Engineering and Computer Science, received the Applied Computational Electromagnetics Society (ACES) Meritorious Service Award at the 2017 ACES Conference in Florence, Italy. Kilic received the award "in recognition of exceptional service to the Applied Computational Electromagnetics Society (ACES) for over a decade, particularly in founding and successfully launching the new *ACES Express Journal*."



Dana Rene Bowler

FACULTY PROFILE

Listening to the Science of Sound

ACOUSTICS PROFESSOR JOE VIGNOLA HAS SPENT HIS CAREER STUDYING THE IMPLICATIONS AND QUALITIES OF HOW SOUND TRAVELS.

Associate professor Joe Vignola has an ear for engineering. After years of research in acoustics — the science of sound — he can't help but pay attention to the characteristics of sound everywhere he goes.

"I think about this all the time, and my kids are probably sick of hearing me talk about it," he said. "But you can't stop yourself from analyzing sound. I'm always trying to identify or solve problems or just understand why things are the way they are."

Vignola's research often investigates atmospheric sound propagation — how sound is affected by the environment, including weather patterns. Why, for instance, are the trains passing near his home louder in some weather conditions than others? Or why is it always so quiet after a snowstorm?

"We always think about sound and light traveling in straight lines," Vignola said, "but actually sound bends, it turns around corners, and wind and temperature profiles affect the way the sound bends. There are particular, specific factors in the atmosphere that can cause sound that is radiating upward to bend so that it arcs back down to the ground. That's called a temperature inversion, the main mechanism that causes this downward refraction."

As part of his research, Vignola is working with the Navy to develop computer models predicting how sound transmissions from ships, planes, and other vehicles will be affected by weather conditions. These models will provide the Navy valuable information about how detectable ships are under various conditions.

Vignola also does research on underwater acoustics, studying underwater sounds to learn about the migration paths and behaviors of whales.

"Sound is everything in the ocean. Water is not a great transmitter of light, but it is a very good transmitter of sound," Vignola said. "Here at Catholic University, we have a very long tradition of studying ocean sounds. A radio doesn't work underwater; light doesn't travel far; you can't have any forms of electromagnetic communication or use radar to send images of the sea floor. But you can use sound."

Vignola first became interested in acoustics while he was an undergraduate at the Georgia Institute of Technology. He sees the subject as a bridge between mathematics and the observable world.

"That's something I find really compelling," he said, "how over the few hundred years acoustics has been studied, people have built these elaborate mathematical descriptions that we can apply to all these different things — machines, cars, planes making noise, and how to make them quieter."

While pursuing his Ph.D. at Georgia Tech, Vignola studied optical laser measurements in acoustics, or how to use lasers or optical tools to measure sound and vibration. After graduation, he spent 15 years working in the Naval Research Laboratory in Washington, D.C., researching structural acoustics — the mechanisms of how objects or pieces of machinery make sound.

Since joining the Catholic University faculty in 2006, Vignola says he feels lucky to work at one of only 10 schools in the United States with a dedicated acoustics program. He enjoys helping students on their various research projects, which in recent years have included everything from designing musical instruments to studying the acoustics of architecture.

"It's very satisfying to take someone who is completely new to a subject and help them move forward and make progress toward a career," he said. "Acoustics is this tiny little niche in the world of engineering, but once you're in it, there's a ton of different things you can do."

New Faculty and Staff

Jandro L. Abot, Ph.D.

Jandro L. Abot, associate professor of mechanical engineering, recently accepted a tenure-track position after serving as a clinical faculty member since 2010. He received his Ph.D. in Theoretical and Applied Mechanics from Northwestern University, and was a member of the faculty in the department of aerospace engineering and engineering mechanics at the University of Cincinnati prior to coming to Catholic University.

Abot leads a multidisciplinary research group engaged in engineering mechanics, materials engineering, fabrication, thermal and electromechanical characterization of composite materials, and their structural health monitoring using carbon nanotube-based sensors. He is a past Fulbright Scholar and the recipient of research awards from the Air Force Office of Scientific Research, the National Aeronautics and Space Administration, and the National Science Foundation.

He is the organizer of the Multifunctional and Smart Composites session at the American Society for Composites technical conferences, and the Sensors for Structures session at the Symposia on Sensor Science. In addition, he was the recipient of the 2012 Kaman Award for Excellence in Teaching and is an active member of the American Society for Composites, the American Society of Mechanical Engineers, the American Society for Engineering Education, and the Fulbright Association.

Christian Bomela, Ph.D.

Christian Bomela joined the Department of Mechanical Engineering as a clinical assistant professor in August. Before coming to Catholic University, Bomela was a visiting assistant professor at Valparaiso University in Valparaiso, Ind., since August 2015, and a visiting assistant professor at Dalian Jiaotong University in Dalian, China, in the summer of 2016.

He received both his Ph.D. and M.S. in mechanical engineering from the University of North Carolina at Charlotte, in 2014 and 2010, respectively. While pursuing his Ph.D., he was an adjunct faculty member at the Central Piedmont Community College from 2010 to 2015. He also received his B.S. in Mechanical Engineering from the University of Kinshasa in the Democratic Republic of the Congo (DRC). Bomela was an instructor in mechanical engineering practical works at the Polytechnic College of the University of Kinshasa, in the DRC, from 2000 to 2003, and an engineer in charge of high-voltage stations at the DRC national power company from 2001 to 2003.

Bomela has been president of the Congolese Community of Charlotte, N.C., since 2013. His interests include energy systems and their analysis, as well as excellence in teaching through student engagement techniques — improving student learning and retention in fluid mechanics and heat transfers, computational fluid dynamics, thermodynamics, turbomachinery, and mechanical measurements.

Jason Davison, Ph.D.

Jason Davison joined the Department of Civil Engineering in August as a clinical assistant professor. Previously, he was a postdoctoral scientist at Aquanty Inc., where he researched Canada's water resources and the impact of global climate change.

Davison received his Ph.D. in Earth and Environmental Sciences from the University of Waterloo in 2017. His research focused on integrated atmosphere, surface, and subsurface water flow models. He received his M.S. in Environmental Fluid Mechanics and Hydrology from Stanford University and his B.S. in Civil and Environmental Engineering from the Georgia Institute of Technology.

Davison's research interests include water cycle modeling, environmental policy, continental scale hydrology, and climate change.

Graciela Inés Pezo, M.B.A.

Graciela Inés Pezo joined the School of Engineering as assistant to the dean for administration in April. Pezo has an M.B.A. focusing on international business and a master's degree in legal administration and paralegal certification from Marymount University. She also holds a B.A. in Government and International Politics and Legal Studies from George Mason University.

Before coming to Catholic University, Pezo worked as an accounting specialist and treasurer. Additionally, she has

had experiences in both the legal and business fields, as well as in national and international communications. Pezo's marketing and communication experience also includes being part of the digital team for Aleteia's "Pope is Hope" when Pope Francis came to visit the United States. She was a spokesperson for the movement in a televised segment which informed audiences about the appeal and message that Aleteia had for its #GoodisWinning campaign.

Bradley Taylor, Ph.D.

Bradley Taylor joined the Department of Electrical Engineering and Computer Science as a visiting assistant professor. A graduate of the U.S. Naval Academy and Naval Nuclear Power School, Taylor served aboard several submarines and as a project engineer and operations and plans manager for the Navy's submarine fleet. He worked as a controls engineer and consultant in private industry for several years, with experience in critical infrastructure plants, such as electric power, water and wastewater treatment, and in cybersecurity, optical, and laboratory information systems.

He returned to the Naval Academy as an instructor, and has further teaching experience at the George Washington University, the Naval Surface Warfare Center Indian Head, and the University of the District of Columbia. He received his M.S. and doctorate in computer science from the George Washington University.

Taylor is active in several professional societies, including the International Society for Automation, where his work prompted an invitation to serve as a charter voting member of the now 500+ member Industrial Automation and Control Systems Security standards committee.

Mel Williams Jr., M.S.E.

Vice Admiral (retired) Mel Williams Jr. joined the School of Engineering in February to serve as the associate dean for external affairs. In this new position, his duties include building partnerships; supporting strategic planning and execution; and serving as director of the Engineering Management graduate program, director of the Materials Science and Engineering graduate program, and director of off-campus graduate programs.

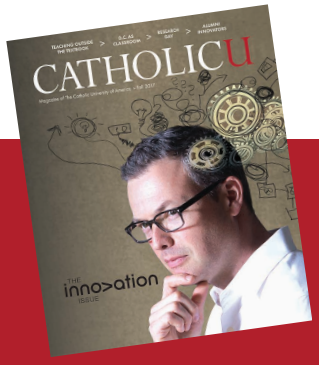
He previously served as executive director of strategic research development with the University of California, Davis, and as the associate provost for military and veterans' affairs at the George Washington University. For two years he was the Associate Deputy Secretary of Energy, the presidential appointee responsible for day-to-day management and operational excellence at the U.S. Department of Energy.

Williams completed service in the U.S. Navy in October 2010 after 32 years as a commissioned officer and one year as an enlisted sailor. His nearly 10 years in command included service as a fleet commander; a submarine group commander; a submarine squadron commander; and a submarine commander. He is one of the U.S. Navy and Submarine Force "Centennial Seven" — the first seven African Americans to command a U.S. Navy submarine in the hundred-year history of the Submarine Force. Other key assignments included that as deputy commander, U.S. fleet forces; director of global operations at U.S. Strategic Command; chief of staff for the Kitty Hawk aircraft carrier strike group during initial combat operations of Operation Enduring Freedom following the 9/11/2001 attacks on our nation; and Executive Officer on USS Louisville during initial combat operations in 1991 during Operation Desert Storm.

He is a 1978 graduate with merit from the U.S. Naval Academy (Bachelor of Science degree in mathematics), holds a Master of Science degree in engineering from The Catholic University of America (2012 Distinguished Alumni), and attended Harvard's John F. Kennedy School of Government (national and international security).

He is the co-author (with his father) of the leadership book, *Navigating the Seven Seas*, which since 2012 has been designated by the U.S. Navy as one of the 18 books determined to be "essential reading" for all who serve.

"It is a privilege and honor for me to join the Catholic University of America," Williams said, "and to serve and support the faculty, staff, and students within the School of Engineering."



Congratulations to two members of our faculty, **Otto Wilson** and **Xiaolong Luo**, who are both featured in the latest issue of the University's magazine, *CatholicU*. The newly redesigned magazine's focus in its inaugural edition is innovation across our campus. For more information, see **catholicumagazine.catholic.edu**.

Like Father, Like Sons – and Grandsons: A FAMILY LEGACY

IS ENGINEERING TALENT HEREDITARY? THE BURNS FAMILY HAS SENT THREE GENERATIONS — GRANDFATHER, THREE SONS, AND TWO GRANDSONS — TO THE SCHOOL OF ENGINEERING.

After returning home from serving in World War II in 1947, Robert Burns, B.M.E. '51, pursued his education on the GI Bill. He received his degree in 1951, and then went to work for an engineering firm in Washington, D.C., helping it open a branch office in Philadelphia. After the project, for a local airport, was completed, Bob then opened his own firm in Philadelphia.

Bob's three sons, Matt, Mark, and John, didn't exactly follow their father's footsteps. Bob was a mechanical engineer, but all three sons studied electrical engineering.

SECOND PHASE

Initially, Matt Burns, B.E.E. '80, thought he might attend the University of Delaware because a high school friend was studying engineering there. Bob pointed out that Matt and his brothers could go anywhere for college, but that he was only paying the tuition at Catholic University. "Give it a try for a year and if you don't like it, you can change schools," Bob said.

After college, Matt took a job at Western Electric in optical fiber communication systems for the Bell System. He was later transferred to Bell Labs, where he received a U.S. patent for work inspired by his early study of digital filters at Catholic University. After the breakup of the Bell System five year later, Matt earned a graduate degree from Lehigh University in 1985 and joined the small engineering business operated by his father.

With his dad close to retirement, they worked together on a business transition plan and growth strategy for the company. Matt is now president/CEO of Burns Engineering, a top-10 consulting firm based in Philadelphia. Matt also served for five years as the chair of the first Executive Development Board of the School of Engineering, which he helped to establish in 2006.

After graduating from Catholic University, Mark Burns, B.E.E. '82, took a job at BDM Corporation as a communication systems engineer. In 1987, he earned a master's degree in electrical engineering from George Mason University. In 1990, he joined Stanford Telecom as a senior engineer, and after a series of acquisitions, is now a technical director at Harris Corporation. In this role, Mark manages the operations, maintenance, and engineering of NASA's Near Earth Satellite Communications Network. Mark credits his Catholic University professors with inspiring his interest in radio antenna theory, communications theory, and real-world engineering practices.

Younger son John Burns, B.E.E. '85, began his career with a defense contractor in Annapolis, Md., as a FORTRAN computer programmer analyzing aircraft flight data on a Sperry UNIVAC mainframe computer. Soon, however, he joined the family engineering business to help Matt further the company's growth and to focus on airport construction. He led the Burns aviation practice, managing design of passenger terminals, airport security systems, and airfield guidance lighting and runway instrument landing systems for some of the largest U.S. airports. Currently senior vice president and COO of the family firm, John now focuses on business operations. He is also the principal investigator for the Airport Cooperative Research Program guidebook, *LED Airfield Lighting System Operation and Maintenance*. As a former student of Dean Emeritus Charles Nguyen, John still has copies of Nguyen's handwritten notes used in lieu of engineering textbooks. John credits Nguyen as an inspirational professor who brought energy and knowledge well beyond the textbook to his classroom.

THE RISING GENERATION

Bob's grandsons, John and Paul, both Matt's sons, completed the accelerated bachelor's-master's engineering program at Catholic University. John F. Burns, B.M.E. '14, M.S. '15, is currently in St. Louis as a project engineer at Nooter/Eriksen, a supplier of heat-recovery steam generators for power plants. John remembers new dean John Judge as one of his "go-to" professors. His volunteer work includes leading the University chapter of Engineers Without Borders, making a trip to Paraguay with Judge, the group's faculty advisor.

Paul Burns, B.E.E. '15, M.S. '16, lives in Washington, D.C., and works as an electrical design engineer for NV5 in Alexandria, Va. specializing in electrical power substations. He also worked at C3M, a division of Clark Construction, on electrical systems for the Washington Metro. Paul's interests include renewable energy and other technologies contributing to the evolution of the electric power grid.

The Burns family believes that the student-faculty experience during college creates the inspiration for life-long achievement. In 2007, the family created the Burns Faculty Fellowship Award to recognize and inspire young engineering faculty to excel in research. The Burns family believes that a successful academic program starts with great faculty motivated to be both excellent teachers and researchers. The family is proud that Dean John Judge was one of the first recipients of the Award.

In a similar spirit, the Burns family has taken a leadership role in making a gift to establish the Dean Charles C. Nguyen Leadership Award. This new award, created by the engineering school's Board of Visitors in Nguyen's honor, will be presented annually to students demonstrating academic, technical, or managerial leadership.

The generosity expressed by the creation of these awards shows that the Burns alumni don't necessarily believe in keeping it all in the family.

Bringing Innovation to the Marketplace

Chris Danek, B.M.E. 1989, is an in-demand consultant who helps start-ups as well as Fortune 500 companies bring new ideas to the marketplace. A medical device developer with more than 60 U.S. patents, his inventions have helped thousands of patients. Danek says he's reached a point in his career where joy comes from helping others turn *their* innovative ideas into practical solutions.

After graduating from Catholic University, Danek headed straight to Stanford University, where he earned a Ph.D. His plan was to enter academia. "The Silicon Valley effect started to intrigue me. There was a tremendous amount of opportunity for start ups, particularly in the medical device industry," says Danek, who went on to earn an M.B.A. from the Wharton School of Business.

Danek led the initial clinical development of bronchial thermoplasty, the first approved intervention to treat asthma. He also co-founded AtheroMed, Inc., where he built the team and led the development of a clinically and commercially successful treatment for peripheral arterial disease.

"In medical device development, the outcomes, experience, and safety of the patient always come first. When the focus stays on the patient, the rewards are incredible," says Danek. "When people tell you they can go back to work, or they can go on a hike for the first time in a long time — when you meet people who have a better quality of life because of something you helped invent, it makes all the time and energy to bring a product to the market worthwhile."

> "Collaborate, believe in your vision, and be persistent."

Danek remembers his time at Catholic University fondly. "The small class sizes and the friendships enhanced my education. The School of Engineering provided a strong foundation for what I have achieved." Danek stays in touch with his alma mater, and is always quick to lend his time or guidance engineering faculty and students.

His advice to fellow engineers and students who want to try the field of medical device development?

"Collaborate, believe in your vision, and be persistent. Work on things that matter — place the patient first. Are you addressing a meaningful problem? It has to be worth all of your time and energy. Medical device development can take years spent on research and development, clinical trials, and regulatory approvals. So consider if our solution will be sustainable and useful years from now."

Engineering Alumnus to Join the Franciscan Capuchins

Prior to earning his master's degree in mechanical engineering last May, Phu Pham, an international student from Vietnam, was active in research with professor Xialong Luo in the School of Engineering's BioMicroFluidics Lab. Now, after years of successful study and research, he's making a sharp switch in his career, by entering the postulancy program for the Franciscan Capuchin religious order.

"This is my ultimate longing, to serve the Lord," Pham said.

Inspired by God's message of mercy and love, Pham first considered the religious life at age 21. He taught the faith as a youth catechist for a year and joined Light of Jesus, a lay Catholic ministry that began in the Philippines and now has chapters all over the world. Through that group, Pham became involved in service, working to help people living in poverty meet their spiritual and physical needs. Though he was seriously considering entering the religious life, he still had doubts about what his vocation would be. After earning his bachelor's in mechanical engineering, he moved to the United States to pursue higher education.

Since coming to Washington, D.C., Pham has served as a minister of the altar at the Basilica of the National Shrine of the Immaculate Conception. He has enjoyed studying at the University because of the strong integration between the Church and school. Inspired to find ways to reach those most in need, Pham chose to begin his new journey as a religious brother in the hope of "fully bringing the feeling of renewal to the people."

Phu Pham (center top)

Sica Honored by University Alumni Association

Vincent "Vinny" Sica, B.M.E. 1983, was honored by Catholic University's Alumni Association with an Alumni Achievement Award. Sica was recognized for his distinguished career and his service to the University during an awards dinner held April 8 on campus.

As vice president and general manager for Lockheed Martin Space Systems Company Mission Solutions, Sica helps to develop, deliver, and operate affordable engineering and sustainment solutions for commercial, military, and intelligence users across the globe.

Sica was recently a leadership donor to Murphy's, a new gathering place and restaurant in the Edward J. Pryzbyla University Center. In addition to his philanthropic efforts, Sica currently serves on the board of directors for Volunteer Fairfax, a nonprofit that promotes local volunteerism. He is a member of the School of Engineering's Board of Visitors.

"Vinny's continued support, not just as a donor but as a mentor to our students, has been a tremendous asset to the School of Engineering," says John Judge, dean. "We are lucky to have so many alumni like Vinny who have remained close to their alma mater, sharing their time, skill, and leadership with us. We are thrilled that Vinny was recognized for his impressive career and service."

//OUR STUDENTS

Promoting World Health Through Medical Equipment Donation

The University chapter of the Biomedical Engineering Society (BMES) has engaged in a yearlong program to assist Brother's Brother Foundation, a nonprofit organization that donates used medical equipment from the United States to hospitals in 149 countries worldwide. The BMES executive board, consisting of students Olivia Giangiordano, Abdullah Alalyani, John Walker, and Joseph Duffy, has collaborated with a team of biomedical engineers from Children's National Hospital, consisting of Jeffery Hooper, Thomas Scalfaro, Reagan McCloskey, and Rachel McCoy (all alumni of the School of Engineering) to analyze the used equipment, perform electrical safety testing, find service manuals and service providers with global reach, and generate "report cards" for each piece of equipment.

So far, the students and professionals have generated reports that aided the donation of two ultrasound instruments to Haiti, an electrocardiogram machine, an anesthesia gas machine, pulse oximeters, vital signs monitors, ventilator systems, and a centrifuge.

When asked about the collaboration, Children's Hospital engineer Thomas Scalfaro says "Children's is blessed to be well-funded by donors, so we have the opportunity to get new equipment frequently. This also means we have relatively new equipment that can be donated. Brother's Brother Foundation is a great organization that can take that extra equipment and help it be put to good use."

"The report generated by the CUA Biomedical Engineering Students is an essential document that helps ensure the end-users know basic technical aspects of the particular equipment, as well as where service and spare parts may be obtained," commented Chris Raub, an assistant professor in biomedical engineering and faculty mentor to the BMES chapter.

Members of the BMES executive board agree. "It is nice to see a real-world application of what we are learning in the class room. It is a good experience to have," Giangiordano said.

Students Design and Build Drones That Fly and Swim

In spring 2016, four seniors in mechanical engineering — Robert Leeson, Steven Weber, Erica Good, and Emily Fredette — conducted a conceptual study of a new type of drone that could fly and swim interchangeably. The study was a class project for ME554 Aerospace Design, taught by Masataka Okutsu.

The team presented its results on Research Day and received the Most Outstanding Undergraduate Presentation Award.

"My classmates and I had high expectations for the course," said Leeson, who also presented their work at the American Institute of Aeronautics and Astronautics (AIAA) Student Paper Competition in 2016 in Worcester, Mass. "But we ended up achieving goals beyond what we thought was possible."

Another group of undergraduate students joined the project in summer 2016. This group, including three Brazilian students — Dioser Dos Santos, Paulo Henrique Faleiro Costa, and Lucas Flach Vasconcelos — doing summer research at Catholic University, built the preliminary prototype of a drone based on aircraft configuration.

During the past academic year, the project continued as senior design projects taught by Okutsu. After some further tinkering and flight tests, the drone was proven flyable.

The team's work has been well received at various conferences, including the AIAA Student Paper Competition at Charlottesville, Va.

Team member Danielle Caruccio was accepted as a presenter for a graduate-level paper competition, held as a part of the AIAA Aviation Forum in Denver in June. The undergraduate team was allowed to compete at the graduate level because Caruccio, the first author of the paper, had a dual status as an accelerated master's student. Her audience was impressed that a group of undergraduate students achieved this project with a budget under $600.

Students Excel at ASCE Games

This year the Catholic University chapter of the American Society of Civil Engineers traveled to Old Dominion University in Norfolk, Va., to compete in the annual Virginias Section Regional Conference. The group sent both the concrete canoe team and the steel bridge team to participate in various competitions and events. The steel bridge team's many hours of practice paid off, as they excelled in the build competition.

"The final product spanned 21 feet and supported 1,700 pounds before deflecting .003 inches past regulation," said captain Christopher Martin (Class of 2018). "Timed construction came to 26 minutes, faster than the previous four years! I am so proud of the entire team for all of the hard work they put in."

The concrete canoe team ran with the momentum, and after presenting the canoe and participating in both men's and women's races, the team took sixth place overall. Both teams did well during the competition and enjoyed putting their talents to the test. At the end of the conference, in a show of school spirit, the club also participated in the sand-castle building competition, taking first place.

The School of Engineering looks forward to hosting the games in 2018!

Pope Francis Scholar Receives Graduate Student Employee of the Year Award

After earning her bachelor's degree and teaching at the University of Santo Tomas in the Philippines, Kathleen Libnao received the Pope Francis Scholarship to pursue a graduate degree in civil engineering at Catholic University. The recently established Pope Francis Scholarship Program provides assistance to students from the Philippines who pursue degrees at the School of Engineering.

During the school year, Libnao worked part time at the School of Theology and Religious Studies while taking a full course load and doing research in transportation engineering.

On April 25, 2017, Libnao received the Graduate Student Employee of the Year Award, which was presented during the Cardinal Leadership Celebration event.

Congratulations, Class of 2017!

DOCTORAL DEGREES

Ji Chen
Dissertation: *Spring Operated Wearable Enhancer for Arm Rehabilitation*

Hubert Seth Hall
Dissertation: *Exploration into the Use of Numerical Modeling to Assist the Two-Microphone Transfer Function Free Field Test Method*

Xiaomeng Liang
Dissertation: *Modeling Motility Controlled Bacteria Transport*

Stephen Francis Lloyd
Dissertation: *Wave Propagation Analysis and Inverse Modeling to Identify Fluid-Solid Interfaces and Arbitrary Moving Source Functions*

Eyad Yahia Makki
Dissertation: *An Enhanced Quantitative Performance Model for Automatic E-commerce Websites Evaluation*

Yi Su
Dissertation: *Unified Quantitative Modeling for Integrated Multi-objective Project Management with Singularity Functions*

Master of Science, Biomedical Engineering

Hanadi Matouk Alqosiri
Ibrahim Rashed Alsedran
Razan Salem Omar Bahabri
Cristina Eleonora Butrico
Nicholas E. Civetti
Santiago Ocampo Correa
Van Kha Lam
Brooke Nicole Petery
Phu Le Hoang Pham
Catherine Cindrella Premraj
Kathleen Mary Sheridan

Master of Science, Civil Engineering

Mohammed Abdulaziz Abanumay
Faysal Hussain Albalushi
Mousa Owaidh T Alharthi
Abdulaziz Mohammed A. AlHusain
Abdulaziz Alshaibi
Catherine Hess
Huu Trong Huynh
Kathleen Jane C. Libnao
Kyle E. Loomie
Hussain Sameer H Malki
Quan T Ngo
Nam Ngo
Khiem Hoang Duy Nguyen
Bruke Gebrekidan Siraga

Master of Science, Electrical Engineering

Khawla AlHamdan
Khai Cao
Tyler Edward Cork
Sarah Elizabeth Cunningham
Anh Sinh Tram Thai

Master of Science, Computer Science

Jamal Alikhani
Mohammed Abdullah Alshahrani
Li-Tse Hsieh
Jeffrey Charles Jenkins

Master of Science, Engineering Management

Razan Abulhamayel
Sami Alaid
Mohammed Khalid Alamoudi
Mohammed Ghayadh H Alanazi
Naif Ahmed R Alboainain
Sultan A Alhassoun
Ibrahim Abdulgani A Almuhanna
Hamad Faleh Aloneizi
Mohammed Khaled ALotaibi
Abdullah Alotaibi
Ahmed Masoud Alqahtani
Fouad Alrushaid
Majed Ammar Y Alsofyani
Razan Salem Bahabri
Nadia Katherine Barón Martinez
Brooke Nicole Petery
Jordan William Small
Bassam Ghazi Ahmad Tharwat

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Khalid Abdulrahman Alfaris
Abdulaziz Nasser M. Alqahtani
Hanadi Matouk Alqosiri
Munirah Fehaid Alsubaie
Waleed Salim Badahdah
Appajosula Yashodhara Rao
Tannaz Tayyarian

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Michael Myron Barton
Seth D. Hubbard
Fahad Ismail M Jambi
Phu Le Hoang Pham
Robert T Taylor

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Sean Michael Adams
Dana Abdulrahman Alhagas
Nouf Saeed S. Alharthi
Bashaer Alotaibi
Manar Hameed Alyasi
Mohammad Abdullah Bagatadah
Christine Anna Dedoulis
Allison Mary Fasano
Brendon Alexander Frederick

Timothy Howley Keith
Brenna Ellen Lakeman
Jamil Georges Marzouka
Elnaz Najafi
Dominic Padova
Benjamin Dean McCann Pesante
David F. Posillico
Catherine Cindrella Premraj
Benjamin Dariush Rahimi
Christopher K. Rahimi
Kathleen Mary Sheridan
Brian Patrick Simmons
Thien-Quoc Nguyen Tran
Joseph C Vidal
Rachel Anna Vierra

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Connor William Adams
Abdulaziz Alshaibi
Benjamin Edward Arthus
Caitlin Rose Boyle
Edward Charles Burgard IV
Nicholas Michael Carneglia
Elizabeth Anne Castellan
Ashley Ciacco
Michael Anthony Colucci II
Nicholas S. Gallo
Nicholas Alexander Haas
Kevin Allen Johnson
Joseph Michael Longo
Steven M. Lukas
William Peter Mamola
Colin James O'Donnell
Connor Rea Outman
Michael S. Paterno
Andrew Philip Reuling
Luis A. Rivera Criado
Ross Sanford
Clair Schmitzer
Eduardo Javier Teran
Javier F. Teran
Jack Elliott Ursprung
Thomas Michael Wong

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Hanh Kim Bui
Julia Katherine Collins
Son Dinh
Nicholas J. Dutz
Louis Khouri
Tsotne Kvelashvili
Douglas McLeod
Siuma Montero Carranza
Tuan Minh Nguyen
Mai Thanh Nguyen
Thuc Duy Phan
Mark Lane Solace
Anna Stumme
Paul Anson Tuthill

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Nouf Fahad Alharbi
Ronald Ankrah Jr.
Adam Joseph Caimona
Brandon Matthew Hanger
Michael John Jacobs
Dulanjana Augustus Jayawardane
Alan Job Kallarackal
John Paul McPherson
Tan N. Tran
Khoi Vu

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Kevin Albin
Fahad Khaled Alshaikh
Talal Mohammed Alshehri
Justin William Baker
Abdullah Mohamed Bakhshwin
Alhussain Tariq Batterjee
Matthew J Bracci
Colleen Mary Cahill
Joshua Patrick Capozella
James J. Carroll III
Danielle Marie Caruccio
Sean Donnellan
Caleb S. Fischer
Sean Foerschl
John Joseph Giardina III
Ethan Gorczynski
Nicholas John Robert Hostovsky
Andrew Vincent Johnson
Derek Anthony Kuebler
Alan W. Lacayo
Stefan Frank Lapcevich
Victor Nicholas Licata
David K. McConnell
Kevin Edward Motylinski
James Joseph O'Malley
Brett Austin Padula
Emily Ann Parker
Edward John Pfaeffle
Patrick Jorge Richard
Ethan Robinett
Meaghan C. Rush
Guido Maria Saccaggi
Connor Bishop Schultz
Anthony Joseph Sferra
Eric Vincent Smith
Peter J. Smith
Spencer Peter Tripp
Arden Siobhan Walton
Peter Warwick

Dual Degree, Bachelor of Civil Engineering and Bachelor of Science in Architecture

Lorie Lonchamp
Nicholas Torrin Yager

Scholarships Make it Possible

As part of a senior design project, Ben Pesante, B.B.E. 2017, and three classmates designed a shoe that tracks motion and force change. Thanks to connections formed with Catholic University alumnus Andrew Gravunder, B.B.E. ’11, M.S. ’13, they were able to do their research in state-of-the-art NIH laboratories.

“The purpose of this shoe is to track rehabilitation progress for people with gait abnormalities caused by such conditions as arthritis, cerebral palsy, or multiple sclerosis — anyone who would need a clinician to classify that information,” says Pesante.

Working with NIH mentors was an added benefit of the team’s educational experience. It wasn’t the first time Pesante had the experience of working at the National Institutes of Health. He was a summer intern in NIH’s functional and applied biomedical lab, where he worked on a motion sensor that measures hand motion of patients to relax their hands at a normal rate.

Being able to work directly with patients in real-world research trials was inspiring for Pesante, who plans to become a physician.

“Just being in the environment where we were actually seeing patients and interacting with them was really cool,” he said. “It helped me to realize how God is calling me to directly help people in a clinical setting.”

Scholarships made these rich education experiences possible.

“I would not be attending Catholic University without scholarships,” says Pesante. “I took full advantage of my experience as an undergraduate student here. I studied biomedical engineering as well as Spanish for health care, played on the varsity men’s soccer team, and interned at NIH.”

Pesante is continuing his education as a master’s student in biomedical engineering. “All of this is possible because of scholarships,” he says.

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