Some of the faculty and staff members who participated in No-Shave November pose in front of the mechanical engineering sign on the 2nd floor of Black Engineering Building on November 30, 2016. From left: Matt Dikeman (Academic Adviser), Fred Lloyd (Academic Adviser), Josh Delaim (Teaching Lab Coordinator), Joel Buehler (Systems Support Specialist), Jim Slezdek (Teaching Lab Coordinator), Wyman Martinez (Teaching Lab Coordinator), Cris Schwartz (Associate Professor), and Nick Fett (Communications Specialist). Photo by Kristin Clemens.

More than a dozen faculty and staff from the Department of Mechanical Engineering participated in this year’s No-Shave November.

No-Shave November is “a web-based, non-profit organization devoted to growing cancer awareness and raising funds to support cancer prevention, research, and education.” National organizations participating in this year’s campaign include the American Cancer Society, Prevent Cancer Foundation, Fight Colorectal Cancer, and St. Jude Children’s Research Hospital.

The effort for ISU’s Department of Mechanical Engineering was spearheaded by associate professor Cris Schwartz.

“I don’t know if there is anyone in ME, or in general, who has not been affected by cancer either personally or via a sick family member,” he said. “This is something that all of us can relate to. I also felt like the staff and faculty that we have in the department are very good people and also very fun people. This was an opportunity to do something as a team that I don’t know if any of us would have thought to do on our own. The fact that we raised money and had some friendly competition made it very worthwhile for me.”

Collectively the 14 department participants raised $1,269 to combat the disease that claims about 22,000 lives worldwide each day. For Schwartz and several others, this was their first time participating.

“I have never done this in the past, but I have known others who have. In fact, I don’t think I’ve gone without shaving this long since I was twenty years old. With the amount of gray in my beard, it is immediately obvious that things have changed since then,” he said.

While this year’s event only included faculty and staff from ME, Schwartz said he would eventually like to include students too.

“I would absolutely consider getting students involved in the future. I can imagine having different ME teams who can compete for most funds raised. The nice thing about the No-Shave November program is that it is not gender specific. Anyone can do it, and participate in any way that they see fit,” said Schwartz. “However, with the size of our enrollment in ME we may get a call from the companies that make razors telling us that their sales are dwindling.”
ME freshman has self-published five novels

While some students come to college with state championships, debate titles, and other accolades under their belt, one mechanical engineering student came to college with five published books to his name.

Ryan Byrnes arrived in Ames via suburban St. Louis in the fall of 2016. Even though he has a passion for writing, the 19-year-old chose to study mechanical engineering at Iowa State.

“I came to Iowa State for several criteria—it was within a day’s drive [of home], it was very affordable, it had a wide array of majors, and it was highly ranked in mechanical and aerospace engineering,” said Byrnes. “I chose to study mechanical engineering because it is a very stable job market that pays well. I intend for engineering to be a means to support myself financially while I pursue another career as a writer.”

While the creative aspect of writing may differ from the more mathematical and scientific approach of engineering, Byrnes said he actually sees the two fields as inter-related.

“During my first semester of college I started to appreciate engineering as I learned more about it. I realized that the arts and the sciences kind of complement each other. I can use engineering as a way to physically improve people’s lives and appreciate the world physically. Than you can also use the arts to improve people’s lives psychologically and it’s also a way to appreciate the world for its more abstract things,” he said.

“A lot of times the creative writing people and the STEM [Science, Technology, Engineering, and Mathematics] people don’t really intersect that much. But the few times it’s been done it’s had a lot of success.”

Byrnes used the example of Andy Weir, author of the 2011 science fiction novel The Martian. Weir was raised by a particle physicist and an electrical engineer and studied computer programming at the University of California-San Diego. Given his STEM background, Weir always made scientific accuracy a focal point in his writing. Byrnes also considers John Steinbeck, author of the Pulitzer Prize-winning 1939 novel The Grapes of Wrath, to be one of his major writing influences.

Byrnes first developed his interest in writing in first grade after being given an assignment where he had to write a story about an alien.

“I ended writing a ten-page story about a boy who gets transported to another planet inhabited by an alien named Gloppy. From then on, I wrote stories regularly, building up until fourth grade, when I was confident enough to start writing novels,” Byrnes said.


After The Adventures of Wheatal, Byrnes published a four-book series entitled Son of Time. The young adult fantasy series is about three friends who stumble on a treasure hunt for six magic crystals which is their only way to stop a warlord from another dimension. He said that the series was largely inspired by J.R.R. Tolkien, author of the Lord of the Rings books.

Though all five of his books to date have been fiction, the young writer said he is eager to dabble in other genres as well.

“I specialize in fiction, although not exclusively. I have plans to start ghost-writing for numerous people—mostly nonfiction—just to see how far it takes me,” he said. "Psychologists have proven it is good to be well-rounded, especially for a writer in multiple genres. I believe it was William Faulkner who said an author must read everything—classics, contemporaries, the newspaper, even garbage."

Byrnes has sold more than 1,000 copies of his books through retailers including Amazon and Barnes & Noble. He has also started his own publishing company, Avency Press, through which he has self-published all five of his books.

Though Byrnes’ college career is in its infancy, he is already thinking about what he wants to do after graduation.

“After graduation, I have entertained several paths. I plan on searching for a job in engineering that is secure and makes a decent contribution to society, while at the same time finishing my next few novels, ghost writing, and searching for a literary agent,” he said. "If possible, I would like to get an MFA in Creative Writing at the University of Iowa. Although the Hawkeyes are our sworn rivals, they have one of the greatest writing programs in the world.”
ME’s Agba uses software to prepare students for industry

Similar to a set of calipers, micrometers and tape measure, computers have become tools that are part of the daily routine for many mechanical engineers.

Students in the ME 324 Manufacturing Engineering Lab work closely with a simulation software program known as MAGMASOFT® which helps to model various casting processes for a wide variety of different metals. Traditionally, engineers would combine engineering principles with trial and error when developing castings however as Emmanuel Agba—a senior lecturer in mechanical engineering—explains, software programs such as MAGMASOFT® are able to simulate different manufacturing processes in a virtual environment beforehand, which in most cases dramatically reduce the costs and labor associated with trial and error.

“With a software program like MAGMASOFT®, you not only get the software but you get the engineering too,” said Agba. “The software is developed based on a real work environment.”

Iowa State University has contracted with MAGMA, Inc. since 2009, when Dr. Agba joined the ISU faculty. Agba first worked with the software when he was a Manufacturing Manager for Ford in Michigan and felt that it would be worthwhile to use it with his students too. He developed training courses at Ford to teach engineers how to use software tools but felt that if these skills can be taught in colleges and trade schools, it will help students to be better prepared when they enter the work force.

“When I came to Iowa State, I felt that we needed to develop students with skills that will benefit the industry. The linkage between schools and industry is very important,” Agba said.

Not only does Agba prepare students for jobs through coursework but also through their participation in various student groups and activities. He serves as the faculty adviser for Team PriSM, the solar car racing team at ISU, and his students also utilize several engineering software programs when designing and manufacturing parts for the solar car.

MAGMA is headquartered in Aachen, Germany with offices and subsidiaries in Brazil, China, Czech Republic, India, Korea, Singapore, Turkey, and the United States. With many companies embracing more of a global presence than in the past, Agba said he emphasizes to his students that the field of mechanical engineering should be viewed from an international perspective.

“Iowa needs to be a global industrial hub which serves Iowa State, but also focuses on the skillsets to be exported around the world like Africa, India, China, and Mexico”

Agba has worked closely with Roy Stevenson, Customer Development Manager at MAGMA, Inc. in Schaumburg, Ill. during this collaboration. Stevenson received his MS in Industrial Engineering from Iowa State in 2004 and he said he was eager to partner with his alma mater on this project.

“MAGMA, Inc. was excited to develop a partnership with Iowa State because of its reputation as an outstanding engineering school. It is our belief that the many engineers that graduate from ISU will benefit from using MAGMASOFT® to understand the metal casting process as students, and MAGMA, Inc. will also benefit from the road when these recent engineers insist that MAGMASOFT® is used on the components they are designing, sourcing or producing once they have left Iowa State and started their careers in various industries,” he said.

Stevenson was on campus earlier this month to meet with Agba and discuss the software. The discussion resulted in Stevenson offering Agba a free upgrade from 10 seats of MAGMASOFT® to 20 seats to accommodate high demand from ME students. During his visit he also observed that the campus has changed a lot since his time as a student.

“While touring the engineering facilities on my last visit to ISU, I was blown away by the facilities that the ISU students have access to. There is no better way to learn manufacturing processes than to work with them in a hands-on environment,” said Stevenson. “ISU takes this practical experience and couples it with lectures from experts in these fields. This is experience and process knowledge that will be used on the job from day one.”

MAGMA partners with 20 different universities in North America as well as many more globally. Additionally, MAGMA does regular outreach activities with high schools and trade schools to promote the metal casting industry and engineering career opportunities.

“As a student, to use the exact same technology that engineers in industry are using, while at the university, is experience that is invaluable,” he said. “To come into a new job and a new career and hit the ground knowing not only the manufacturing processes, but also the best available technology to understand those processes and to efficiently and effectively design components for those processes is really valuable.”
ME's Denny Kramer named "outstanding senior" for fall '16

Denny Kramer, a mechanical engineer from Earling, Iowa, was on the Dean’s List every semester during his time at Iowa State. He also served for several years as a community advisor and a learning community peer mentor for undeclared engineering, participated in the Quarter Scale Tractor club and served as the fundraising co-chair for Engineers without Borders.

Kramer held a tooling engineering co-op (2014) with Kinze Manufacturing, where he designed and redesigned product components and planned continuous improvement projects. As a lean manufacturing engineering intern (2015) with Polaris Industries, Kramer eliminated non-value added standard work, designed and verified new tooling a new product, and implemented group lead boards that better tracked safety, quality, delivery, and productivity metrics. Finally, Kramer was a reliability-maintenance engineering intern with the Olin Corporation and performed stress and FOS calculations, designed models to predict product performance and reviewed inspection reports.

Kramer will be working for John Deere in the Engineering Development Program.

Contributed by Engineering College Relations

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ME alum Rex Harvey elected chair of USA Masters Track & Field

ISU mechanical engineering alum and former Cyclone pole vaulter Rex Harvey has been elected chair of USA Masters Track & Field.

The Redfield, Iowa-native will head the division of USA Track & Field for athletes 35 years and older. He holds a BS in mechanical engineering from Iowa State and an MS in systems management from the University of Southern California. As a graduate student he also served in the U.S. Air Force during the Vietnam War. Following his service, Harvey worked in the engineering field for nearly three decades and developed 15 patents, mostly for commercial aircraft and supercomputers.

As a prep at Dextfield High School he was a 17-time individual champion and four-time team state champion. He was a Big 8 Conference runner-up six times in the pole vault and went on to compete for six USA international track and field teams. He was a finalist on the 1976 Olympic trials team and broke the World Record in the M45 Decathlon in 1991.

“I grew up in a very small town. My introduction to the great wide world beyond that town was through Track & Field. It has shaped and directed my life in a wonderfully positive way. I would like to pass the opportunity to expand their horizons, and honorably distinguish themselves on the track, and on the field, to as many people as possible,” Harvey said in a press release.
Wickert reappointed as senior vice president and provost

President Steven Leath has reappointed senior vice president and provost Jonathan Wickert to a second five-year term, effective July 30, 2017.

Wickert became Iowa State’s provost on July 30, 2012, following a national search. At the time, he was completing his third year as dean of the Engineering college (2009-12).

“I am pleased Dr. Wickert has agreed to serve for another five years as senior vice president and provost,” Leath said. “He has been instrumental in our pursuit to advance Iowa State’s academic programs, attract and retain top faculty, and enhance our scholarly reputation. We’ve made great progress, and with Dr. Wickert’s leadership, we will continue to move Iowa State’s academic mission forward.”

Highlights of Wickert’s first term in the senior VP/provost role include:

Ensuring the continued quality of undergraduate and graduate programs in a time of record enrollments
Hiring more than 400 tenured and tenure-eligible faculty under a presidential initiative to build the quality and ranks of ISU’s faculty
Investing in the creativity and scholarship of faculty, which has produced record levels of sponsored research funding
Encouraging collaboration across the university community to boost graduation rates and maintain a 95 percent job placement rate

Wickert currently is the lead investigator on a 16-school Midwestern alliance focused on increasing the quality and quantity of students completing STEM programs and the quantity of underrepresented students who pursue graduate degrees. A $5 million grant from the National Science Foundation supports the project.

“It’s a great privilege to serve as Iowa State’s provost, and I am grateful for the opportunity to continue in the role,” Wickert said. “We have celebrated numerous accomplishments over the past four-plus years, enabled by outstanding students, faculty and staff, and strongly supported by President Leath and the Board of Regents. I look forward to the next five years and further progress in moving Iowa State forward.”

Wickert is a professor of mechanical engineering and came to Iowa State in 2007 as chair of that department. Previously, he served 17 years on the mechanical engineering faculty at Carnegie Mellon University, Pittsburgh.

Contributed by Inside Iowa State

ME’s Meng Lu receives funding through Exploratory Research Projects program

The Exploratory Research Projects program at Iowa State’s College of Engineering is supporting faculty members as they gather preliminary data for high-risk, high-impact, novel research ideas. This spring, Dr. Lu’s research was among seven projects that will receive grants to explore new research areas.

Meng Lu, assistant professor of electrical and computer engineering and mechanical engineering, “A wearable patient monitoring system based on noninvasive epidermal biosensors, multi-sensor data fusion, and predictive decision making” (Co-PI: Yong Guan, associate professor of electrical and computer engineering)

This project will explore a wearable sensor technology that will continuously and predictively monitor a patient for symptoms of heart failure. The device will integrate state-of-the-art flexible electronic biosensors and data processing algorithms to provide a noninvasive and less expensive option for health care.

Other researchers from the College of Engineering to receive funding include: Vikram Dalal, Electrical and Computer Engineering; Stephen Gilbert, Industrial and Manufacturing Systems Engineering; Simon Laflamme, Civil, Construction, and Environmental Engineering; Leifur Leifsson, Aerospace Engineering; Zengyi Shao, Chemical and Biological Engineering; and Qun Wang, Chemical and Biological Engineering.

Contributed by ECR

ME grad student named Iowa Space Grant Consortium fellow

Stuart Barkley, a PhD student in mechanical engineering, was recently named a fellow for the Iowa Space Grant Consortium. Barkley’s research project is titled “Microwave Plasma Control of Composite Solid Propellant” and aims “to develop an entirely new approach for throttling and extinguishment control of solid propellant flame though microwave plasma enhancement.”

The Iowa Space Grant Consortium (ISGC), which supports aerospace research, education, and outreach for Iowans, has been part of NASA’s National Space Grant College and Fellowship Program since 1990. The ISGC is a collaboration with Iowa’s three regent universities and Drake University as well as other industrial and governmental affiliates, including the Ames Laboratory.

Contributed by ECR
Being more than 1,300 miles from home, art is what keeps junior mechanical engineering student Ben Levine from becoming homesick.

Levine is originally from Mansfield, Mass. — about halfway between Boston and Providence, R.I. — and he moved to Ames two years ago to study mechanical engineering at Iowa State. His decision to choose ISU was based on a combination of factors: a cousin who attended, the strong engineering programs, and the fact that “it was far away from home.”

It has been at ISU that Levine has been able to combine this interest in mechanical engineering with his passion for art. Levine first got involved with art in middle school, creating duct tape wallets. He was intrigued by statues and other sculptures he saw at museums and other public art displays in New England which led to his interest in industrial art. He then began constructing crabs and other “little monsters” out of soda cans and similar scrap materials.

Levine also attributes his interest in industrial art to The Steel Yard, a non-profit organization based in Providence “committed to cultivating an environmental of experimentation and a community strengthened by creative networks.” It was through The Steel Yard that Levine got introduced to welding.

“When I was fifteen, like a lot of people, I felt really awkward and was really self-conscious. I found The Steel Yard through some research because I wanted to learn to weld. I took a weekend welding workshop class there and I loved it,” said Levine.

“I started volunteering and meeting the people who work there and they have become like a second family to me. I can honestly say I am who I am today because of the great people I got to work with at The Steel Yard. Since then I’ve taught Welding to high school students and helped to run some really cool events there.”

Even though he has a passion for art, with the surrealism of Salvador Dalí being one of his biggest influences, Levine chose to study mechanical engineering at Iowa State because he felt it offered a great deal of versatility in terms of careers. He also felt that the ME curriculum would teach him skills and knowledge that he could apply to his art.

“I think mechanical engineering is really versatile. I think that with the art side of things it works really well because a lot times I’ve found things that we’ve learned in class that I’ve had to use when building a sculpture,” he said.
“If I’m using scrap steel and I don’t know where that steel came from I can use that materials science side of things to say ‘what do I need to do to temper this steel to align the crystalline structures to make sure it will weld properly?’ So I think mechanical engineering transitions well and also it’s just such a versatile field that I pretty much have all of my options open for where to go from here.”

While art and science are often seen as different sides of a spectrum, Levine argues that these two fields are actually interrelated.

“I think a lot of people think that as engineers or as artists it’s like you have a creative side and you have this really technical side. In actuality you have both of those and it’s really a matter of how much you can gain in knowledge on both ends. So if you have a creative design side but you also have the mechanical structures than you can create some really amazing pieces because you know both sides of it. You can make something that looks beautiful but also functions really well.”

Part of the beauty of the artwork for Levine is using scrap materials that he can obtain for little or no cost.

“I try very hard not to use stock material. I try to go out to scrapyards to find material whether it’s a tractor piston or a broken cam shaft. And I try to figure out how can I turn that into something else.”

One example Levine pointed to was using old pistons to create hooves for a bull statue. Some of Levine’s recent art projects are currently on display at the Vinyl Café in downtown Ames. It was also through the Vinyl Café that Levine was tipped off about a workspace with a welder just outside of town. He has used the space for a couple of months now and has been grateful for the generosity of the owner.

“I would like to thank Terry Weiland for his generosity in letting me use his space and equipment. He is an amazing guy and I really value the trust he gave me in letting me use the space. It is an honor and a privilege,” Levine said.

Levine has also been grateful for efforts by ME advising staff who have worked with him and encouraged him to combine his engineering interests with his passion for art. Levine’s academic adviser, Jessie Vosseller, said that Levine’s story is a great example of the versatility that an ME degree can offer.

“There are so many career options out there for a ME student, which can be overwhelming. I think the more a student considers their individual passions, and how those could tie into a career, the less overwhelming it hopefully becomes,” she said. “Ben is a great example of finding and using his resources at Iowa State and in the community to tie together his degree with his passions for recycled materials and processes.”

Levine said he expects to graduate in December of 2018. Eventually he hopes to do entrepreneurial work but in the short term he hopes to work for a small company “building out infrastructure and factory processes.” He also wants to live in a community where he can “have an impact on the art side of things.”

Much like Levine was able to come to college and combine his interests, he encourages others to find ways to combine their interests.

“I kind of like to tell people that they should really find what they enjoy and what they find creative and try to link that back to their majors or their studies because a lot of times people try to keep those two things separate and I think it’s really beneficial to link as much as you can together,” he said. “I really appreciate the interest that people have had with this. It makes me feel good that people are interested in the work that I do and this kind of art because I think it goes unnoticed sometimes.”
Two brothers at Iowa State have combined their interest in mechanical engineering and their passion for cycling with a start-up business.

Jared Trent, 21, and Brady Trent, 19, have owned and operated Trent Bicycles since August. Their business, operated out of a garage on Ames’s southeast side, offers bicycle repairs as well as preowned bikes.

“The idea for Trent Bicycles came from wanting to bring in more income to help pay for college expenses,” said Jared. “Immediately thinking about my hobbies and skills led to noticing an open market on Iowa State’s campus for a professional bike shop available to students that was more affordable and accessible than current alternatives.”

Both said Jared and Trent were influenced by their father, Dustin, who is also a mechanical engineer and a businessman.

“I chose [to study] mechanical engineering because my dad’s a mechanical engineer. Jared’s a mechanical engineer. So it’s kind of fitting that I would go to one of the best mechanical engineering schools honestly in the nation so that was a good fit for me,” said Brady. “Really it just teaches you how to solve problems and that’s why I chose it.”

Jared said he remembers his interest in engineering started when he was a kid.

“Engineering had my interest when wanting to take everything apart and occasionally put them back together,” said Jared with a grin. “I started with moped engines and bicycles and have continued to expand my interest at Iowa State. This school was the best choice when deciding which discipline of engineering to pursue.”

Each brother brings his own skills outside of engineering to the business. Jared, who is minoring in English, handles the company’s communications and community outreach while Brady, a General Business minor, focuses on the finances, accounting, and other business aspects. Brady also handles some communications duties such as designing the website and managing the social media pages.

Jared said he has been to take skills and principles learned in the classroom and apply them to the business.

“From the English department, learning communication skills became even more valuable when it directly relates to people I work with,” said Jared. “From engineering, critical thinking and
problem solving applications are always coming up. For example, keeping track of the business’ finances accurately became easy after taking IE 305 [Engineering Economic Analysis]. The class taught me how to analyze and predict investments and compare projects. The knowledge continually yields better business decisions that puts me in a better position.”

Jared has completed internships with Summit Products in Altoona and Creative Werks in Des Moines. He currently teaches and grades for Engineering Graphics and Introductory Design (ME 170) and Manufacturing Engineering (ME 324). He plans to graduate in fall 2017.

Brady, who plans to graduate in spring 2019, said his coursework in the college of business has helped him to learn some of the lingo as well as the more intricate aspects of running a business.

“Having any sort of understanding about accounting and financing will be a powerful combination with ME,” said Brady. “A specific skill I like to focus on with anything is being able to talk the talk. People take you much more seriously if you can prove that you understand. This is true with any learning.”

The Trent brothers also offer advice for both young students as well as aspiring entrepreneurs. Jared advised young students to weigh both their skills and their interests when selecting a major.

“For someone considering engineering as a major, it is important to take note of what it offers. The networking, open doors, and starting pay are all important aspects to look at, however it is more important to have a passion for what you are doing. Engineering offers so many areas to go into that it can actually be difficult to decide which one to pick. For me personally, manufacturing has been the most fun.”

The younger Trent offered similar advice from more of a business perspective.

“For a young person, for anyone really, I’d just say go out and do something. That’s really the biggest piece. You can’t hold yourself back. If you do some competitive analysis, you’re like there’s ten people that already do this well just find a new to do it, find a different way, and you’re going to be successful. That’s really about it.”

Photos by Nick Fetty
Iowa State to manage biorefinery projects for new Manufacturing USA Institute

AMES, Iowa — Iowa State University will bring its expertise in biorenewable technologies and pilot plant operations to the country’s 10th Manufacturing USA Institute.

The recently announced advanced manufacturing institute is dedicated to improving the productivity and efficiency of chemical manufacturing. Those improvements could include combining processes such as mixing, reacting and separating into single steps.

Such process intensification could boost manufacturing productivity while cutting costs and reducing waste. That could save the chemical industry more than $9 billion annually, according to the U.S. Department of Energy’s announcement of the institute.

The new institute will be known as RAPID, the Rapid Advancement in Process Intensification Deployment Institute. The American Institute of Chemical Engineers in New York City will lead the effort, which was developed in collaboration with the U.S. Department of Energy’s Savannah River National Laboratory in South Carolina and the Georgia Institute of Technology in Atlanta. Additional information about the RAPID Institute and its objectives can be found at www.processintensification.org.

On Dec. 9, the U.S. Department of Energy announced it would support the institute with $70 million over five years, subject to federal appropriations. Another $70 million is expected from RAPID’s partners, including companies, universities, laboratories and other organizations.

“This institute is intended to take technologies – ideas that are well beyond basic research – and translate them into workable processes that can be demonstrated in the field,” said Robert C. Brown, the director of Iowa State’s Bioeconomy Institute, an Anson Marston Distinguished Professor in Engineering and the leader of RAPID’s Distributed Biorefinery program.

Iowa State researchers are managing the project’s biorefinery efforts because they are “an extremely talented and well-known team that’s highly regarded in the industry,” said Karen Fletcher, RAPID’s chief executive officer, speaking during a recent tour of Iowa State’s BioCentury Research Farm.

In addition, she said the Iowa State team has already pulled in multiple partners willing to help commercialize distributed biorefineries.

“We can make big leaps with shared funding instead of small steps with individual projects,” Fletcher said. “We’re very focused on the commercial value of this work, and Iowa State gets that.”

The proposal that won the Department of Energy’s approval includes $8 million to support development and testing of biorefineries that feature modular design and construction for ease of manufacturing and mass production. Two possible projects highlighted in the application include:

1. **Pyrolysis-based Modular Energy Production Systems** for conversion of wastes and biomass into fuels, chemicals and other products, with $3.2 million from the energy department and additional support from Easy Energy Systems of Emmetsburg; the State of Iowa; Stine Seed Co. of Adel; and the Iowa Energy Center. Pyrolysis as traditionally practiced involves quickly heating biomass without oxygen to produce a biochar for fertilizer and a liquid bio-oil for energy. Iowa State researchers have improved the process by adding a small amount of air to the reaction, partially burning some of the biomass as a source of heat for the reactor. The so-called autothermal process dramatically increases the rate that biomass can be converted to products, allowing construction of smaller and simpler reactors suitable for modular systems.
The new process produces sugars that can be fermented to biofuels and a solid fuel suitable as a coal substitute. The big idea is to develop small, efficient biorefineries that can process local biomass, saving the cost and trouble of transporting and storing biomass from a larger region.

2. Anaerobic digestion of grassy biomass and wet wastes to convert waste biomass into carbon-neutral fuels and chemicals, with $4 million from the energy department and additional support from Earth Energy Renewables of Bryan, Texas; Roeslein Alternative Energy of St. Louis; the State of Iowa; the Iowa Energy Center; and Iowa State. The project will build on technology developed by Mark Holtzapple of Texas A&M University to efficiently ferment biomass for production of carboxylic acids. The acids can be converted into valuable industrial chemicals and fuels, all the way up to gasoline.

Brown said both projects and the dollars associated with them are still subject to final contract negotiations between the Department of Energy and the leaders of RAPID. But he says they’re good candidates to move ahead.

“We believe these projects fit the institute well and can very quickly advance,” Brown said. “These are also projects that will be developed at a scale that addresses the commercially significant issues.”

As for the entire RAPID effort, the Department of Energy sees the new manufacturing institute as a problem-solver for America’s chemical industry.

“Our investment in this cross-cutting technology is an investment in the future of U.S. manufacturing,” said David Friedman, acting assistant secretary of the Department of Energy’s Office of Energy Efficiency and Renewable Energy, in a statement announcing the institute. “As we expand the Manufacturing USA network, we provide greater opportunities for businesses of all sizes to solve their toughest technology challenges and unleash major savings in energy-intensive sectors like oil and gas, pulp and paper-making and other industries.”

Contributed by ISU News Service

Nanostructured Biosensors Detect Pesticide, Help Preserve Environment

When does too much of a good thing become a bad thing? That’s the question Dr. Jonathan Claussen, assistant professor at Iowa State University’s Department of Mechanical Engineering, and his team of researchers aim to help farmers answer when it comes to pesticide use. Underuse can harm farmers’ crops, while overuse can result in runoff into the soil or waterways.

Claussen and his team created a flexible, low cost and disposable biosensor that can detect pesticides in soil. This biosensor is made of graphene, a strong and stable nanoparticle, and provides instantaneous feedback, as opposed to the time and money it would otherwise take to send a sample to a lab and await results.

USDA’s National Institute of Food and Agriculture (NIFA) supported the project with an Agriculture and Food Research Initiative (AFRI) grant as part of the Nanotechnology Program.

The biosensor is made by first printing graphene ink onto paper. A laser then traces over the ink to improve its electrical conductivity by welding together flakes of the graphene ink, making a nanostructured surface that is three dimensional.

“The flakes almost look like rose petals coming up from the surface of the paper,” said Claussen. “They form the base material to test soil on.”

To do this, the biosensor is dipped into a slurry of soil and water. It is then connected to an electrochemical reader in the field to test for pesticide.

“It’s like a pH test strip,” said Claussen. Test results can help farmers quickly understand how much pesticide is needed to maintain healthy crops and minimize environmental damage. Also, results can help farmers understand where environmental remediation may be needed if pesticide overuse is evident.

The biosensor has great potential for use beyond the agriculture community. Its properties can be converted for use in the biomedical, environmental, or food safety fields, simply by changing the biological components that are immobilized on top of it.

“What fascinates me most about this project is the real world impact it can provide,” said Claussen. “The graphene sensors do not require the use of precious metals that are typically used to increase the performance of electrochemical sensors. Therefore, [this] technology really could be used by the masses for flexible/low cost electronics and sensors.”

Contributed by U.S. Department of Agriculture
ME alum finds success as both an engineer and writer

Even though he studied and pursued a career in mechanical engineering, one Iowa State alum said that his alma mater was also the place that sparked his interest in writing.

Gary Casey (BSME ’66) grew up on a 160-acre farm near the northwest Iowa town of Peterson. He developed an interest in mechanical engineering at an early age, disassembling and reassembling lawnmower engines and being, according to him, “the official family bike repairman” at the age of 10.

Not only did Casey like working with his hands but he also enjoyed reading and learning about why things work the way they do. Around the age of 12 he remembers reading old mechanical engineering textbooks, which were his uncle’s when he attended ISU and studied mechanical engineering. Casey also remembers reading the World Book Encyclopedia and said that the “A” volume was his favorite because it included Aircraft and Automobile.

Toward the end of high school Casey began developing interests in other engineering fields from architectural to aerospace to civil. He wanted to work on airplanes but decided to study mechanical after doing some research and discovering that many of people who work for airplane companies actually have backgrounds in mechanical engineering.

One of Casey’s memories from his time on campus was his thermodynamics course. He said he failed the course the first time and was forced to retake it, acting the class the second time around.

“It’s not how much you know, it’s what you need to know,” said Casey. “I got to a point where I understood tests. The idea was to get into the head of the instructor to find out what he was asking for and do that.” It was at Iowa State that he also first became interested in writing.

“I remember taking a course when I was in engineering school about presentations,” he said. “I still remember some of the ideas about how to create a presentation and make it fit what the audience wants. The whole idea was to figure who your reader or watcher is and where they come from, and figure where you want them to be at the end and how to lead them to where you want them to be. That’s also kind of how you write a book.”

Casey used these communication skills throughout his professional career. With 37 patents to his name, Casey has been averaging roughly one patent for each year since he’s entered the workforce. Since retiring and working independently he has been granted two patents and is currently pursuing a third for a stovetop popcorn popper.

Casey gained some teaching experience as an instructor at Wayne State University in Detroit where he served as an industry representative and taught a senior-level design course. He said colleagues suggested he write a book based on the things he taught people throughout his career so he took that to heart and in 2013 published his first book, Commonsense Engineering.

“It was a mishmash of subjects that I worked on over the years and it was sort of a short, irreverent book about what technology can do, and what it doesn’t do, and what’s a waste of money. Just a whole bunch of short subjects,” he said.

After publishing the book, he gave topic-specific presentations for a few engineering companies and other “practicing professionals.”

However, for his next writing endeavor Casey deviated from the non-fiction, informative style of writing in Commonsense Engineering. Casey published his first novel, The American Family Robinson, in June 2016. Despite the different genres of these two books, Casey said his writing style was similar in both.

“I tried to make it half written style and half conversational. You don’t want to make it all conversational because that doesn’t read well as a book but I also didn’t want it to read like a textbook,” he said. “The writing style between the two books was not much different.”

Casey first started writing the novel as a way to pass time while frequently traveling for work. After writing a few thousand words his wife Sarah read it and encouraged him to finish.

Even though his granddaughter is the inspiration for the book’s main character, Rose, Casey decided to make the setting roughly a century before she was born.

“I made it far enough away in time [early 20th century] that I could make observations without sounding too critical,” he said. “In modern times there’d be more focus on scandals and hyperbole and everything that goes on nowadays so I thought a simpler time would be easier to write.”

The book follows Rose and her two brothers who were orphaned at an early age and who find that they must stick together to get through the tough times.

Gary Casey’s first book, Commonsense Engineering, was published in 2013.
“The core of the book is how in my opinion the glue that has held civilization together for thousands of years is really the core family unit. The book is really about how these three kids tried to keep their family together in difficult times,” said Casey.

Another thing Casey focused on while writing the book was being as factually accurate as possible.

“My pet peeve in all books and movies is to see something they could have gotten right but screwed up because they didn’t do just five minutes of research to make it accurate,” he said.

One example of this factual accuracy came during a part in the book when Rose rides in a Ford Model-T car. Casey writes that Rose struggles to find the door handle to get into the car, not realizing that the handle is actually on the inside of the car, which is how that model of Model-T was actually designed.

Another example Casey pointed to was that he was accurate during a scene in a science classroom where the students learn about ice density. In addition to being accurate, Casey felt that these were things that a young character might observe anyway, which worked for the book since it was written from Rose’s perspective.

Though he’s an engineer by trade, Casey said he thinks it’s critical for engineers to be able to write and communicate effectively. He said that nowadays engineers need to be both the engineer and the salesperson.

“You’re not necessarily selling to a customer but you’re selling to your boss, you’re always selling,” he said. “Too many people try to sell themselves. That’s not what you’re trying to do. You’re trying to sell the idea, not yourself.”

He added that he thinks it would be good to teach effective writing and communication skills and strategies as part of the engineering curriculum.

“The whole idea of strong writing and communication skills is critical for an engineer.”

ME students recognized by the Program for Women in Science and Engineering

Throughout the past year, the Program for Women in Science in Engineering has been commemorating its 30th anniversary with a variety of events and activities that included key note speakers, a STEM Fest and tailgate. On Dec. 3, WiSE wrapped up the festivities with a banquet.

More than 150 individuals attended the event, including Mary Ann Evans, who was the founding director of the WiSE program in 1986, Karen Zunkel (BSIE’83), a past director, and Lora Leigh Chrystal, the current director. Chrystal was presented Throughout the past year, the Program for Women in Science in Engineering has been commemorating its 30th anniversary with a variety of events and activities that included key note speakers, a STEM Fest and tailgate. On Dec. 3, WiSE wrapped up the festivities with a banquet.

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WISE Undergraduate STEM Award: Olivia Carrasco, senior in mechanical engineering, and Julia Eckhoff, senior in mechanical engineering.

The WiSE Undergraduate STEM Leadership Award recognizes outstanding leadership by an undergraduate student majoring in science, technology, engineering or math during their junior or senior years. The WiSE Leadership Award is intended for students whose exemplary leadership is broader than a single department or student organization. Awardees are expected to have demonstrated outstanding leadership in one or more major college-wide, university, community, or professional organization. The award includes a $1000 scholarship.

From left: Jonathan Wickert, Senior Vice President and Provost; Olivia Carrasco, mechanical engineering senior, and Lora Leigh Chrystal, WiSE Director.
One Iowa State University student was part of history last month when he witnessed Donald Trump being sworn in as the 45th president of the United States.

Cole Ignaszewski – a sophomore studying mechanical engineering – was among a select group of Minnesota 4-H members invited for a leadership conference in Washington D.C. in January. Part of that conference includes attending today’s presidential inauguration.

Ignaszewski – who participates in Steele County 4-H but is from the town of New Richland in Waseca County, just west of Steele County – said that the outcome of November’s election did not affect his decision to attend the event. He was interviewed by Minnesota 4-H officials in June and in July he was informed that he had been selected for the trip to the nation’s capital.

“[During the interview] they asked ‘Whoever wins, do you still want to go on this trip?’ And I answered ‘It’s not really about that. It’s not about who wins or loses in the November election. It’s about being a part of history and being there. It’s about that peaceful transition of power and being able to take that all in.’”

Ignaszewski has been in Washington D.C. since Tuesday. He and 4-H members from 24 other states have participated in events related to the 4-H leadership conference and have also been taking in the sights and sounds of D.C. Ignaszewski said he has enjoyed meeting with other 4-H members from across the country.

“It was really cool to see how good of leaders are out there besides the ones you know of everyday, besides the ones you grew up with. This isn’t just a Minnesota thing. It’s not just a Midwest thing. It’s all over the country and it’s all because of 4-H so I think it’s very important that people are involved with 4-H. It’s more than just taking part in a fun activity, it’s about growing yourself as a person and as leader.”

Ignaszewski first got involved with 4-H’s Clover Bud’s program when he was in kindergarten and became officially involved with 4-H in third grade. He said he thinks his participation in 4-H has helped to shape the person that he is today.

“The whole time they’re just trying to get us to be better people and be a better leader. 4-H is just growing leaders and I’ve really noticed that out here in Washington at this leadership conference. I’ve noticed how good of leaders [4-H participants] are and not just from Minnesota that I’ve met but from around the country.”

Donald Trump was officially sworn in as president on January 20 around noon eastern time. Ignaszewski said that he hopes the incoming president will consider the importance of agriculture and rural America when drafting policies and negotiating deals during his tenure.

“I just hope that he keeps the family farm in mind. He comes from a big company and obviously he’s a millionaire and I just hope he [thinks about] the small town family farm and does what’s best for them. Because really agriculture and family farms are the backbone of America and it’s really important to keep them prosperous and keep them operating and that will in turn make America prosperous.”

Photo courtesy of Cole Ignaszewski
ME graduate student completes internship with Obama White House

Chloe McPherson – a master’s student in mechanical engineering – recently finished up her stint with the White House Internship Program under President Barack Obama for the fall 2016 semester.

The Omaha, Nebraska-native was among 165 students nationwide to be selected for this opportunity. Dakota Olson, a junior majoring in Global Resource Systems at Iowa State, was the only other student from the state of Iowa to be selected.

McPherson worked in the Domestic Policy Council within the Office of Energy and Climate Change. She said that her studies in mechanical engineering helped to prepare her for the work she did.

“At first thought it may seem unconventional for an engineer to work on public policy, but it is actually vital that the White House and government agencies have people with education and expertise in technical areas such as engineering working on energy and other issues. A background in engineering provides us with a unique technical understanding and perspective when analyzing policies and determining how best to solve some of our nation’s most complex issues,” she said.

She added that her time with the White House Internship Program was both rewarding and memorable.

“Working at the White House has definitely been the best work experience of my life thus far. The Obama White House is an amazing place full of brilliant, dedicated people who truly care about the future of our nation. Interns at the White House are fully integrated members of the team, and are given responsibilities on par to those of full-time staffers. You’d be hard pressed to find another work environment as incredibly fast-paced as the White House, especially in the last six months of an Administration. Each day was truly an adventure, and the many opportunities and challenges that presented themselves along the way have allowed me to grow as a person and as a leader. This has been a very humbling, fulfilling experience, and I am grateful for the chance to contribute to the legacy of a President whom I so fully trust and believe in.”

On campus, McPherson worked in the Virtual Reality Application Center (VRAC) where she researched ways to implement “digital information into the real world.” She, who holds her BS in mechanical engineering from ISU, also served as national publications chairperson for the National Society of Black Engineers during the 2015-16 school year.

More information about the White House Internship Program

The White House Internship Program provides a unique opportunity to gain valuable professional experience and build leadership skills. This hands-on program is designed to mentor and cultivate today’s young leaders, strengthen their understanding of the Executive Office and prepare them for future public service opportunities.

The White House Internship Program’s mission is to make the “People’s House” accessible to future leaders from around the nation.
ISU students take 1st place at Disney Imagineering design contest finals

Three Iowa State University design and engineering students took first place competing in the 26th Walt Disney Imagineering Imaginations Design Competition last month in Glendale, California.

Cristina Diaz, Aurora, Illinois, senior in interior design; Alexander Doppenberg, Spencer, senior in mechanical engineering; and Joshua Kurnia, originally from Jakarta, Indonesia, and now of Ames, senior in architecture, are among six teams of students from seven universities selected as finalists in the competition, sponsored by Walt Disney Imagineering to find and nurture the next generation of “Imagineers.”

In addition to Iowa State, the top teams represent Carnegie Mellon University, Howard University, Miami University, Savannah College of Art and Design, the University of California, San Diego; and University of Notre Dame. Twenty-one finalist students were awarded a five-day, all-expense-paid trip to Imagineering’s headquarters in Glendale, where they are presenting their projects to Imagineering executives and competing for monetary awards.

This year’s competition challenged students to apply the same design principles used in creating Disney’s theme parks, resorts and other attractions to develop new outdoor spaces within their own colleges or universities that could address the diverse needs of students, faculty and visitors while providing a respite from daily stress.

‘Hourglass’

The Iowa State team’s “Hourglass” design is shaped like an hourglass turned on its side. The space features individual, geothermal “pods” belowground for a more private experience and an aboveground sitting area with heated benches where visitors can socialize in comfort year-round.

“Because time — or the perceived lack of it — is a major stressor, especially for college students, we wanted to play with the idea of stopping time,” Kurnia said. “An hourglass represents the constant ticking of time, but if you tip it on its side, the sand stands still; you’ve symbolically stopped time.”

The team chose a site in front of MacKay Hall on central campus for the project because “it’s an area most of us at the university pass through,” Diaz said. “We wanted to provide a space where guests could relax and enjoy the beauty of the seasons.”

The portion aboveground consists of ETFE film, a durable, transparent membrane that’s reflective on one side, stretched over aluminum tubing. People viewing it from the outside see themselves and the landscape reflected, while people inside can see through to the landscape.

“ETFE is a relatively new material used in buildings like the Beijing Water Cube (the 2008 Olympics swimming facility) and the U.S. Bank Stadium in Minneapolis,” Doppenberg said. “We used it in part to incorporate the idea of Iowa State researching new technologies.”

The team designed both daytime and evening experiences with special effects corresponding to the carillon bells ringing in the Campanile, Diaz said. “During the day, sand in the handrails moves every 15 minutes to subtly encourage people to resume their day (after passing at the Hourglass). At night, the structure is lit up and every 15 minutes there’s a light effect that ties back into the hourglass and the idea of time on campus.”

Teamwork + Ingenuity = Success

Disney did not require teams to be multidisciplinary, but Kurnia, who entered the competition last year with a team composed of peers in architecture, thought working with other disciplines could make the project more successful. The three students capitalized on their complementary skill sets, including proficiency in different software packages, to create a cohesive design, he said.

“For Josh and me it was really interesting to bounce ideas off of each other,” Diaz said. “We have related backgrounds but different perspectives on things. And it was great to work with an engineer like Alex who could help us determine if it was actually possible to do what we were proposing.”

“We each took what we knew and collaborated really well,” Doppenberg said. “Usually in our engineering projects, we can speak on a really high level about componentry but have a low level of understanding of how the product will look. The design students can speak on a higher level about the look and feel of the project but have less understanding of the technologies. A big thing for me has been learning to work with people outside my own field and utilizing all of our skills to create a good presentation.”

All three students hope to work in the entertainment industry after graduation.

“We didn’t know each other before, but we have a lot of the same goals,” Diaz said. She has visited Disney parks with her family and “I want to be on the team that provides those kinds of experiences to other people and help other visitors feel the way I do when I go to the park.”

Doppenberg interned at Walt Disney World in Orlando, Florida, in the summer of 2015, and Kurnia is doing an internship there from January through June.

“During the internship I went on rides and started to think about ‘how do you make these?’ To be able to go to Glendale and interact with the Imagineers is a chance of a lifetime and the next step forward,” Doppenberg said.

“I’ve always wanted to work for Walt Disney Imagineering, and it’s so difficult and competitive, so this opportunity to see behind the scenes and potentially interview for a position is what I’m most excited about,” Kurnia said.

Contributed by ISU News Service
Fall 2016 ME Design Expo

Eighty-three student teams from Mechanical Engineering Design (ME 270), Mechanical Systems Design (ME 415), and Multidisciplinary Engineering Design (ME 466) gathered in the Howe Hall Atrium on December 6, 2016 to display and present the projects they’ve worked on throughout the semester.

Visit www.flickr.com/photos/isu-mechanical-engineering for more photos from this event and other happenings in the department!
A special issue of the journal Energy Technology details the latest advances in pyrolysis technologies for converting biomass into fuels, chemicals and fertilizers.

Two pyrolysis experts are guest editors of the issue: Robert C. Brown, the director of Iowa State University's Bioeconomy Institute, an Anson Marston Distinguished Professor in Engineering and the Gary and Donna Hoover Chair in Mechanical Engineering; and George Huber, the University of Wisconsin-Madison's Harvey D. Spangler Professor of Chemical and Biological Engineering.

“The purpose of this special issue is to highlight recent advances in pyrolysis technologies and to discuss the critical research needs of this field,” Brown and Huber wrote in an editorial summarizing the issue. “We think innovations in pyrolysis will advance more rapidly with improved understanding of the fundamental chemical, physical, and catalytic processes underlying pyrolysis technology.”

The special issue is available online.

Fast pyrolysis as traditionally practiced involves quickly heating biomass without oxygen to produce a biochar for fertilizer and a liquid bio-oil for energy. That bio-oil is the cheapest liquid fuel from biomass today, but it must be upgraded and its oxygen content reduced to produce higher-value fuels and chemicals.

And so, Brown and Huber wrote in their editorial, “To achieve the full benefits of pyrolysis technologies, several advancements must be made to better improve the quality of pyrolysis products and the overall efficiency of the process.”

The guest editors invited some of the world’s experts on pyrolysis to contribute papers to the special issue. The result is 20 scientific papers about all kinds of pyrolysis studies, including sewage sludge as a feedstock, computational models of the chemical reactions, catalytic approaches to producing transportation fuels or commodity chemicals, scaling up to pilot plants and the economic competitiveness of pyrolysis products.

Two Iowa State papers

Iowa State research teams led by Brown and Brent Shanks contributed papers to the special issue. Shanks is director of the National Science Foundation Engineering Research Center for Biorenewable Chemicals based at Iowa State, an Anson Marston Distinguished Professor in Engineering and the Mike and Jean Steffenson Chair in Chemical and Biological Engineering.

Brown's paper investigates the heating rates and mass transfer of heated vapors in the micropyrolyzer equipment widely used in labs, including Brown’s own lab. The study was designed to test assumptions that microgram-scale studies demonstrate what happens in larger reactors.
“We wanted to test how fast it heated biomass and how quickly the products left the reactor,” Brown said.

The testing, he said, was an “eye-opening process. This study will help researchers understand the limitations of micropyrolyzers.”

The researchers found heating rates in the sample cups were much slower than expected and that the standard sample cups impeded the escape of vapors. They found that substituting shallow, perforated cups helped the vapors escape.

Shanks’s paper reviews recent studies of bio-oil processing and upgrading. It looks at treating bio-oil after pyrolysis (which typically involves high pressures and multiple temperatures) or various ways of using catalysts to treat pyrolysis vapors before they were condensed into bio-oil.

The paper concludes that the most promising upgrading technology involves treating the vapors with a catalyst, while using low pressures and moderate temperatures. The resulting bio-oil would be suitable for further refining in a traditional petroleum refinery.

That still produces a complex mixture of molecules that can’t be used directly, said Shanks, whose lab has studied the chemistry of bio-oil and is beginning a new study of how catalysts can be used to upgrade pyrolysis vapors.

“No one has perfected the technology, but it’s worthy of further exploration,” Shanks said.

Enthusiasm and additional research

All in all, Brown said the special issue of Energy Technology shows the advancement and understanding of pyrolysis technologies has grown tremendously over the past five years.

While advanced biofuels are still too expensive to make it in the marketplace, Brown said thermochemical processes such as pyrolysis have high prospects for producing renewable fuels and chemicals.

“This special issue illustrates a great enthusiasm for the field of pyrolysis,” he said. “It helps identify where additional research is needed to make pyrolysis a practical reality.”

Contributed by Mike Krapfl/ISU News Service

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Women in Science and Engineering names Sriram Sundararajan WiSE Champion

Equity adviser of the College of Engineering looks for opportunities to increase participation of women within the field.

The Program for Women in Science and Engineering at Iowa State recently honored Sriram Sundararajan, associate dean of the College of Engineering, as a 2016 WiSE Champion. The award recognizes individuals who have supported WiSE and have individually tried to improve success for women in science and engineering.

As the College of Engineering’s equity adviser, Sundararajan works with WiSE to support women students within engineering, including efforts to recruit women into STEM fields and educate faculty about how unconscious biases can affect decisions.

“I am pleased to receive the award, and it’s great that we have such a valuable group like WiSE on campus,” Sundararajan said. “Changing the culture on campus to make it more inclusive is a long process that involves many individuals. We all have to work together to make a difference.”

He adds that programs like WiSE work with the college to come up with creative ways to educate the majority of the population about equity, mutual respect and how to avoid stereotyping.

“For some, issues like stereotypes and biases might not even be on their radar because they are just simply unaware of what others may be experiencing,” Sundararajan said. “That’s why increasing awareness about these topics is so important in improving the learning experience for all students.”

Contributed by ECR

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New classroom opens in Black

The new classroom for ME 415 and ME 466 opened on January 24. The classroom is part of a broader collection of labs, workshops, and other spaces for ME students known as “The Mine,” located in the basement of Black Engineering Building. This shot is from Mike Messman’s 8 a.m. ME 415 course, the first class to occupy the new space.

Contributed by Mike Krapfl/ISU News Service
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