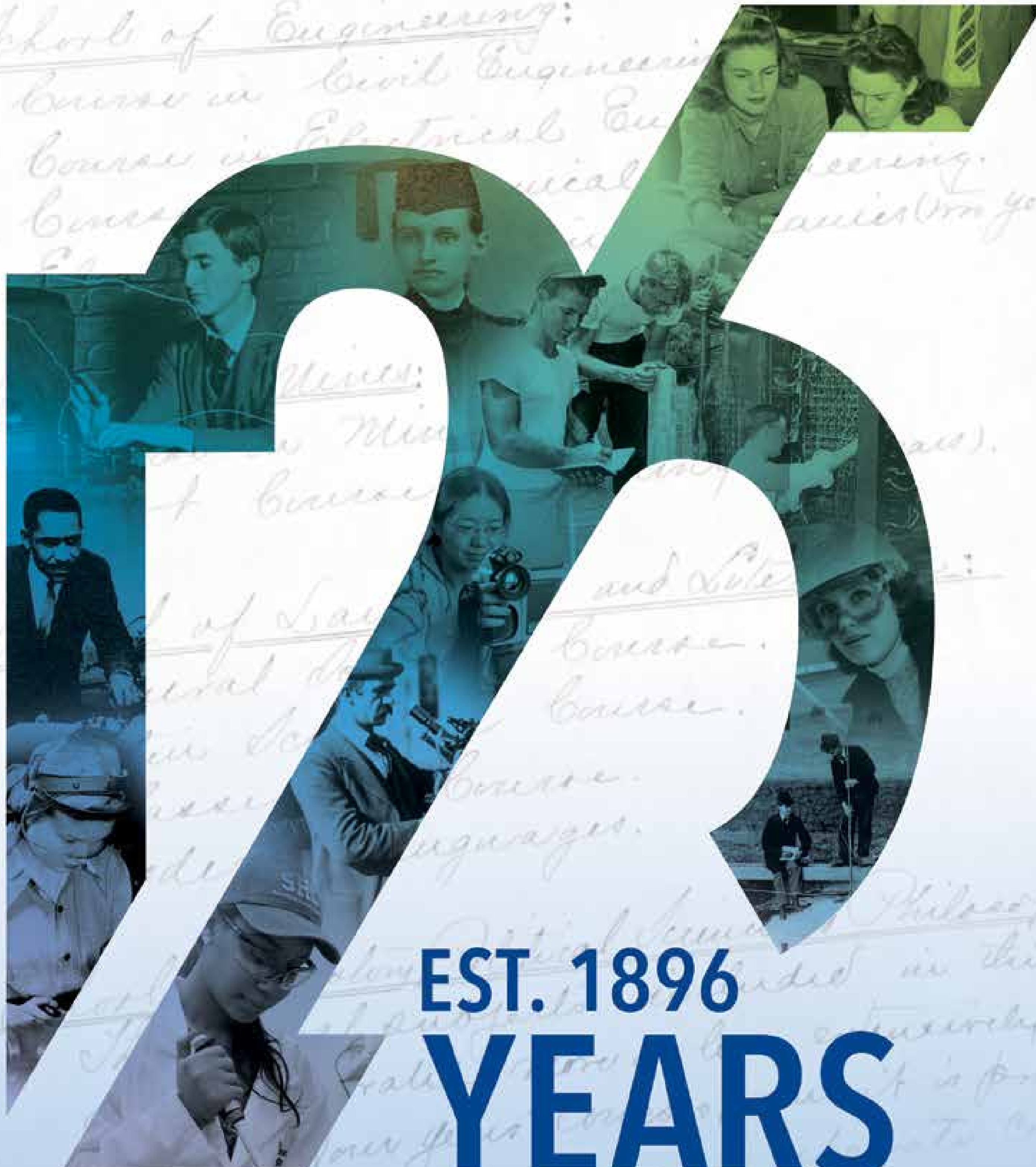
Engineering

PENN STATE

The Magazine of the Penn State College of Engineering

Fall/Winter 2021



EST. 1896

YEARS

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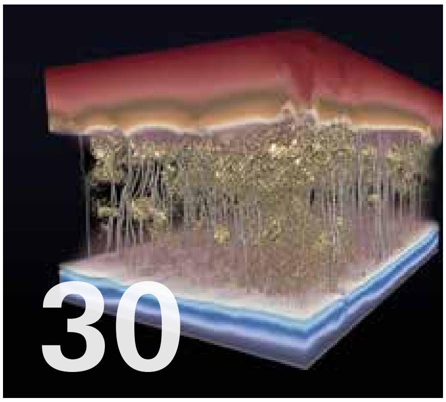
Contents



On the cover:

The college's 125 anniversary graphic features faculty and students from across the history of engineering at Penn State. In the background are hand-written minutes from the Board of Trustees meeting on Jan. 3, 1896, when a vote established the School of Engineering.

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Research

ENVIRONMENT

ADDITIVE MANUFACTURING

ARTIFICIAL INTELLIGENCE

HEALTH

Making an Impact

Students

Alumni

Building toward the future

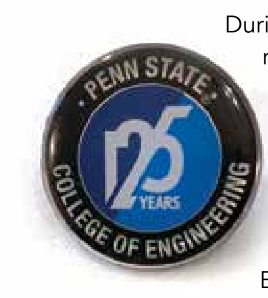
Celebrating 125 years

"It is the energy of our students, our faculty, our staff, and our alumni that has propelled us forward for 125 years and will continue to do so."

In November, the Penn State College of Engineering began a yearlong celebration of our 125th anniversary with a kickoff event for students, alumni, faculty, staff, and friends. Although our initial vision was for an in-person event earlier in the fall, COVID-19 altered those plans, as it has for so many over the past year. But the pandemic did not alter our enthusiasm for commemorating this historic milestone for our college and our engineering community around the world.

Instead of a gathering on campus, we innovated, shifting to a virtual, video-driven anniversary kickoff on Nov. 12. If you have not watched the videos that premiered on that day—or if you simply want to watch them again—I hope you will visit engineering125.psu.edu to do so.

Throughout 2021, our anniversary celebration continues in a variety of ways. For example, on page 44 of this issue of *Engineering Penn State*, we are excited to announce our inaugural class of 40 Under 40 Alumni Award honorees. These are individuals who have already made impressive strides in their careers, communities, and at Penn State. They represent the best of our college and our alumni network.



During this anniversary year, we are also recognizing the power of philanthropy that opens doors for students, provides invaluable support for faculty, and moves the entire college forward. During the year, those who support engineering with a gift of $125 or more will become a member our 125th Anniversary Engineering Giving Society and will receive a commemorative pin.

A third way to celebrate the college's 125th is via a visit to the Penn State Berkey Creamery on campus or online at creamery.psu.edu/e-chip. Order a cone or gallon of Chocolate E-Chip, the Creamery's temporarily renamed Scholar's Chip flavor, which will be available through 2021 following a naming competition in the college last fall.

Beginning on page 10, I invite you to read more about the rich history of our college that we are so excited to celebrate. And join us as we look to the future, guided by a capstone of impact and our strategic cornerstones of excellence, equity, social mobility, and sustainability.

As you will discover, since our earliest days in the late 1800s, our buildings have changed, our demographics have changed, our funding has changed, and our research has changed. One thing that has not changed is the passion of our people. From the very beginning, the Penn State College of Engineering has grown from—and for—people like those highlighted throughout these pages. It is the energy of our students, our faculty, our staff, and our alumni that has propelled us forward for 125 years and will continue to do so. Here's to the past. And here's to the future.

For the glory,

Justin Schwartz
Harold and Inge Marcus
Dean of Engineering
dean@engr.psu.edu

Watch the 125th Anniversary Kickoff Event engineering125.psu.edu

Over $10 million awarded to Penn State for energy center

Penn State has received more than $10 million from the U.S. Department of Energy as an Energy Frontier Research Center Award.

According to principal investigator and center director **Susan Trolier-McKinstry**, Evan Pugh University Professor and the Steward S. Flaschen Professor of Ceramic Science and Engineering and professor of electrical engineering, the research in the center will focus on discovery of new ferroelectric materials, probing the origins of ferroelectricity, developing tools to control the functional properties, growing tailored ferroelectrics at low temperatures, integrating the new materials into a variety of memory devices, and developing processes that allow these materials to be stacked in 3D memory arrays.

The leadership team includes associate director **Vijay Narayanan**, A. Robert Noll Chair of Electrical Engineering and Computer Science, and thrust leaders **Jon-Paul Maria**, professor of materials science and engineering, and **Tom Jackson**, Robert E. Kirby Chair Professor of Electrical Engineering. Other faculty from the college include **Saptarshi Das**, engineering science and mechanics, and **Abhronil Sengupta**, electrical engineering.

Institutional partners include Sandia National Laboratory, Oak Ridge National Laboratory, Purdue University, University of Pennsylvania, and University of Virginia.

The four-year grant is funded between $10 million and $15 million with possibility of renewal.

Penn State to lead $30 million university research alliance

The Department of Defense's Defense Threat Reduction Agency has awarded a combined total of $51.1 million to two university research alliances to counter threats of destruction, with a specific focus on improving current and developing future warfighter technology. Penn State is leading the Interaction of Ionizing Radiation with Matter University Research Alliance, which was awarded $30 million for the next five years, with the potential of extending the alliance for a total of nine years and $54 million of funding with additional funding opportunities available.

Led by **Doug Wolfe**, head of the Department of Metals, Ceramics, and Coatings Processing in the Applied Research Laboratory (ARL), professor of materials science and engineering, engineering science and mechanics, and nuclear engineering by courtesy, Penn State's efforts are focused in ARL and the Colleges of Engineering and Earth and Mineral Sciences. The alliance also includes the University of Michigan, Massachusetts Institute of Technology, and University of Florida, and eight other universities and several national laboratories and industry partners.

Primary Penn State contributors include Meghan Flannery Hayes, head of the Department of Complex Systems Monitoring at ARL; **Marek Flaska** and **Azaree Lintereur**, assistant professors of nuclear engineering; **Aman Haque**, professor of mechanical engineering and engineering science and mechanics; and **Saptarshi Das**, assistant professor of engineering science and mechanics.

The team is investigating how ionizing radiation interacts with matter. According to Wolfe, this research could lead to higher-resolution radiation detectors capable of identifying dirty bombs or concealed radiation materials.

Renderings of West 2 (main photo), ME Knowledge Commons (top right), and Leonhard Commons (bottom right).

Trustees approve plans and funds for part of engineering expansion

The Board of Trustees approved final design plans and authorized expenditures for a new research and teaching building near the western edge of the University Park campus.

Currently known as West 2, the building will provide approximately 105,000 gross square feet to be used as flexible classrooms, multi-use design studios, "cornerstone to capstone" maker spaces, a high-bay research lab, faculty offices, and research cores to benefit all College of Engineering disciplines. It will be built adjacent to the West Campus Parking Deck, which is currently under construction to the west of Leonhard Building and the Earth and Engineering Sciences Building.

Construction of West 2, which began in October 2020, is one aspect of a broader proposed, multi-phase facilities master plan for the college that includes in phase one construction of a second new building to the west of North Atherton Street, renovations to Sackett Building, and the demolition of Hammond Building along College Avenue and the Engineering Units behind Hammond.

"As we transform our footprint on campus, we will be even better equipped to recruit and retain the best faculty, researchers, and students, allowing us to have a long-lasting impact as one of the best engineering colleges with strong educational programs and advanced research capabilities," **Justin Schwartz**, Harold and Inge Marcus Dean of Engineering, said.

Mechanical engineering breaks ground on innovative undergrad lab

To fully reimagine its undergraduate lab experience, the Department of Mechanical Engineering (ME) broke ground on a 5,700-square-foot space in the basement of the Reber Building.

The ME Knowledge Lab will include a collaborative design hub; 3D printers and a light makerspace; lab stations, including characterization devices for wind turbines, gas turbines, battery cells, and materials; a virtual reality learning site; and an autonomous vehicles lab.

Watch the video to learn more: bit.ly/me-lab

New industrial engineering space to invigorate learning

The Harold and Inge Marcus Department of Industrial and Manufacturing Engineering is adding a new student-centered space within the Leonhard Building.

The 6,200-square-foot Leonhard Commons will be equipped with group study rooms, private meeting rooms outfitted with monitors and video conferencing technology, computer desk clusters designed by students, a classroom, gathering hub, recharge zone, printing corner, an open study area with white boards and projector screens, and sectional furniture that can be moved to provide room for lectures and events.

Engineering professor named a fellow of the National Academy of Inventors

Vijaykrishnan Narayanan, A. Robert Noll Chair of Electrical Engineering and Computer Science, has been named a 2020 fellow of the National Academy of Inventors (NAI).

NAI fellows are selected for having "demonstrated a highly prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on the quality of life, economic development, and the welfare of society."

Narayanan will be inducted at the 2021 Fellows Induction Ceremony at the Tenth Annual Meeting of the National Academy of Inventors in June 2021 in Tampa, Florida.

Researchers receive Hall of Fame award for seminal paper on smartphone security

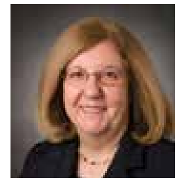
A multi-institution team of researchers received a Hall of Fame Award from the Association for Computing Machinery's Special Interest Group on Operating Systems (SIGOPS) for their 2010 paper that was the first to expose the ways in which smartphone applications use personal data.

The lead author of the paper, "TaintDroid: An Information-Flow Tracking System for Realtime Privacy Monitoring on Smartphones," was William Enck, associate professor in the Department of Computer Science at North Carolina State University, who was a Penn State graduate student at the time of the paper's publication. He was advised by co-author **Patrick McDaniel**, William L. Weiss Chair in Information and Communications Technology in the School of Electrical Engineering and Computer Science.

This paper specifically was chosen by the SIGOPS award committee because it "sparked an important research agenda on smartphone privacy that continues to this day" by documenting "dozens of potential leaks of sensitive and private information" in smartphone applications.

McDaniel's work has led to many accolades, most recently being named a fellow of the American Association for the Advancement of Science.

Engineering department head elected vice president of ASM International



Judith Todd, head of the Department of Engineering Science and Mechanics, was recently elected vice president of ASM International.

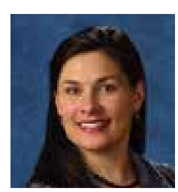
As vice president, Todd hopes to continue working with various groups to help ASM International become the preferred choice for individuals interested in materials. She also hopes to support ASM International in its mission to become a recognized world leader for materials information by developing international chapters, strategic collaborations, and partnerships to provide members with valued resources.

Engineering professor named Consortium to Combat Substance Abuse director

Paul Griffin, professor of industrial engineering, will become interim director of the Consortium to Combat Substance Abuse (CCSA) beginning in summer 2021. Griffin, an expert in health systems engineering, is already a co-funded faculty member of CCSA within the Social Science Research Institute.

Griffin is eager to lead CCSA by helping to identify where engineering and technology researchers can help fill in the gaps for social scientists.

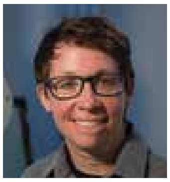
Associate director of global program innovation joins college



Kati Csoman has been named associate director of global program innovation in the Office of Global Engineering Engagement in the College of Engineering—a newly established position that will drive the expansion and enhancement of international engineering opportunities for students.

As the associate director of global program innovation, Csoman will work closely with engineering faculty to advance global engagement, lead innovation in faculty-led abroad courses, and further advance the development of global competencies for engineering students. She also hopes to integrate virtual components into global programs in response to the current limitations on travel during the pandemic.

Engineering professor named Microscopy Society of America president-elect



Deborah Kelly, Huck Chair in Molecular Biophysics, professor of biomedical engineering, and director of the Penn State Center for Structural Oncology, was elected president of the Microscopy Society of America (MSA). Her three-year commitment as first president-elect, then president, then past president, began in January.

As president, Kelly plans to continue to elevate the society's mission through social media engagement and cross-pollination efforts with other national societies. She will also work to attract and retain more underrepresented scientists to MSA.

Newly established director for international engineering student support named

Melika Sharifironizi has been named director for international engineering programs—a newly established joint position with the college's Center for Engineering Outreach and Inclusion (CEOI) and Ken and Mary Alice Lindquist Department of Nuclear Engineering.

As part of CEOI, Sharifironizi will help the college attend to equity issues related to the national origins of its students. Her work will advance student-focused initiatives—including recruitment and retention, academic success, social and cultural climate, and job placement programs.

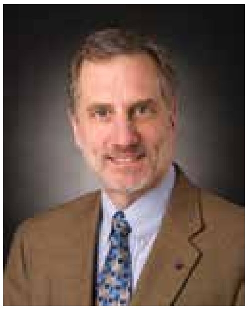
As part of the nuclear engineering department, Sharifironizi will look to establish sustainable energy systems courses with service-learning research projects and support radiochemistry and nuclear chemistry research and academic support. This includes assisting with summer undergraduate opportunities for gender inclusion in nuclear engineering.

Four faculty named to 2020 'Highly Cited Researchers' list

Four faculty members were recognized as Highly Cited Researchers by the Web of Science Group:

Long-Qing Chen
Hamer Professor of Materials Science and Engineering, professor of engineering science and mechanics, and professor of mathematics

Chen, named to the list for the third consecutive year, works to understand, predict, and design materials microstructures, with a focus on their properties and evolution during the processing of materials.



Bruce Logan
Kappe Professor of Environmental Engineering and Evan Pugh University Professor in Engineering

Logan, named to the list for the seventh consecutive year, focuses on developing new renewable energy technologies to achieve an energy sustainable water infrastructure.

Şahin K. Özdemir
Associate professor of engineering science and mechanics

Özdemir, named to the list for the second consecutive year, focuses on optical physics and quantum photonics, as well as the application of this understanding to new technologies.

Donghai Wang
Professor of mechanical engineering and chemical engineering

Wang, named to the list for the third consecutive year, develops nanomaterials for clean energy technologies, such as silicon-based anodes in rechargeable lithium ion batteries.

Don't miss a thing ...

For the latest news and information from the College of Engineering, including alumni spotlights, research from our faculty and graduate students, and more, visit engr.psu.edu and follow us on social media.

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In Memoriam

David Geselowitz, who contributed to artificial heart development, dies

David Geselowitz, distinguished alumni professor emeritus of bioengineering and professor emeritus of medicine, died on Aug. 22 at age 90.

Geselowitz received his bachelor's, master's, and doctoral degrees in electrical engineering from the University of Pennsylvania.

After obtaining his doctorate degree, Geselowitz joined the University of Pennsylvania faculty and founded one of the nation's first doctoral programs in biomedical engineering. In 1971, he moved to Penn State to implement a pioneering graduate program in bioengineering. In 1974, the program was launched under Geselowitz's leadership and became the University's first Intercollege Graduate Degree Program, with faculty from the Colleges of Engineering, Medicine, Science, and Health and Human Development.

Working closely with William Pierce, a surgeon at the Milton S. Hershey Medical Center, Geselowitz supervised the development of an artificial heart. In 1976, to international acclaim, a pneumatic left ventricular assist device was successfully implanted in a human patient. Still used today, the device helps keep patients alive until a heart transplant can be performed. This technology eventually evolved into a full artificial heart, which is still in development at Penn State.

Remembering Gifford Albright, first architectural engineering department head

Gifford "Giff" Albright, the first head of the Department of Architectural Engineering (AE), died on Dec. 30, in State College. He was 89 years old.

In 1953, Albright became the first graduate of the University's restructured five-year bachelor of architectural engineering degree program. After earning his master of science in building engineering from the Massachusetts Institute of Technology in 1955 and serving in the United States Navy Civil Engineering Corps, Albright returned to Penn State as the founding head of the newly re-established AE department in 1962. He held the title until 1983, when he stepped down and continued to serve as a professor until he retired in 1991.

Albright specifically envisioned a computer operating system that allowed individuals in different disciplines to quickly converge on the conception and design of a building with the same goal of specific performance criteria. The resulting program, called Project Man-Machine System for the Optimum Design and Construction of Buildings (Project MODCON), also led to the nation's first course in integrated building systems based on computer applications.

Engineering mourns death of aerospace engineering's Michael Micci

Michael Micci, professor of aerospace engineering, died on Sept. 21, in State College after an eight-month battle with cancer. He was 66 years old.

Micci earned his bachelor of science and master of science in aerospace engineering from the University of Illinois at Urbana–Champaign and his doctoral degree from the Department of Mechanical and Aerospace Engineering at Princeton University.

In 1981, Micci joined the Department of Aerospace Engineering as an assistant professor. He was promoted to associate professor in 1988 and full professor in 1998. He taught aerospace topics ranging from dynamics and control to programming to spacecraft environments. As a genuine rocket scientist, Micci specialized in all forms of rocket propulsion.

In 1994, Micci was the first person to use molecular dynamics to simulate supercritical atomization and vaporization as it occurs in high performance liquid rocket engines.

We Are BECAUSE We Were

Tracing 125-plus years of engineering history at Penn State

by Andrew Krebs

This issue of *Engineering Penn State* commemorates the 125th anniversary of the founding of the Penn State College of Engineering. The vibrancy and impact for which the college is known today threads back through history, not only to the decision by the Board of Trustees in 1896 to organize The Pennsylvania State College into seven distinct schools, one of which was the School of Engineering, but also to countless other decisions, moments, achievements, and individuals that collectively form the fabric of engineering at Penn State in 2021.

Engineering through the years

1896

The Board of Trustees makes it official

On Jan. 3, engineering joins six other newly formed schools within The Pennsylvania State College.

1900

We Are No. 10

Demand grows steadily in the early years of the School of Engineering. By the turn of the century, Penn State ranks 10th in the nation for the number of undergraduate engineering students enrolled.

1909

Engineering experiment station broadens the school's focus

Dean John Price Jackson pushes the need to use theoretical knowledge gained in the classroom and laboratory to solve the practical problems of industry.

1918

School responds to world at war

Penn State and hundreds of other colleges and universities provide technical training for enlisted military personnel via six- and eight-week courses. During the course of the war the school gives instruction to 2,500 troops.

1929

The school benefits Pennsylvanians

By the end of the 1920s, the school's Department of Engineering Extension had given instruction on virtually every engineering topic to more than 30,000 Pennsylvania residents.

1945

The birth of Ordnance Research Laboratory (ORL)

The Navy transfers development and testing of underwater weaponry from Harvard to the school. ORL eventually becomes the Applied Research Laboratory at Penn State.

1955

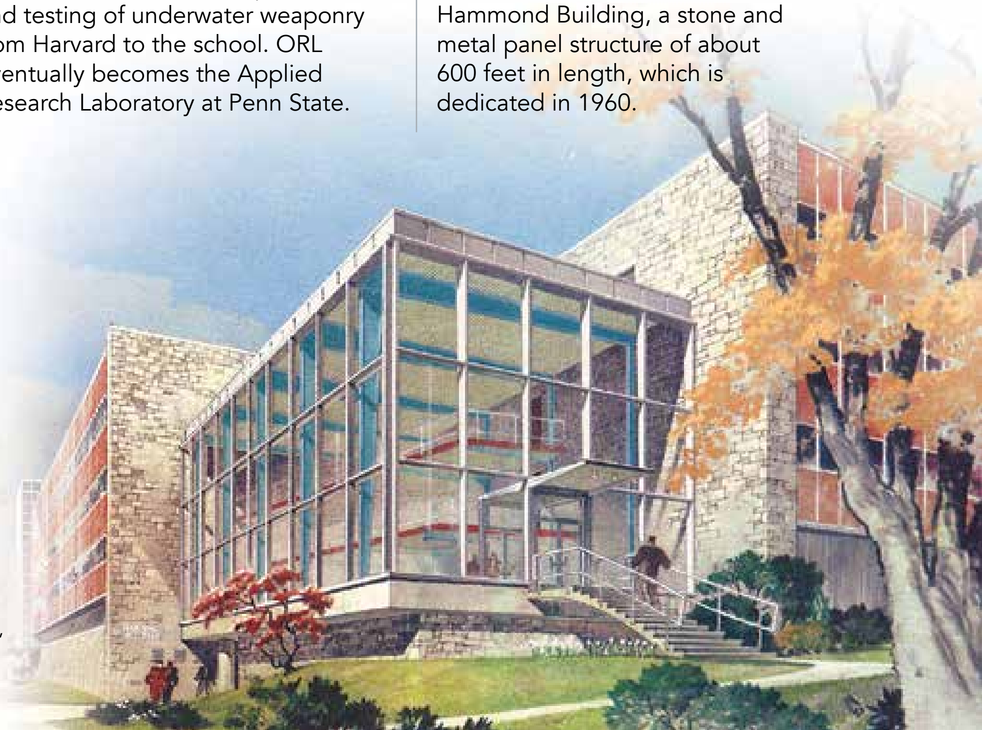
Engineering powers up

Designed by William M. Breazeale, the reactor on the eastern edge of the Penn State campus reaches criticality, the point at which a self-sustaining reaction occurs.

1957

Designing a new home on College Avenue

Howell Lewis Shay and Associates of Philadelphia design the $5.9 million Hammond Building, a stone and metal panel structure of about 600 feet in length, which is dedicated in 1960.



Acknowledgements: *The College of Engineering at Penn State: A Century in the Land-Grant Tradition*, written by Michael Bezilla and published by the Penn State University Press in 1996, served as an invaluable guide to the history of the college prior to and throughout its first century. Special thanks also to the Eberly Family Special Collections Library and Penn State University Libraries.

Left page: Main Engineering Building (early 1900s).
Right page, top: The "Good Roads" train (1910s),
Bottom: Rendering of Hammond Building, Kunkle Lounge, and Sackett Building.

1968
Projecting engineering demand
The American Society for Engineering Education urges educators and the profession "to make every effort to attract an increasing number of students to engineering at both the undergraduate and graduate level."

1976
The helping heart
A team of researchers in the Colleges of Engineering and Medicine introduce the Penn State Heart-Assist Pump, the first device of its kind.

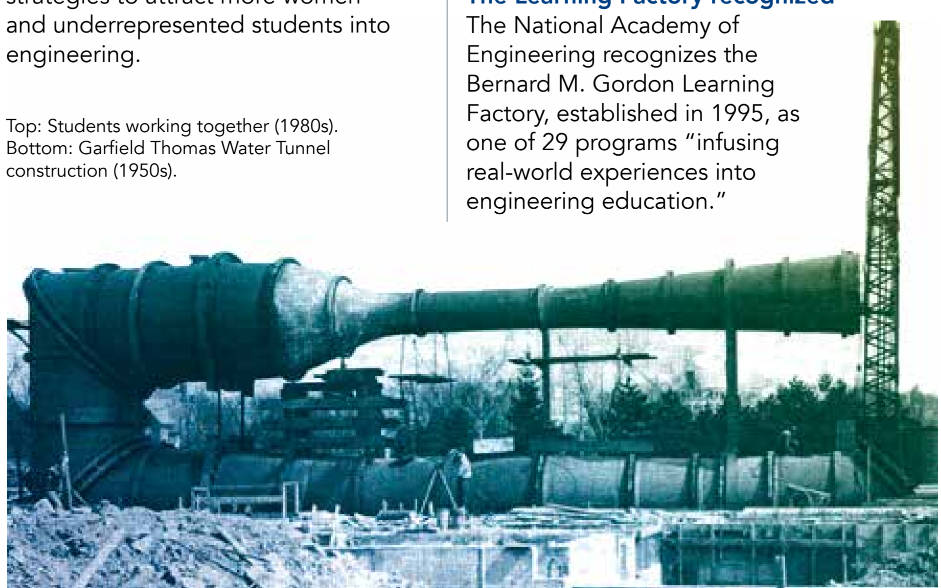
1980
Among the largest
With more than 7,000 undergraduates, the college has one of the largest enrollments in the nation.

1989
Working to expand the engineering community
The new Women in Engineering Program, along with the Minority Engineering Program from a few years earlier, adopt outreach strategies to attract more women and underrepresented students into engineering.

Top: Students working together (1980s).
Bottom: Garfield Thomas Water Tunnel construction (1950s).

1996
An engineering landmark
The American Society of Mechanical Engineers recognizes the Garfield Thomas Water Tunnel, which began operating in 1950, as a national historic mechanical engineering landmark. Today, the tunnel is part of the Penn State Applied Research Laboratory and serves as the principal experimental hydrodynamic research facility for the U.S. Navy.

2012
The Learning Factory recognized
The National Academy of Engineering recognizes the Bernard M. Gordon Learning Factory, established in 1995, as one of 29 programs "infusing real-world experiences into engineering education."



2018

A master plan for the future

Penn State engages with the firm Payette to develop a framework for College of Engineering capital projects over 10 years. The master plan promises to reshape the college and its footprint on campus.

2020

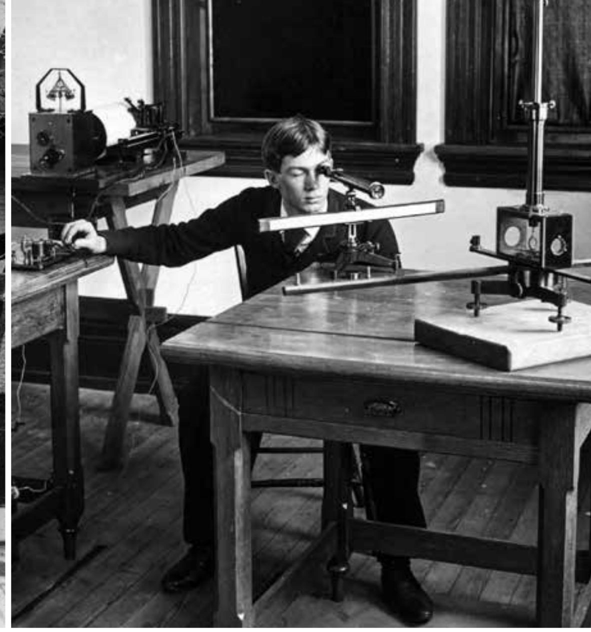
Breaking new ground

Construction begins on the first of two new planned buildings on West Campus, the start of the college's facilities master plan implementation.

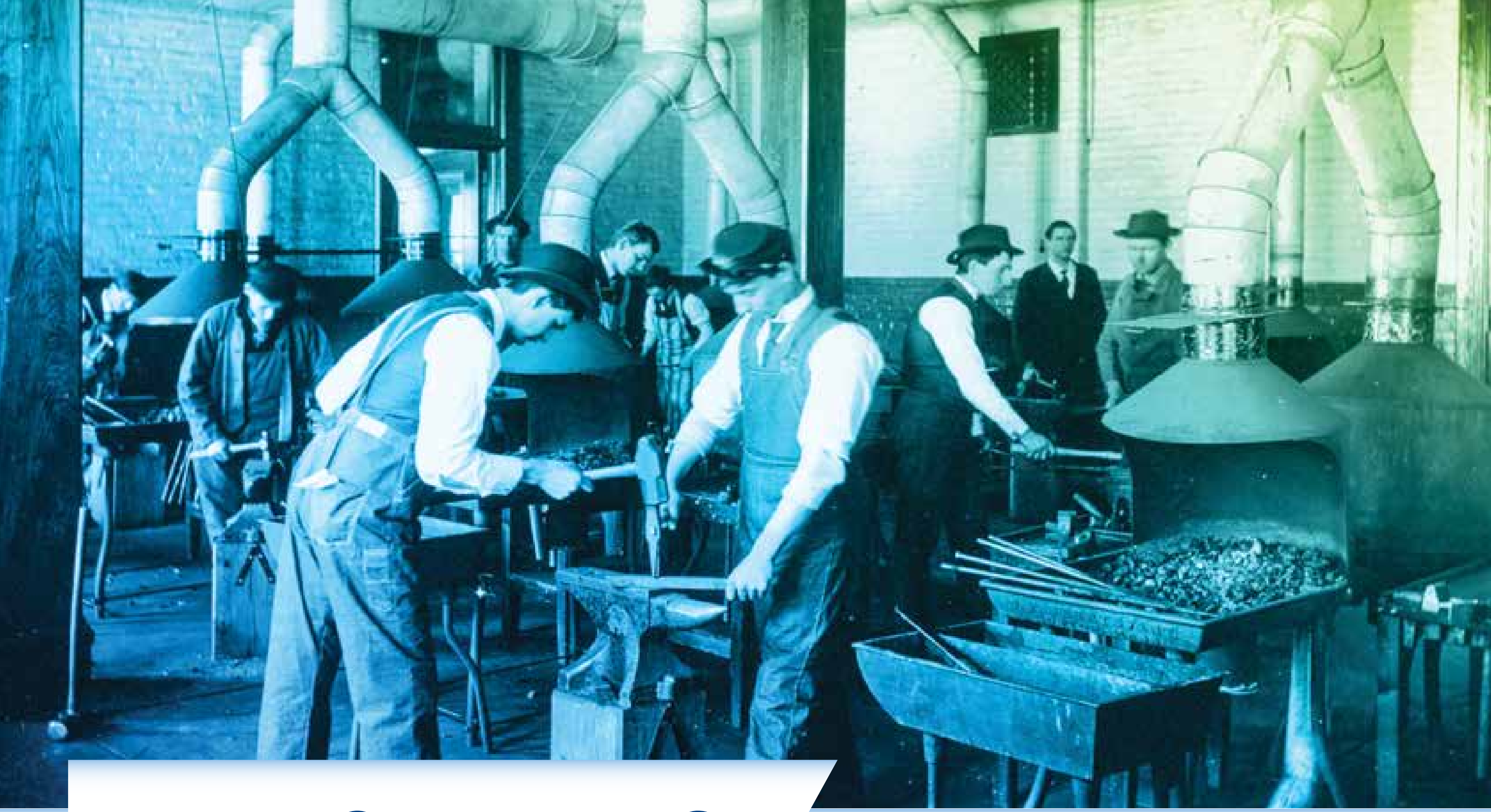
Top: The 10-year facilities master plan for the College of Engineering includes several new buildings on West Campus. Bottom: A reimagining of the current engineering footprint adjacent to the Mall and along College Avenue.

FACES OF ENGINEERING

1890s-1930s



Left page: Electrical engineering students (1890s). Right page, clockwise from top: Student inspection trip to D.C. (1910s), Electrical engineering student (1800s), Civil engineering camp (1920s), Working in the Foundry (1900s), Architectural engineering class (1920s), Students in the telephone laboratory (1920s).



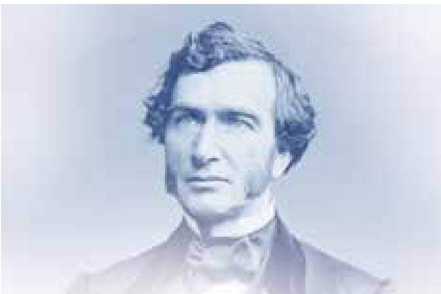
THE **FOUNDING**

Three days into the start of the new year in 1896, the Board of Trustees for the Pennsylvania State College gathered in Harrisburg for its regularly scheduled meeting. Among a series of agenda items that January afternoon, one in particular would reshape the institution.

Two years earlier, in his 1894 annual report, President George W. Atherton noted that successful and rapid expansion in technical areas such as engineering had absorbed an increasing share of the college's resources, sometimes to the detriment of the liberal arts and other non-technical areas.

"If we cannot enlarge our work in all directions," Atherton wrote, "I am clearly of the opinion that we should hold down our technical work at the present level." To Atherton, this was wholly unappealing for an institution like Penn State; one that had finally found its financial footing in the 1890s and was beginning to grow in prominence.

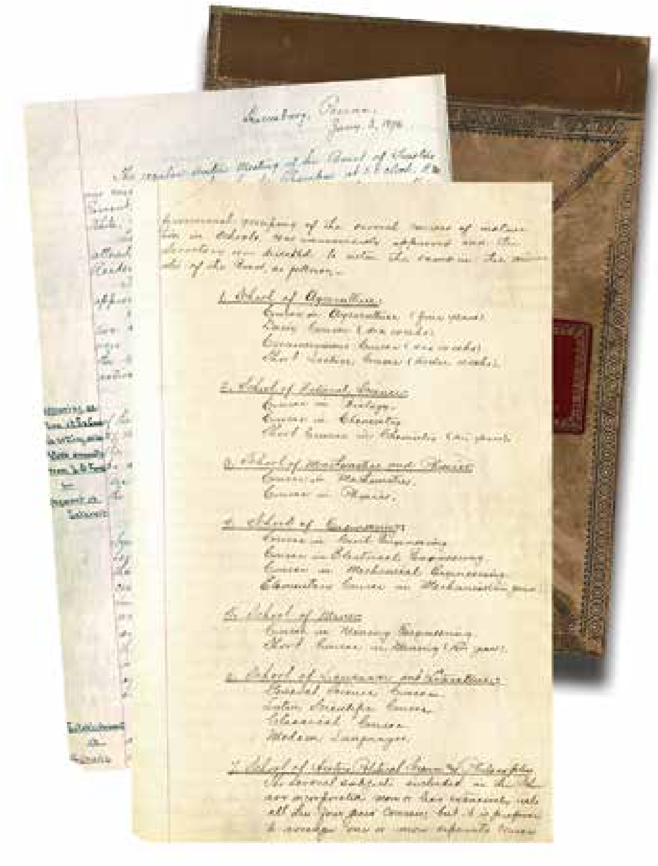
In response, in September 1895, the executive committee of the board recommended the formation of distinct schools within the college. Doing so, it was argued, would increase cooperation and focus among related departments, diminish wasteful redundancies, and shift the role of administration away from the president's office and onto newly appointed school deans. This was the path forward to allow both technical and non-technical education at Penn State to flourish with a new century just over the horizon.



Did you know?

The Morrill Land Grant Act of 1862 created a path for the Farmers' High School—as Penn State was known at its founding—to expand its curriculum beyond its agriculture roots. The act directed schools to teach, among other things, "such branches of learning as are related to agriculture and the mechanic arts."

Top: Mechanical engineering students (1890s). Left: Civil engineering students (1900s). Right page, clockwise: Board of Trustees meeting minutes (1896), Students performing calorimeter work (1890s), Students analyzing flue gas, calibrating gauges (1890s), Instruction (1890s).



During its meeting on Jan. 3, the board unanimously approved the executive committee recommendation from the previous fall and established seven schools at Penn State, one of which was the School of Engineering with its Departments of Civil, Electrical, and Mechanical Engineering.

Across the decades since that decision, engineering-driven advancements have reshaped the world and the Penn State School of Engineering—which in 1953 became the College of Engineering—has played a critical role. Today, the college is engaging around the globe to help solve humanity's greatest challenges, working to build a more inclusive academic community and a more diverse engineering workforce, and partnering in new ways across campus and with government and industry.

In their words

"The question of today: 'Where is the electrician? Where is the engineer?' We must have them both, and we depend in Pennsylvania, to a large extent, upon this college to furnish them."

Former Pennsylvania Governor and Board of Trustees Member General James A. Beaver at the dedication of the Main Engineering Building in 1893.

THE **FIRST DEAN**

Louis E. Reber was leaving academia behind and moving to Texas.

By 1883, the instructor in mathematics and military tactics had grown frustrated with low pay and what felt like a stagnating career. Reber hoped a switch to private business in the Lone Star state would be more rewarding.

Penn State President George W. Atherton proposed a different path. Instead of heading south to Texas, Atherton suggested that Reber go north to spend the next year at the Massachusetts Institute of Technology (MIT), where he could complete graduate work in mechanical engineering and observe best practices in engineering education. Then, Reber could bring his knowledge back to Penn State and apply it to the task of restructuring the existing two-year program in mechanic arts and developing a four-year baccalaureate program in mechanical engineering.

Reber agreed to Atherton's proposal. Following his return from MIT, he worked tirelessly for more than 20 years—the last 12 as the school's first dean—to push engineering forward while balancing growing student demand for engineering courses with shoestring budgets, an undersized faculty, and perpetually limited facilities and equipment.

Reber was the first in a line of engineering deans that stretches across the history of the college: 12 individuals from a variety of backgrounds who have brought with them unique personalities, perspectives, and priorities to the college's chief leadership position.

Top: Engineering faculty (1880s). Front row, left to right, includes Louis Reber, I. Thorton Osmond, William A. Buckout, and George Atherton.

In their words

Louis E. Reber in his 1895 annual report

"The more closely I become acquainted with the equipment and work of some other large engineering schools, the better I am satisfied with the equipment provided and work being done at our own institution."

FOLLOWING IN REBER'S FOOTSTEPS:

Engineering deans at Penn State

1907-1914
JOHN PRICE JACKSON

1915-1937
ROBERT L. SACKETT

1937-1951
HARRY P. HAMMOND

1951-1956
ERIC A. WALKER

1956-1966
MERRITT A. WILLIAMSON

1966-1981
NUNZIO J. PALLADINO

1981-1987
WILBUR L. MEIER

1988-1991
JOHN A. BRIGHTON

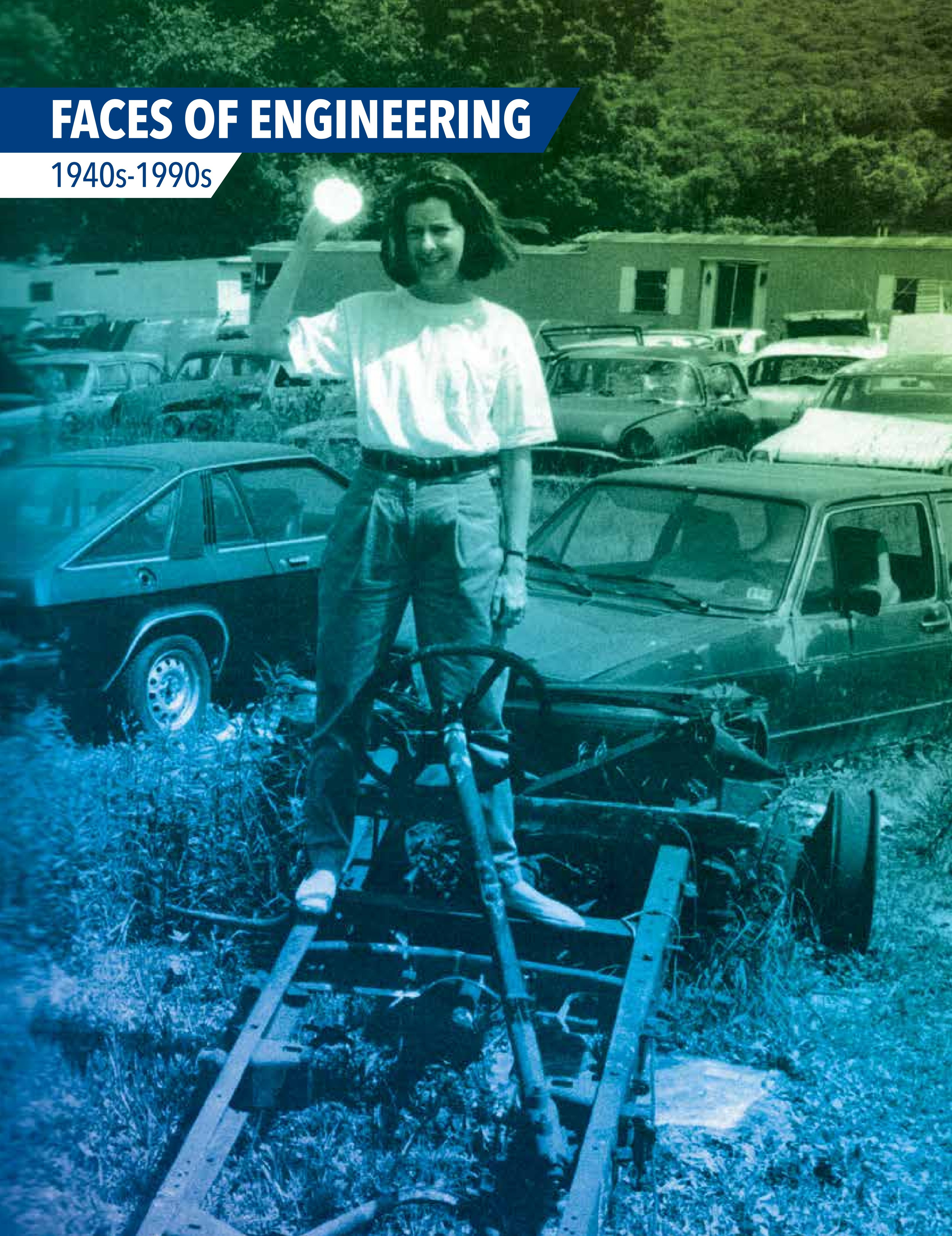
1992-2013
DAVID N. WORMLEY

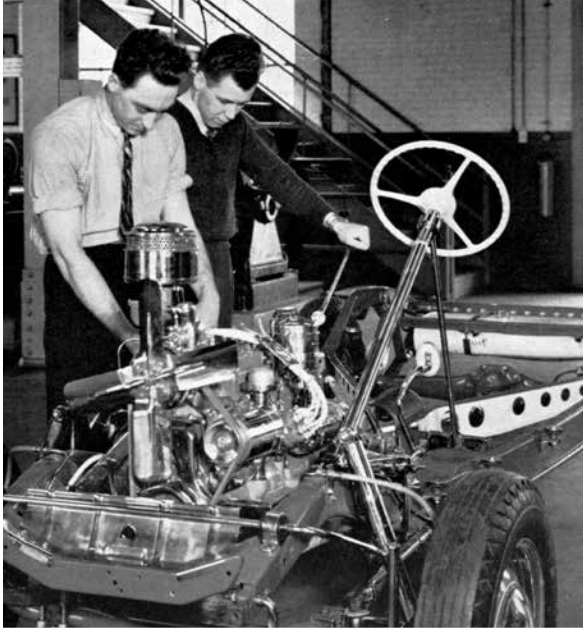
2014-2017
AMR S. ELNASHAI

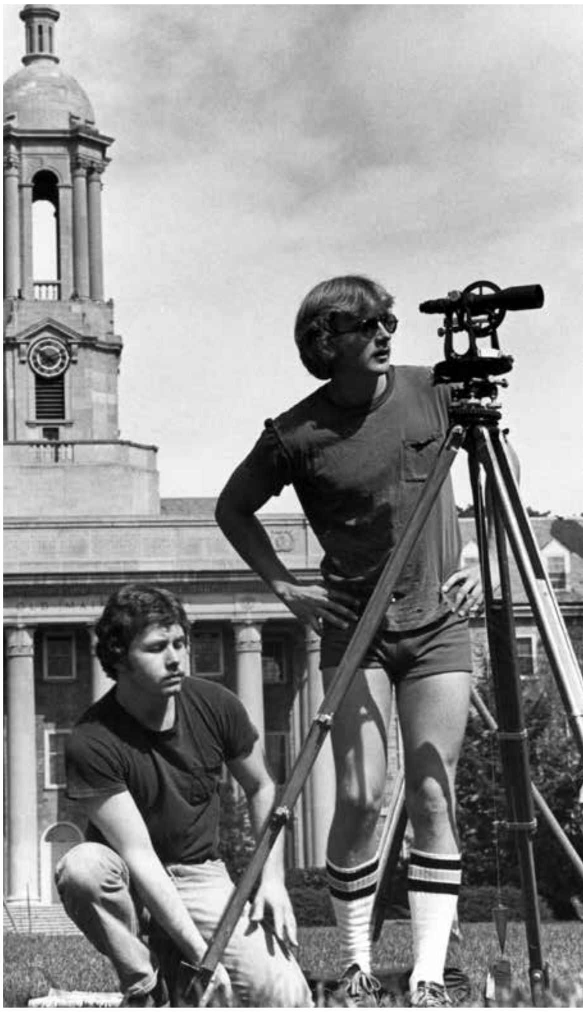
2017-Current
JUSTIN SCHWARTZ

FACES OF ENGINEERING

1940s-1990s







Left page: Barbara Shaw, professor of engineering science and mechanics (1990s). Clockwise, from top: Students conducting research (1980s), Engineering Open House (1940s), Civil engineering students surveying (1970s), Agricultural engineering research (1980s), Curtis-Wright Cadettes (1940s), Engineering research (1980s).

THE **FIRE AND THE FUTURE**

The wail of a fire alarm pulled Penn State President Edwin E. Sparks and his dinner guests onto to the veranda of the University House on the evening of Nov. 25, 1918. They were greeted by the harrowing sight of flames erupting from the nearby woodworking shop that was attached to the rear of the Main Engineering Building.

By the morning after the fire, the building—dedicated in 1893—was little more than a smoking shell; its interior completely gutted. The School of Engineering, which only a few months earlier had admitted its largest first-year class in history, was left reeling as nearly all the classrooms, laboratories, and offices of the Departments of Civil and Mechanical Engineering were lost.

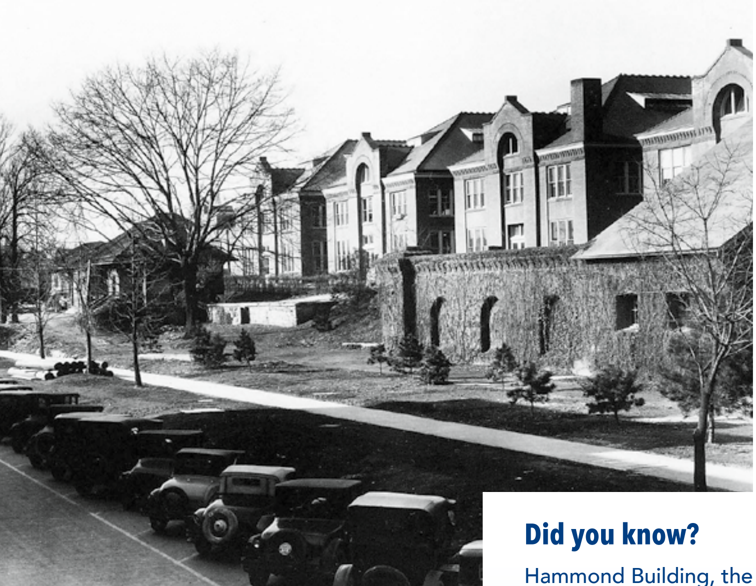
From that period of monumental crises, the school pressed forward in the years that followed. The engineering footprint that is still recognizable today began to take shape on the University Park campus in the form of new Engineering Units, the opening in 1921 of a building (now known as Reber) for the Department of Mechanical Engineering, and construction of a new Main Engineering Building (now called Sackett) in 1929.

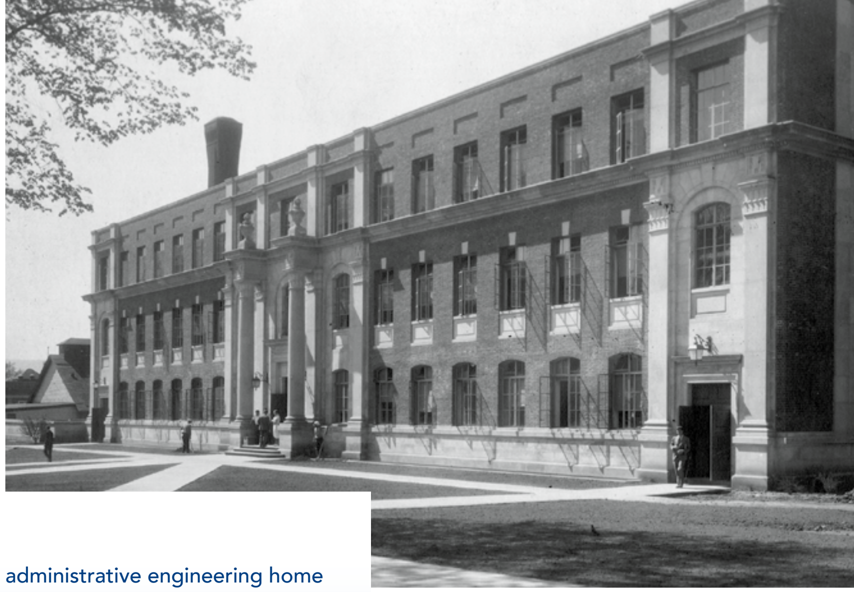
More than a century after that destructive November night, physical transformation is once again on the horizon for the college; this time strategically planned instead of in response to a disaster.

As part of a proposed decade-long facilities master plan implementation, construction is now underway on West 2, a new research and teaching building near the western edge of the University Park campus. Phase one of the plan also proposes construction of a second new building to the west of North Atherton Street, renovations to Sackett Building, and the demolition of Hammond Building and the Engineering Units behind Hammond.

After the planned conclusion of phase one, the master plan recommends a second five-year phase that includes construction on the footprint of the demolished Hammond Building and Engineering Units, further renovations to Sackett Building, and the addition of a third building to West Campus.

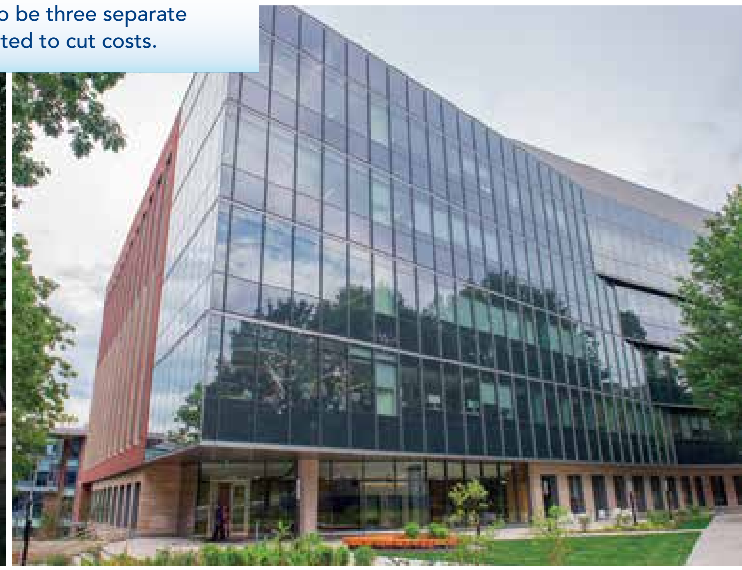
Top: Main Engineering Building on fire (1918). Bottom: Burned out hulk of Main Engineering Building (1918). Right page, clockwise from top: Engineering Units and power plant (1920s), New Main Engineering Building, now Sackett (1930s), Chemical and Biomedical Engineering Building, Hammond Building, West Campus rendering, with West 1, West 2, and the engineering quad.

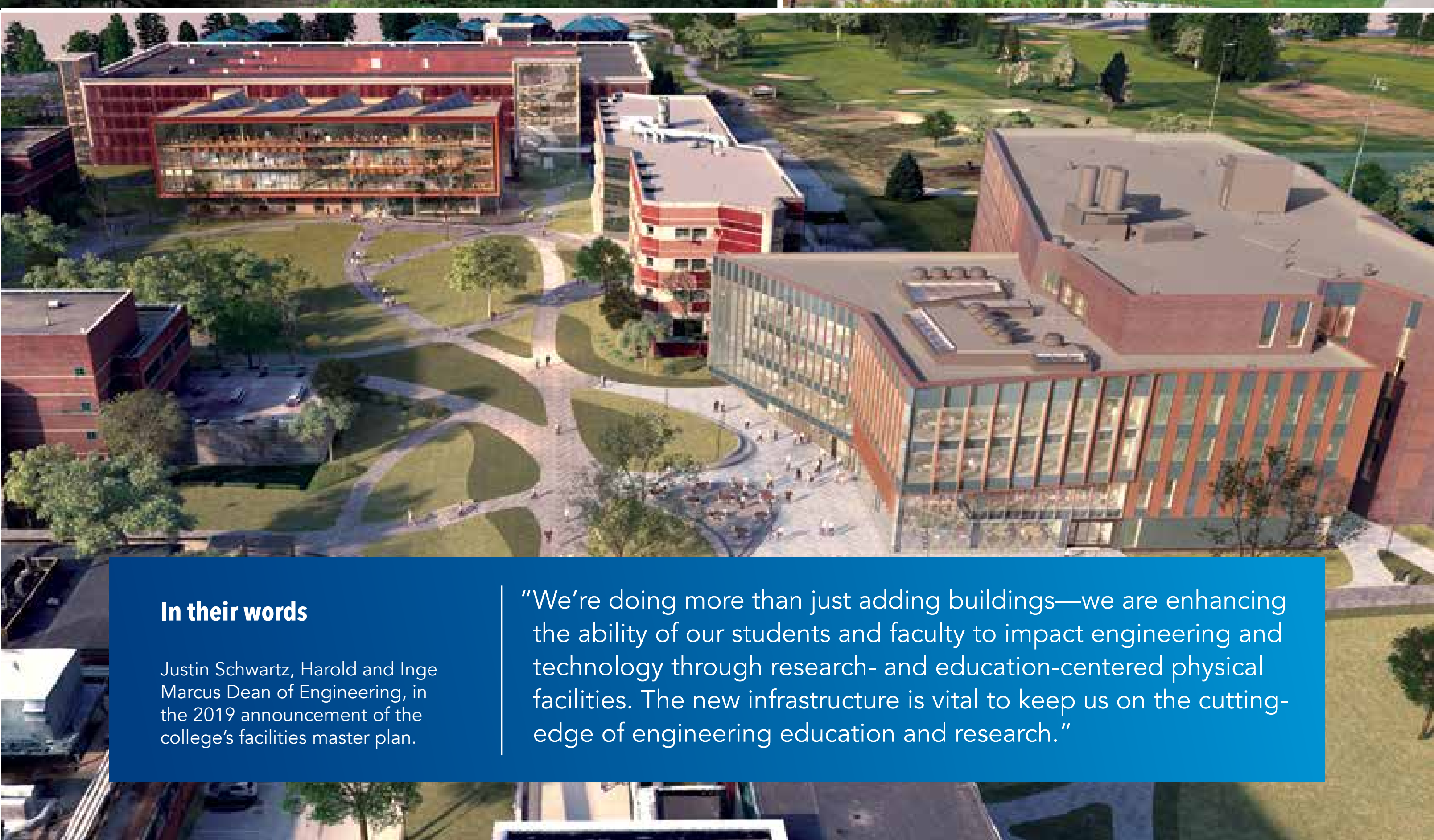




Did you know?

Hammond Building, the administrative engineering home since 1960, was initially supposed to be three separate structures but plans were consolidated to cut costs.





In their words

Justin Schwartz, Harold and Inge Marcus Dean of Engineering, in the 2019 announcement of the college's facilities master plan.

"We're doing more than just adding buildings—we are enhancing the ability of our students and faculty to impact engineering and technology through research- and education-centered physical facilities. The new infrastructure is vital to keep us on the cutting-edge of engineering education and research."

THE **DAWN OF DISCOVERY**

The Penn State College of Engineering's research enterprise, which in the 2019-20 fiscal year exceeded $153 million in expenditures and helped propel the University's research operation past $1 billion for the year, traces its roots back to the early 1900s and the founding of the Engineering Experiment Station.

Early research, published in the *Engineering Experiment Station Bulletin*, included "Results of Experiments on the Effects of the Form of A.C. Waves on the Life and Efficiency of Incandescent Lamps" and "Practical Suggestions for the Construction of Concrete Floors."

Over time, the station's work in diesel engineering and heat transfer in building materials earned international acclaim, but it wasn't until the decades following World War II that research in the college expanded greatly. Developments such as the founding of the Ordnance Research Laboratory in 1945, the opening of the college's nuclear reactor in 1955, and collaborative work to develop a heart-assist pump first used in 1976 greatly aided in Penn State's rise to engineering research prominence.

The more than 400 researchers who call the college home today continue to break new ground across countless areas. From unveiling the structure of mutated cancer-causing proteins, to devising wearable sensors, to improving desalination membranes, to contributing to missions to other planets, the research of Penn State engineers is helping to confront society's greatest challenges.

"As a college, we are strategically focused on continuing to grow our research enterprise," said **Justin Schwartz**, Harold and Inge Marcus Dean of Engineering. "That growth starts with hiring top faculty and providing the resources they need to succeed."

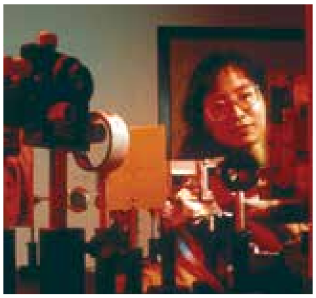
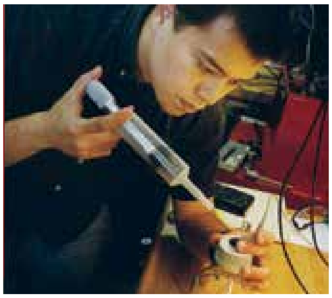
Top: Civil engineering student (1940s).
Right page: Engineering research throughout the years.




Did you know?

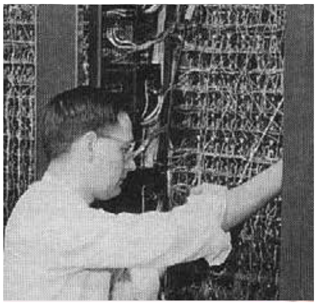
Throughout the 1950s, research expenditures in the college climbed steadily, with the Ordnance Research Laboratory and the Ionosphere Research Laboratory (IRL) leading the way. The IRL, with a budget of nearly $1 million by the end of the decade, funded work exploring chemistry and physics in the upper atmosphere, resulting in important applications for areas such as space travel.

Right: First phase of Ordnance Research Laboratory construction (1940s).

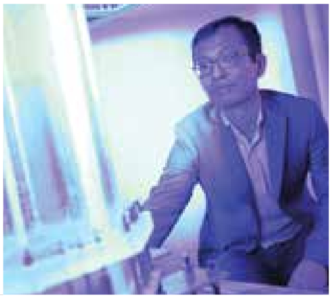










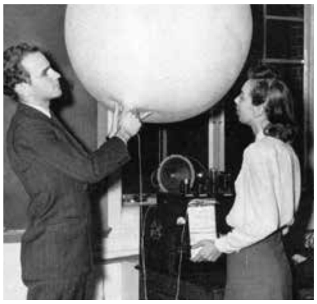




In their words

Associate Dean for Research and Graduate Programs George Lesieutre discussing recent research growth in the college.

"(Engineering researchers) are looking for things that matter. They're willing to team up and collaborate with people outside their own expertise to work as part of a team and to find solutions."







THE **EDUCATIONAL LEGACY**

One of the Penn State College of Engineering's lasting legacies has been in preparing thousands of engineering students for successful careers in industry, government, academia, and beyond.

As early as 1902, employers like General Electric, Westinghouse, and the Pennsylvania Railroad were clamoring to hire more engineering graduates from Penn State.

"We should very much like to get a good representation from your class in electrical engineering this year, and we will agree to place in our testing department at least six of your men."

"My object in writing is to find out if any of the 1902 boys would like to enter signal work?"

"More State men are wanted here and right now!"

Since 1896, the college has awarded nearly 129,000 degrees to more than 120,000 individuals and has annually ranked among the largest engineering programs in the nation in terms of student enrollment.

Penn State has long been an engineering education innovator not only at the undergraduate and graduate degree levels, but also through programs designed to reach a broader community of learners, an extension of its original Land Grant ideal.

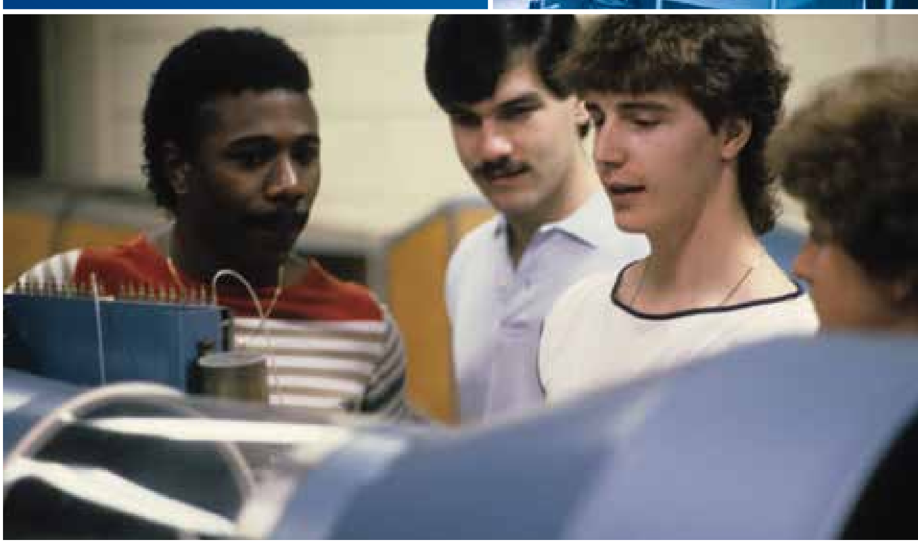
By the end of the 1920s, the Department of Engineering Extension had given instruction on virtually every engineering topic to more than 30,000 Pennsylvania residents; work that would continue for decades.

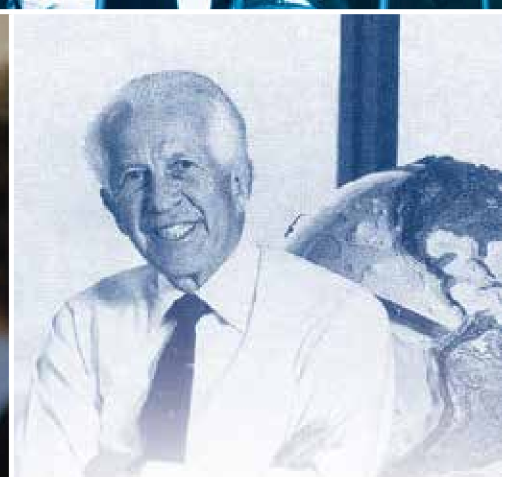
With World War II on the horizon in the early 1940s, Penn State's Engineering Science and Management Defense Training Program provided engineering training to more than 10,000, the largest enrollment of any institution in the country. During the war, several large corporations like Curtiss-Wright contracted with the school to train women for jobs as engineering technicians in defense plants.

In their words

"My heroes growing up were engineers. I wanted to be an engineer, and that's why I came to Penn State."

Guion S. Bluford Jr. '64, who in 1983 became the first African American in space. Bluford served on four NASA Space Shuttle missions.





Did you know?

A multimillion-dollar commitment from William E. Leonhard ('36) and his wife, Wyllis, in 1990 established the Leonhard Center for Enhancement of Engineering Education in the college. The Leonhards were recognized as Penn State's Philanthropists of the Year in 2004.

In the 1980s, the new Women in Engineering Program and Minority Engineering Program—later renamed as the Multicultural Engineering Program—adopted outreach strategies to attract more women and underrepresented students into engineering.

It's work that continues today as a key strategic focus of the college.

"It is important that we ensure we are leaders in equity and inclusion, opening doors to students and faculty from broad, diverse backgrounds and ensuring a collegial, welcoming climate for everyone," said **Justin Schwartz**, Harold and Inge Marcus Dean of Engineering, as he announced Tonya Peeples as the college's first associate dean for equity and inclusion in 2018. "I want to see all Penn State students, post-docs, and faculty reach their highest levels of achievement."

Left page, top: Electrical engineering classroom (1950s), Bottom: Molten iron flowing out of the Penn State cupola (1950s). Right page, top: Start of the Women in Engineering Program (1980s), Bottom: Aerospace engineering students (1980s).

THE **NEXT STEPS**

After 125 years of innovation and growth, of challenges confronted and overcome, and of persistent pursuit of excellence, the Penn State College of Engineering story is still being written.

Top and right page: Penn State Engineering students in recent years.

"Impact is our strategic capstone," said **Justin Schwartz**, Harold and Inge Marcus Dean of Engineering. "What impact are we having on the world at large, on our students, within our disciplines, and on each other? As we consider our vision for the future of the College of Engineering, that capstone of impact is supported by four strategic cornerstones."

Schwartz shared his perspectives on those cornerstones as the college looks beyond its 125th year and to the future for engineering at Penn State.

CORNERSTONE 1: EXCELLENCE

"In everything we do—from education and research, to advising and career services, to equity, and all the other aspects of our college and the initiatives under way here—we must focus on excellence each and every day. And we must recognize and reward the countless examples of excellence across our community. It's not about checking a box or doing something in the same way because that's how it's always been done. It's about innovating, taking on new challenges, and being a leader among institutions worldwide."

CORNERSTONE 2: EQUITY

"I think equity is the greatest challenge we face in engineering education. For decades, the known social science related to equity and inclusion has expanded. As a discipline, though, we have failed to translate that science into practice, and little progress has been made over many years. We must do better. As a college—and in a leadership role alongside other top engineering universities—we are working to do so. A key example is

FACES OF ENGINEERING

2000s-Today

the development, now under way, of a comprehensive equity action plan for engineering; a plan that engages faculty, staff, and students to actively participate in creating a more inclusive and equitable culture within the college. Ours is one of the largest engineering colleges in the world, so what we achieve here today has impact around the world tomorrow."

CORNERSTONE 3: SOCIAL MOBILITY

"Both access and preparation inform the cornerstone of social mobility. How are we honoring Penn State's land-grant mission and making sure that the doors to an engineering education are open to a broader array of individuals? One step we've taken is a fundamental change to our college's scholarship awarding process, moving to a more comprehensive assessment to gauge qualifications. We are also working to expand elements of our engineering curriculum with the understanding that technical knowledge is only part of the equation. Skills in areas such as leadership, teamwork, communication, and professional ethics are critically important for our graduates to contribute to their engineering professions and compete in the engineering workforce. A Penn State engineering degree has enabled upward social mobility for more than 100,000 students and their families in the past and will continue to do so for decades to come."

CORNERSTONE 4: SUSTAINABILITY

"As engineers continue to develop solutions to help address issues like climate change, areas such as energy and the environment are certainly part of this strategic cornerstone for the college. The work of our Sustainability Council helps to forward our mission in this area. But we also take a broader view of sustainability as a lens through which we evaluate our internal priorities. What are the long-term implications and the potential for lasting impact? For example, as our faculty continues to grow—we've added more than 150 individuals since 2015—we are striving to hire educators and researchers who will thrive in decades-long careers at Penn State. In our initiatives around equity, we are looking well beyond one or two years as we work to drive systemic change, cementing a future that continues to build upon a dynamic 125-year legacy for the Penn State College of Engineering. As we invest our precious resources—time and money—we must show excellence in resource stewardship by investing in ways that produce long-lasting impact."

Membrane nanostructures hold the key to clean water

by Ashley J. WennersHerron

A desalination membrane acts as a filter for salty water: push the water through the membrane, get clean water suitable for agriculture, energy production, and even drinking. The process seems simple enough, but it contains complex intricacies that have baffled scientists for decades—until now.

Researchers from Penn State, The University of Texas at Austin, Iowa State University, Dow Chemical Company, and DuPont Water Solutions published a key finding in understanding how membranes actually filter minerals from water, online in Science. The article was featured on the print edition's cover, issued on Jan. 1.

"Despite their use for many years, there is much we don't know about how water filtration membranes work," said **Enrique Gomez**, professor of chemical engineering and materials science and engineering at Penn State, who led the research. "We found that how you control the density distribution of the membrane itself at the nanoscale is really important for water-production performance."

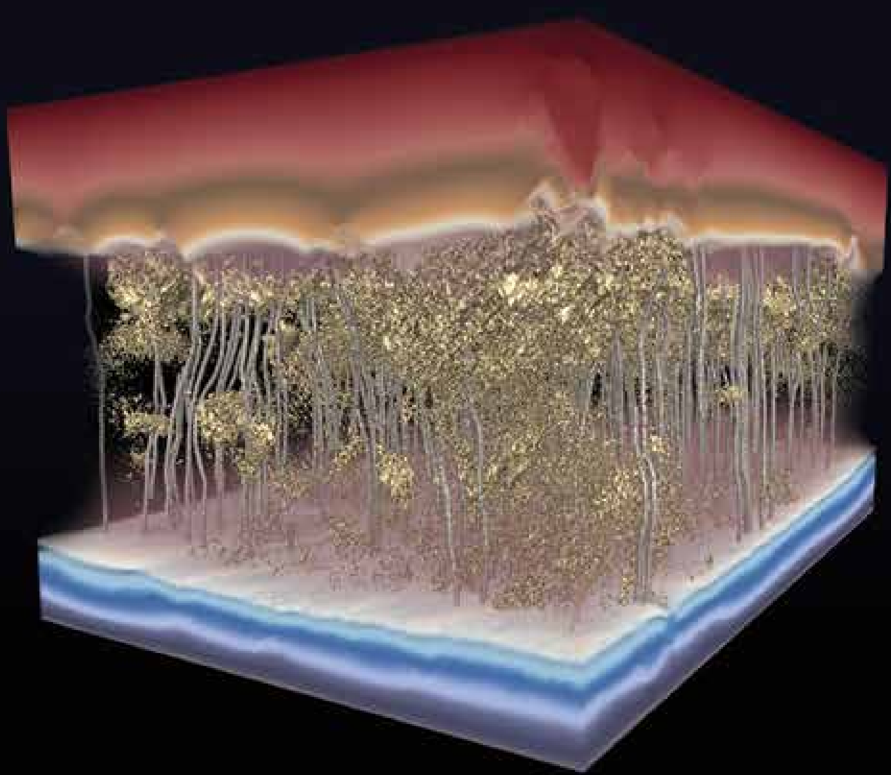
Co-led by Manish Kumar, associate professor in the Department of Civil, Architectural, and Environmental Engineering at UT Austin, the team used multimodal electron microscopy, which combines the atomic-scale detailed imaging with techniques that reveal chemical composition, to determine that desalination membranes are inconsistent in density and mass. The researchers mapped the density variations in polymer film in three dimensions with a spatial resolution of approximately one nanometer—that's less than half the diameter of a DNA strand. According to Gomez, this technological advancement was key in understanding the role of density in membranes.

"You can see how some places are more or less dense in a coffee filter just by your eye," Gomez said. "In filtration membranes, it looks even, but it's not at the nanoscale, and how you control that mass distribution is really important for water-filtration performance."

This was a surprise, Gomez and Kumar said, as it was previously thought that the thicker the membrane, the less water production. Filmtec, now a part of DuPont Water Solutions, partnered with the researchers and funded the project because their in-house scientists found that thicker membranes were actually proving to be more permeable.

The researchers found that the thickness does not matter as much as avoiding highly dense nanoscale regions, or "dead zones." In a sense, a more consistent density throughout the membrane is more important than thickness for maximizing water production, according to Gomez.

This understanding could increase membrane efficiency by 30% to 40%, according to the researchers, resulting in more water filtered with less energy—a potential cost-saving update to current desalination processes. ■



Growing duckweed to help the Chesapeake

by Tim Schley

With a four-year, $1.7 million grant from the National Science Foundation, Penn State researchers will investigate how duckweed could be grown on Pennsylvania farms to limit nutrient pollution into the Chesapeake Bay.

Duckweed grows rapidly in water with elevated levels of nitrogen and phosphorus, often the result of fertilizer and manure runoff. While many consider the plant a pest, farmers may find duckweed to have multiple benefits, according to **Rachel Brennan**, associate professor of environmental engineering and lead investigator of the project.

In a preliminary assessment, Brennan's team calculated an estimated economic return for farmers if they repurposed some of their land from growing soybeans into a lined pond for growing duckweed. By mixing manure with water in a controlled pond instead of applying it to an open field, farmers could not only reduce pollution from their land but also produce more protein. ■

Using biochar to clean contaminated wastewater

by Jeff Mulhollem

Biochar—a charcoal-like substance made primarily from agricultural waste products—holds promise for removing emerging contaminants such as pharmaceuticals from treated wastewater.

A team of Penn State researchers conducted a novel study that evaluated and compared the ability of biochar derived from two common leftover agricultural materials—cotton gin waste and guayule bagasse—to adsorb three common pharmaceutical compounds from an aqueous solution.

The results are important, according to researcher **Herschel Elliott**, professor of agricultural and biological engineering, because they demonstrate the potential for biochar made from plentiful agricultural wastes—that otherwise must be disposed of—to serve as a low-cost additional treatment for reducing contaminants in treated wastewater used for irrigation. ■

Powerful partners: Clean-burning fuel from sun, wind, and seawater

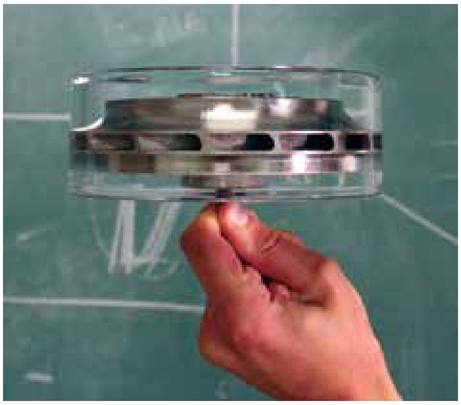
by Tim Schley

The power of the sun, wind, and sea may soon combine to produce clean-burning hydrogen fuel. A Penn State team, led by **Bruce Logan**, Kappe Professor of Environmental Engineering and Evan Pugh University Professor, integrated water purification technology into a new proof-of-concept design for a sea water electrolyzer, which uses electricity to split apart the hydrogen and oxygen in water molecules.

"Sea water splitting" could make it easier to turn wind and solar energy into a storable and portable fuel. However, if sea water is not desalinated prior to entering the electrolyzer, the chloride ions in the water turn into toxic chlorine gas, which degrades the equipment and seeps into the environment.

To prevent this, the researchers inserted a reverse osmosis (RO) membrane used for purifying water, replacing the ion-exchange membrane commonly found in electrolyzers.

Through a series of experiments published in Energy & Environmental Science, the researchers tested two commercially available RO membranes and two ion-exchange membranes. While one RO membrane restricted the necessary electrical current to perform electrolysis, the other performed well in comparison to the ion-exchange membranes. ■



Modeling waves to uncover 3D-printing defects

by Gabrielle Stewart

Andrea Arguelles and **Christian Peco**, assistant professors of engineering science and mechanics, and Francesco Simonetti, professor at the University of Cincinnati, received a three-year, $500,000 National Science Foundation grant to advance quality control methods for parts produced through additive manufacturing.

Currently, researchers can use ultrasonic waves to evaluate internal product features without damaging the product itself. However, this nondestructive evaluation (NDE) method is sometimes hindered by unwanted interference with curved edges, corners, and other non-uniform features typical of 3D-printed parts.

The researchers want to change this by developing a model that can simulate wave movement in complex-shaped 3D-printed parts. To achieve this, they will use a recently developed NDE technique known as cryoultrasonic NDE. Pioneered by Simonetti, cryoultrasonic NDE involves encasing an object in ice to facilitate the movement of ultrasonic waves for highlighting defects. In this project, the researchers will develop an acoustically tuned form of the ice to allow seamless movement of the wave from the ice to the product part. ■

To enhance the accurate ultrasonic investigation and wave modeling process of nondestructive material testing, researchers aim to develop acoustically tuned ice to encase manufactured parts. A crystal-clear, proof-of-principle ice is pictured at left. (Photo credit: Francesco Simonetti)

Simplifying the complex: Metal component manufacturing

by Erin Cassidy Hendrick

In pursuit of an improved, less expensive way to additively manufacture complex metal components, Penn State researchers have received a three-year, $546,806 grant from the National Science Foundation.

Qian Wang, professor and associate head for administration in mechanical engineering and the principal investigator of the project, aims to develop new models for laser powder bed fusion additive manufacturing (AM). Essentially, this process deposits metal powder in thin layers and uses a laser to melt and fuse them together, repeating the process until the piece is complete.

While AM enables the creation of these parts, the process is expensive, time consuming, and can often result in a flawed final component.

To avoid these problems, a widely used numerical model called finite elements is used to computationally enhance the design. However, this method is time and resource heavy, while also being difficult to adjust in real time.

Harnessing her background in dynamics and control, the new models Wang will develop will capture the essential physics of the process with a significantly reduced computational complexity, as compared to finite element models. ■

Seeking greater power efficiencies for AI systems

by Sarah Small

In order to develop more intelligent and efficient artificial intelligence (AI) systems, computer scientists use neuromorphic computing, a field that relies on mimicking the human nervous system in order to create efficient and intelligent computing systems. However, researchers in the nascent field are still working toward success, and the sought-after power efficiencies have yet to be achieved.

Thanks to a three-year, $1 million grant from the National Science Foundation, Penn State computer scientists are exploring ways to achieve these power efficiencies through a specific approach called spiking neural networks (SNN). The research is led by principal investigator **Chita Das**, department head and distinguished professor of computer science and engineering, and co-PIs **Vijaykrishnan Narayanan**, A. Robert Noll Chair of Computer Science and Engineering and Electrical Engineering, and **Abhronil Sengupta**, assistant professor of electrical engineering.

The SNN approach uses biologically inspired, event-driven spike-based computation and communication in its design. One of the distinguishing features of SNN as a computing paradigm is the integration of the element of time into algorithms and models. The researchers are exploring novel magnetic device structures to directly mimic such temporal non-linear characteristics in hardware, scalable architecture, and interconnection fabrics for these devices, along with novel hybrid algorithm designs to leverage the benefits of both SNN models and traditional non-spiking deep learning models.

If successful, the improved power efficiency and intelligence that mirrors human neural networks could be applied broadly to improve all forms of AI and computing systems. ■

Enhancing how humans and AI systems collaborate

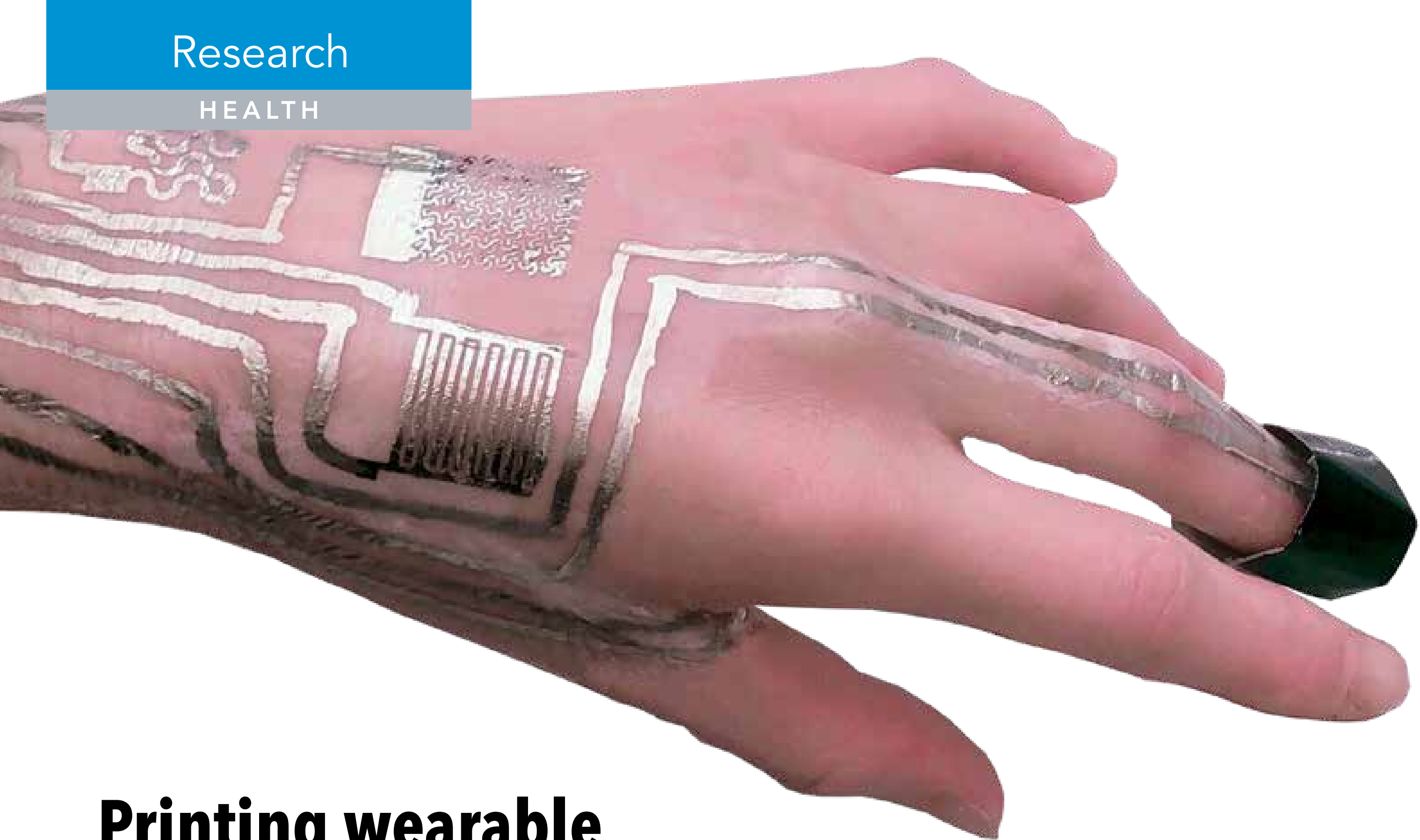
by Erin Cassidy Hendrick

The Defense Advanced Research Projects Agency has awarded Penn State, SRI International, and University of Texas at Austin researchers $437,023 to contribute to a $5.6 million project to merge the strengths of artificial and human intelligence, with the goal of advancing the utility of relevant cyber-physical systems.

Every day, the U.S. military performs missions and tasks where both human and computer decision-making skills are critical. The sheer amount of data and considerations for security and safety can make these tasks daunting for a human operator, so many systems utilize artificial intelligence (AI) to absorb some of the complexity.

Christopher McComb, assistant professor of engineering design and mechanical engineering, and his team seek to streamline and enhance the collaboration of humans and AI through a foundational approach. The researchers will focus on the creation of a co-designer system, building an AI concept that can generate insights and work with the human operator as quickly and efficiently as possible.

“The ultimate goal isn’t to create some system that replaces people,” McComb said. “Instead, we want to build something that takes over some of the boring, detailed work and frees humans up to do what we do best—solving big problems.” ■



Printing wearable biosensors without heat

by Ashley J. WennersHerron

With a novel layer to help the metallic components of the sensor bond, an international team of researchers printed sensors directly on human skin. (Photo credit: Ling Zhang)

Wearable sensors are evolving from watches and electrodes to bendable devices that provide more precise biometric measurements and comfort for users. An international team of researchers has taken the evolution one step further by printing sensors directly on human skin without the use of heat.

Led by **Huanyu "Larry" Cheng**, Dorothy Quiggle Career Development Professor in the Department of Engineering Science and Mechanics, the team published their results in ACS Applied Materials & Interfaces.

Cheng and his colleagues previously developed flexible printed circuit boards for use in wearable sensors, but printing directly on skin has been hindered by the bonding process for the metallic components in the sensor. Called sintering, this process typically requires temperatures of around 572 degrees Fahrenheit (300 degrees Celsius) to bond the sensor's silver nanoparticles together.

"The skin surface cannot withstand such a high temperature, obviously," Cheng said. "To get around this limitation, we proposed a sintering aid layer—something that would not hurt the skin and could help the material sinter together at a lower temperature."

By adding a nanoparticle to the mix, the silver particles sinter at a lower temperature of about 212 F (100 C).

"That can be used to print sensors on clothing and paper, which is useful, but it's still higher than we can stand at skin temperature," Cheng said, who noted that about 104 F (40 C) could still burn skin tissue. "We changed the formula of the aid layer, changed the printing material, and found that we could sinter at room temperature."

The room temperature sintering aid layer consists of polyvinyl alcohol paste and calcium carbonate, and it reduces printing surface roughness to allow for an ultrathin electromechanical layer that can bend and fold. A hair dryer set on cool removes the water used as solvent in the ink.

The sensors are capable of precisely and continuously capturing temperature, humidity, blood oxygen levels, and heart performance signals, according to Cheng, as well as linking to a monitoring network via wireless transmission.

The sensor remains robust in tepid water for a few days, but a hot shower will easily remove it.

"It could be recycled, since removal doesn't damage the device," Cheng said. "And, importantly, removal doesn't damage the skin, either. That's especially important for people with sensitive skin, like the elderly and babies. The device can be useful without being an extra burden to the person using it or to the environment." ■

Faster sepsis test for reduced deaths

by Ashley J. WennersHerron

One in three people who die in U.S. hospitals have sepsis, the body's extreme response to infection that can lead to multiple organ failure. Diagnosis can take up to five days, but death may take only hours from the initial onset of sepsis.

Now, a Penn State and Stanford Medicine collaboration aims to change that with a five-year, $3.8 million grant from the National Institutes of Health.

"This project will develop a rapid diagnostic system for sepsis," said **Pak Kin Wong**, co-principal investigator and professor of biomedical engineering and mechanical engineering at Penn State.

With one blood test, Wong and co-principal investigator Samuel Yang, an associate professor of emergency medicine at Stanford University School of Medicine, plan to not only classify the pathogen causing infection but also pinpoint how resistant the pathogen is to antibiotics.

Based on a biosensing strategy developed in Wong's laboratory, the researchers will capture and sort individual pathogens based on their size and begin identifying them with molecular probes, testing antibiotic susceptibility—in just two hours.

"The single-cell technology is particularly crucial for sepsis, which has a very low pathogen load compared to other types of infection," Wong said. "By counting the bacteria one at a time, our technique will also quantify the pathogen and detect polymicrobial infection, when the disease is caused by more than one pathogen." ■

1 in 3 people who die in U.S. hospitals have sepsis

Monitoring effectiveness of HIV treatment at home, not at the hospital

by Sarah Small

Development of a new method to monitor the effectiveness of human immunodeficiency virus (HIV) treatment at home instead of in hospitals is underway by Penn State researchers. The research is supported by a three-year, $1,012,996 grant from the National Institutes of Health (NIH).

When people undergo antiretroviral treatment for HIV, mortality and morbidity rates are reduced significantly by reducing the viral load to undetectable levels. In order to ensure the success of the treatment, patients need to be tested routinely to check their viral loads.

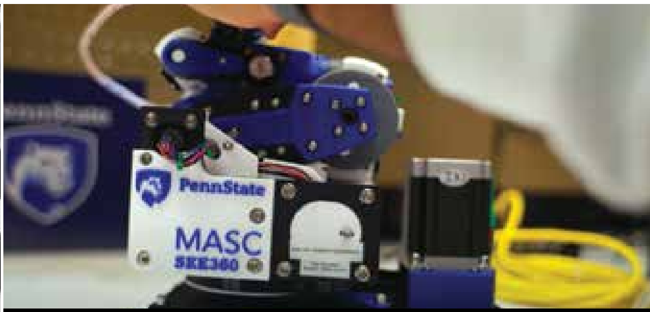
Currently, testing of viral loads relies on nucleic acid testing (NAT), which cannot be conducted outside of hospitals and laboratories because of the testing complexity. **Weihua Guan**, principal investigator and assistant professor of electrical engineering, and co-investigators Drs. Cynthia Whitener, Wallace Greene, and Jonathan Nunez—all faculty at Penn State's College of Medicine and clinicians at Milton S. Hershey Medical Center—are changing that.

"We are developing a quantitative NAT on an ultra-compact device to detect viral rebound that is simple enough for laypersons to test themselves," Guan said.

The new method will enable patients to use a finger prick test at home, similar to the concept of insulin monitoring for people with diabetes.

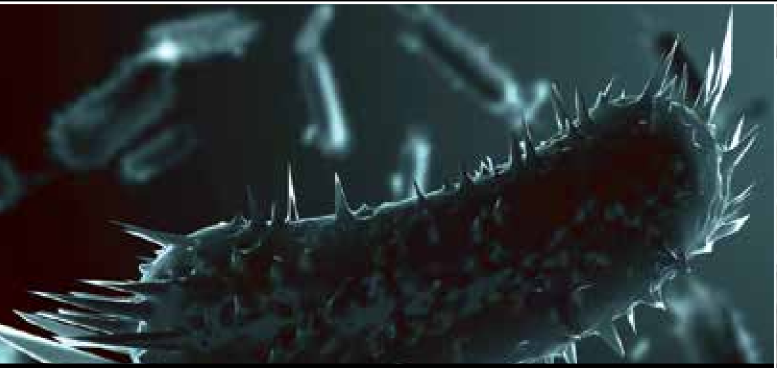
The researchers plan to design, manufacture, and validate five prototypes. If these milestones are met, the researchers will receive an additional $1,317,127 in funding, distributed over two years, from NIH. ■

Investigating Amelia Earhart's disappearance mystery with neutrons bit.ly/engr-amelia



The power of robotics and automation bit.ly/engr-robotics

Secrets of fly vision for rapid flight control bit.ly/engr-fly



Putting a bacterial cell to sleep bit.ly/engr-bacteria

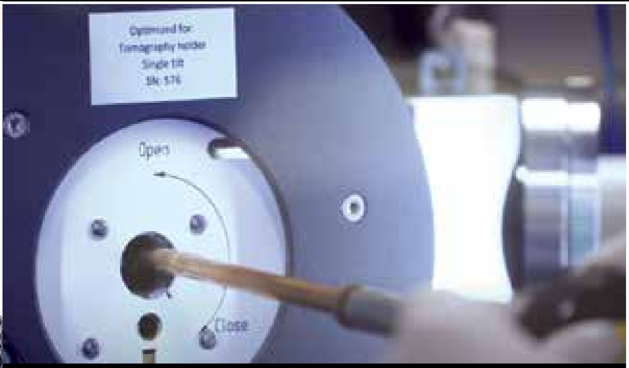
Engineering design: Become a master designer bit.ly/engr-design

Imitating nature to improve computing bit.ly/engr-nature

Enhanced water-repellent surfaces discovered on insects bit.ly/engr-enhanced

Engineering research on the rise bit.ly/engr-rise

Combating climate change with energy literacy bit.ly/engr-energy



The complex mystery of membranes bit.ly/engr-membranes

Alfred P. Sloan Research Fellow named bit.ly/engr-fellow

$8M NASA grant pilots course to hybrid-powered aircraft bit.ly/engr-nasa

View the boot camp video
bit.ly/engr-app

Students' app improves literacy skills in Kenya

by Christie Black

Nyansapo, an app developed by College of Engineering students, uses artificial intelligence (AI) to assist children in learning literacy skills. The app was launched in August during a 10-day boot camp in Kenya where reported results showed participants increased their level of literacy.

Tanish Rastogi, a sophomore majoring in computer science, said literacy rates in Kenya are low due in part to a 40-to-one student-to-teacher ratio in the classroom.

"Because of this disparity, many students do not develop essential literacy skills, and due to the COVID-19 pandemic, students have been out of school since March and their day-to-day lives have been completely disrupted. This boot camp was an opportunity to present a learning experience in a safe environment," Rastogi said.

Nyansapo was developed during the 2020 Nittany AI Challenge, a yearlong competition facilitated by the Nittany AI Alliance. Team members include Rastogi, **Edward Amoah**, **Rhea Baweja**, **Ritik Parmar**, **Benson Wainaina**, **Jason Wang**, and **Kushagra Jaiswal**—all students in the College of Engineering. Nyansapo was selected as the winner of the challenge.

"As a team, we developed the mobile app while working together from all over the world during the COVID-19 pandemic. From Singapore to Kenya to the United States, development consisted of at least 50 Zoom meetings, hundreds of WhatsApp messages, Google documents, as well as sharing code and app builds," Rastogi said.

> "At the end of the boot camp, about **96%** of the kids involved in the program improved by at least one level."

"This boot camp would not have been possible without the support of the Nittany AI Alliance and the Penn State Humanitarian Engineering and Social Entrepreneurship program."

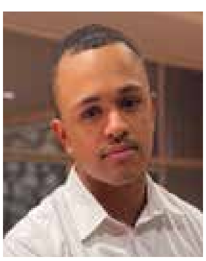
Rastogi said that during the boot camp, 80 hours of teaching sessions were conducted. All the teachers worked with an average of 13 primary school learners between the ages of 9 and 17 years. The children were grouped according to their learning levels in letter, word, paragraph, and story. The sessions allowed for group and individual learning.

"The learner's progress with the Nyansapo app was tracked before the start of the program, after 10 hours of instruction, and at the end of the boot camp," Rastogi said. "The app provided teachers with useful information, like commonly missed words, to help teachers prepare effectively for the training sessions. The sessions involved simple activities and materials appropriate for different literacy levels. At the end of the boot camp, about 96% of the kids involved in the program improved by at least one level."

Rastogi said the team is planning to hold additional boot camps in the future. ■

First-generation student paves his path to success

by Miranda Buckheit



When **Carlos Antoine Norman, Jr.**, a first-generation college student, was looking at universities, a West Allegheny high school teacher's recommendation led him to Penn State.

Norman began exploring Penn State majors and was torn between two of his interest areas: business and engineering. He learned about industrial engineering: a practical major that could allow him to use engineering applications to impact the business world.

"I wasn't too sure of the rigor of engineering when I arrived, so I joined the Multicultural Engineering Program Orientation (MEPO) to get acquainted," Norman said.

MEPO helped him develop more critical thinking skills and he received valuable guidance from a senior industrial engineering major who served as his MEPO mentor. Norman has now been serving as a MEPO mentor for three years.

Despite the introductions Norman made during MEPO, he felt very overwhelmed as a first-generation college student.

"I even considered dropping out until I found BLUEprint," Norman said. "I wouldn't still be here if I didn't build that network and get involved."

He also found solace in serving as an ambassador for the Paul Robeson Cultural Center, where he has learned more about his social identity and gained cultural confidence.

"If I hadn't done MEPO, I wouldn't have learned about the cultural center or become as much of a well-rounded person as I am now," Norman said.

He is also a member of the Penn State chapters of the National Society of Black Engineers and the Society of Hispanic Professional Engineers.

Pending his May 2021 graduation, he has accepted an offer as an operations analyst for Goldman Sachs.

"I hope to continue my work and I hope to somehow leave a legacy at Penn State for other students like me," Norman said. ■

Making her mark

by Erin Cassidy Hendrick

Madison Reddie, mechanical engineering graduate, was named the fall 2020 student marshal for Penn State's virtual commencement ceremony on Dec. 19.

Reddie collaborated with faculty on several projects. Two were conducted with John Carroll, distinguished professor of information sciences and technology, and focused on creating assistive technology for people with disabilities. She also researched how to improve the ergonomics of bus operator workstations with **Matt Parkinson**, professor and director of the Learning Factory in the College of Engineering, who served as her faculty marshal.

As a Schreyer Scholar, Reddie also completed an undergraduate thesis studying and improving the accessibility of design research, with the goal of better translating academic knowledge to guide real-world impacts.

These experiences gave her a strong foundation in academic research and encouraged her to pursue her doctoral degree in global development engineering.

"In the future, I'm going to keep looking for ways to use my knowledge to make the biggest impact," Reddie said. ■

CHARGING AHEAD
through research

by Erin Cassidy Hendrick

Xiaoyue Zhao, a mechanical engineering doctoral student, envisions a future where small and portable electronics can be powered simply by the act of walking.

"By using the triboelectric effect, we could potentially put materials in our shoes or clothes that are able to generate electricity for electronics," she said.

Usually in engineering, triboelectricity is seen as a harmful side effect that needs to be negated within the design of a system.

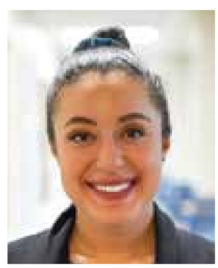
"But instead, our lab views this as energy that is being wasted," she said. "What if we can harness this existing energy that we already create to solve problems we have in society?"

The emergence of triboelectricity is highly dependent on the properties of the materials at play. Working within the Convergence Center for Living Multifunctional Material Systems, Zhao was able to explore this by drawing upon the expertise of not only the University, but also the center's partner, the University of Freiburg.

"Using triboelectricity would be environmentally friendly and sustainable," she said. "We can find ways to harvest so much more energy that doesn't come from fossil fuels and could potentially impact our daily lives." ■

From the human body to the human mind

by Miranda Buckheit



Noriana Radwan, a former kinesiology student and division one soccer player, knew that she wanted to help others reach peak athletic performance with her degree—or so she thought. Now, Radwan studies industrial engineering and conducts research on teamwork and cognitive styles.

Radwan, a doctoral student in the Harold and Inge Marcus Department of Industrial and Manufacturing Engineering, currently works within the Technology and Human Research in Engineering Design (THRED) Group, a team within the School of Engineering Design, Technology, and Professional Programs.

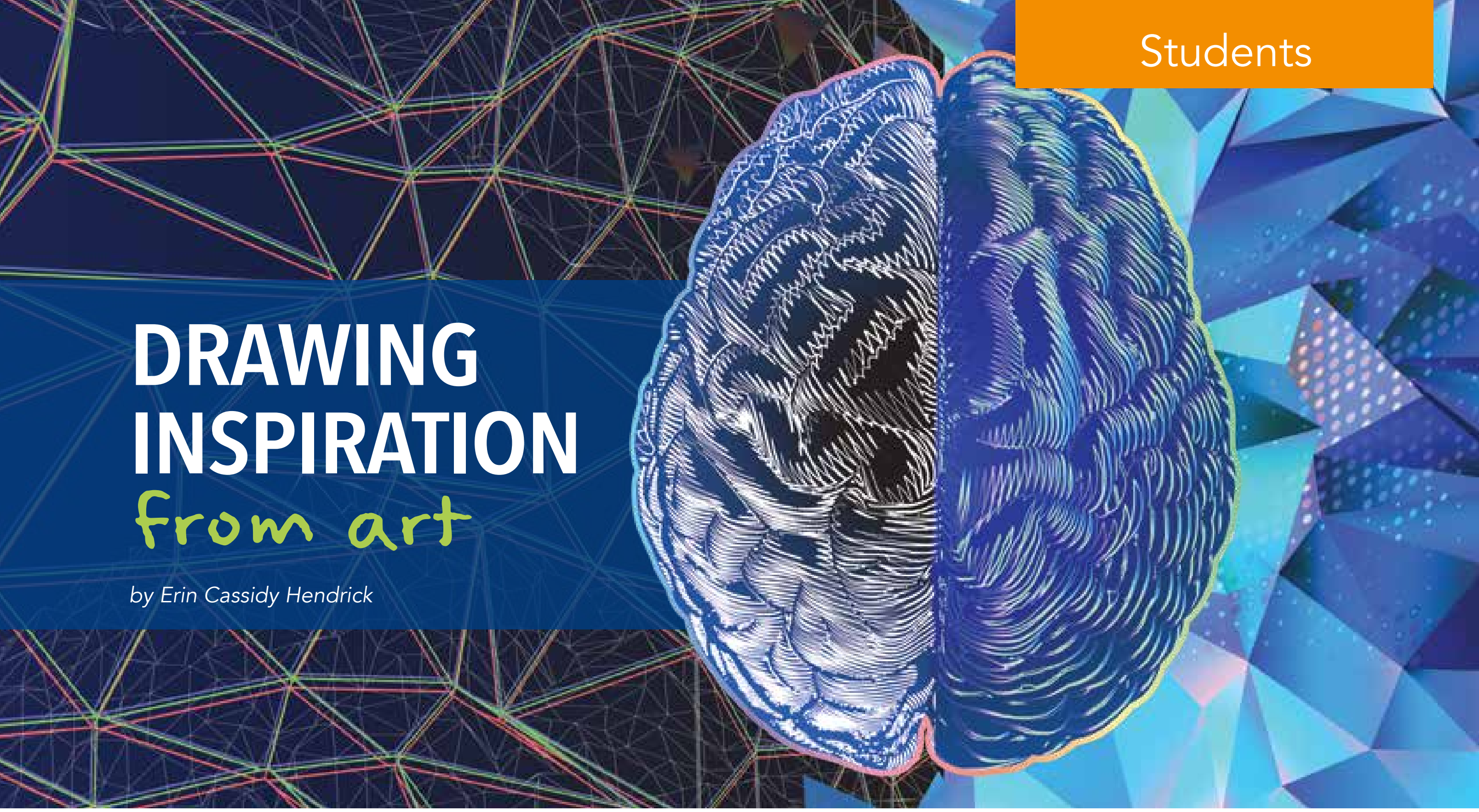
Under the mentorship of THRED Group Director and Assistant Professor **Christopher McComb**, Radwan's research explores human factors, rather than the human body that Radwan had studied for many years.

"It's been amazing to pursue something that I have never done before—it's come with its challenges, but I wouldn't have it any other way," Radwan said. "If you put your mind to it, you can do it."

The goal of Radwan's current project with McComb is to measure a person's preferred way of problem solving.

"I think that my life has been a constant learning experience," Radwan said. "I never saw myself as an engineer, but this has been a super rewarding experience from top to bottom. I look forward to my future as a researcher and engineer and I am thankful for the life I have been able to build for myself outside of my studies." ■

"I never saw myself as an engineer, but this has been a super rewarding experience from top to bottom."



DRAWING INSPIRATION from art

by Erin Cassidy Hendrick

As a discipline, engineering often challenges students to fuse technical skills with creative design. During the fall semester, a College of Engineering senior capstone design group took this notion one step further through a collaboration with Bonnie Collura, professor of art and sculpture in the School of Visual Arts.

With Collura's guidance, their final project was able to successfully assist their sponsor, the Penn State Center for Biodevices, in its COVID-19-focused research.

According to **Mary Frecker**, professor of mechanical engineering and biomedical engineering and the director of the Center for Biodevices, surgeons are in need of extra protection when performing endoscopic skull surgery.

"During these surgeries, clinicians may be exposed to aerosol droplets from the mouth and nose of patients that have COVID-19 or other infectious respiratory conditions," Frecker said. "Since patients aren't able to wear face masks during surgery, we are exploring the design of protective nasal coverings with unique geometries to seal a patient's nose."

As part of the University's response to the COVID-19 pandemic, researchers constructed a chamber where masks and various filtration materials could be tested for efficiency. However, for the nasal coverings, the team needed a specially shaped mannequin-like structure, mimicking a person's face.

> "As engineers, we want to make the best and most user-friendly products, and that can often mean getting advice from unlikely sources."

That's where the senior capstone group, comprised of undergraduate engineering students **Kristen Quasey**, **Kevin Litzinger**, **Alexandra Ferri**, **Zachary Ebert**, and **Justin DePhillipo**, came in. Their task was to design and fabricate the "face" of the testing chamber, allowing researchers to optimize and test their coverings.

In their rapid prototyping phase, the team ran into challenges while finding the right material. They consulted with **Zoubeida Ounaies**, professor of mechanical engineering and the course instructor, who connected the students with Collura.

The team eventually settled on a 3D-printed "nose" and a larger "face" traditionally casted in silicone, which they determined could reasonably recreate the texture of a person's skin and fit other needed parameters.

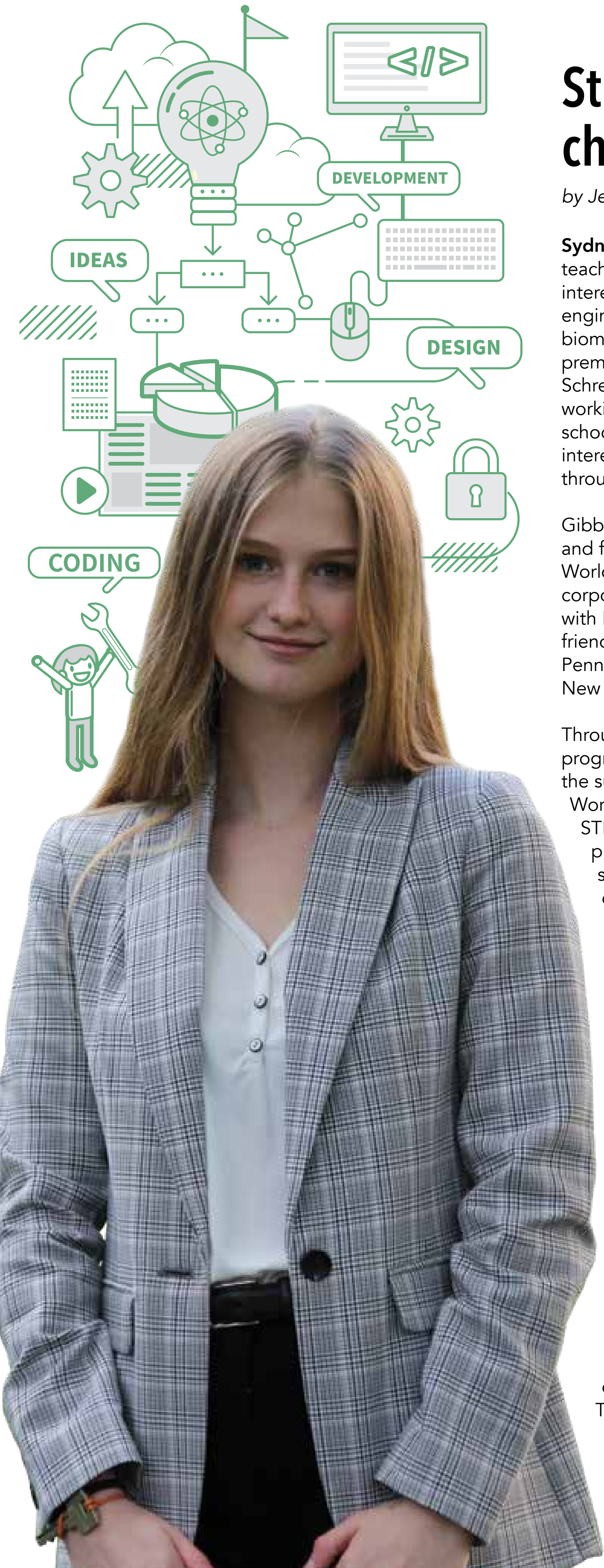
By December, the team delivered testing fixtures that are now being used by the Center for Biodevices.

While the end result was a biomedical testing product, the students described Collura's materials expertise and perspective as an artist as transformational.

"I see a lot of similarities between art and engineering. You can be really creative, which isn't talked about as much in engineering," Litzinger said. "People only think about dealing with math and physics."

While this collaboration was not planned, the students said they believe it enhanced the final product and enriched their perspectives as engineers.

"I'd love to see more silos broken down between disciplines like we've done in this project," Ferri said. "As engineers, we want to make the best and most user-friendly products, and that can often mean getting advice from unlikely sources." ■



Student's nonprofit nurtures childrens' interest in STEM

by Jeff Rice

Sydney Gibbard's parents and teachers helped encourage her interest in science, technology, engineering, and math. The biomedical engineering and premedicine student and Schreyer Honors Scholar is now working to help elementary school students develop similar interests and maintain them throughout their lives.

Gibbard is the co-president and founder of Girls Code the World, the domestic nonprofit corporation she created in 2018 with Mina Shokoufandeh, her friend and classmate at The Pennington School in Pennington, New Jersey.

Through in-person and virtual programs, usually held during the summer, Girls Code the World creates specialized STEM curriculums and lesson plans that are designed to supplement their regular classwork. Activities have included coding, constructing walking robots, the study of terrariums, team projects, and guest speakers. Girls Code the World has worked with more than 50 girls at seven schools and has a particular interest in working with low-income and underrepresented communities.

Girls Code the World mostly works with girls in grades 3-5. Gibbard said that data has shown that middle school is when many girls begin to lose interest in STEM classes or confidence in their abilities. The programs are designed to establish that confidence before the students reach middle school.

"They're getting them at that right age, where they can say 'These are the opportunities that are out there. This is what you can do with this. This is where you can go. These are role models and examples you can learn from who have actually gone there and apply it in your everyday life,'" said Kristen Aballa, a Penn State alumna and teacher at the Christina Seix Academy in Trenton, New Jersey, where Gibbard and Shokoufandeh have worked with her class for the last three years.

Girls Code the World also includes the Aspire Mentoring Program, which matches young students with mentors in high school or college or professionals.

Gibbard and Shokoufandeh have been able to use the Penn State network to help expand the program, including assistance from **Jessica Menold**, assistant professor of engineering design and mechanical engineering, who has advised them on applying for grants.

The next step for Girls Code the World is encouraging high school students to take the organization's curriculum into their own communities and broaden the reach of the programs.

"We are providing high school girls with an opportunity to showcase leadership, and to share their skills with younger girls, and it's something they can put on their résumés," Gibbard said. ■

Innovating the human experience

by Miranda Buckheit

Jessica M. González-Vargas and **Zheng Ma**, industrial engineering doctoral candidates, each received best paper awards from the Human Factors and Ergonomics Society's Training Technical Group (TTG) and Surface Transportation Technical Group (STTG), respectively, for their work to improve various technical aspects within the field of human factors.

González-Vargas is advised by **Scarlett Miller**, associate professor of engineering design and industrial engineering and director of the School of Engineering Design, Technology, and Professional Programs' engineering design program. Ma is advised by **Yiqi Zhang**, assistant professor of industrial and manufacturing engineering.

González-Vargas' winning paper rose from her work with Miller via a study conducted with medical experts to improve their current Dynamic Haptic Robotic Trainer system.

Ma's winning work focused on the impact of a driver's driving style and an autonomous vehicle's (AV) operation on the driver's trust, acceptance, and takeover behaviors in normal and hazardous scenarios when riding in a fully AV. ■

Architectural engineering student selected for ASTM International program

by Tessa M. Pick

Tyler Demyan, fifth-year student in the integrated architectural engineering bachelor's and master's program, was selected to participate in the American Society for Testing and Materials (ASTM) International Emerging Professionals Program. He is the first Penn State student chosen for the program since it launched in 2015.

The purpose of this program is to give new members of ASTM International the opportunity to network with long-term ASTM members and industry partners. Program participants also learn more about ASTM International with the goal of becoming more effective members of the society and potential leaders of ASTM committees and industry. ■

Penn State Society of Women Engineers wins national award

The Penn State Society of Women Engineers (SWE) received the 2020 Outstanding Collegiate Section (OCS) Gold Mission Award for the seventh consecutive year at the virtual WE20 National Conference. This award is the highest possible collegiate recognition within the national SWE.

According to the SWE website, the OCS Gold Mission Award is awarded to SWE chapters that have contributed to SWE, the engineering community, and their campuses. Penn State SWE has taken home this award for the past seven years because of its work in professional development, advocacy, diversity, and inclusion—a representation of SWE's national motto, "Advance, Aspire, and Achieve."

Engineering student chapter recognized for member dedication

The Penn State student chapter of the Institute for Operations Research and the Management Sciences (INFORMS) has been recognized with the organization's second-highest student honor: the Magna Cum Laude award.

Active student chapters are required to turn in an INFORMS Annual Student Chapter Activity Report every year. In this report, students document their activities, such as communications, special events, initiatives, community service, and group operations.

Submissions are rated based on overall impact and reach and awards are given based on four classifications at the annual INFORMS meeting: Summa Cum Laude, Magna Cum Laude, Cum Laude, and honorable mention.

Introducing the inaugural 40 Under 40 Alumni Award cohort

The College of Engineering has selected the first cohort of honorees as part of its new 40 Under 40 Alumni Award program, which recognizes graduates who are 40 years old or younger for their early career impact. In subsequent years, the number of honorees in the program at any one time will grow to 40.

"This newly established award recognizes some the college's most influential alumni who have made great strides in their careers, communities, and at Penn State," said **Justin Schwartz**, Harold and Inge Marcus Dean of Engineering. "These young alumni inspire future engineers and serve as powerful role models for our students."

The following 22 engineering alumni were selected for the 2021 cohort of honorees based on their representation of Penn State's core values: integrity, respect, responsibility, discovery, excellence, and community; their commitment to maintaining a lifelong relationship with the college; and their success in professional experience, leadership, and community service.

Benjamin Cooper
Bioengineering ('07)
Assistant Professor, Medical Student Clerkship Director, Director of Proton Therapy, and Department Operations Faculty Representative at NYU Langone Health, Department of Radiation Oncology

Michael Hargather
Mechanical Engineering ('04, '08 Ph.D.)
Associate Professor of Mechanical Engineering and Dean's Research Scholar at New Mexico Tech, Research Scientist, Energetic Materials Research and Testing Center

Kevin Irick
Computer Science and Engineering ('06 M.S., '09 Ph.D.)
Founder and CEO of SiliconScapes LLC

Jeffrey Kutz
Mechanical Engineering ('05)
Vice President, Global Engineering Operations at Bridge Gap Engineering LLC

Paul Lynch
Industrial Engineering ('04, '07 M.S., '11 Ph.D.)
Associate Professor of Industrial Engineering at Penn State Behrend

Matthew Malone
Mechanical Engineering ('08)
Vice President of Operations at Barber-Nichols

Lourdes Medina
Industrial Engineering ('09 M.S., '12 Ph.D.)
Assistant Professor of Industrial Engineering at University of Puerto Rico at Mayagüez

Natalie Miller
Architectural Engineering ('09 B.A.E/M.A.E.)
Senior Project Manager at Davis Construction

Gopal Nadadur
Mechanical Engineering ('10 M.S., '12 Ph.D.)
Associate Director, Vaccines, Non-Communicable Diseases, and Solar Power for Health at Clinton Health Access Initiative

Benjamin Ross
Engineering Science ('06, '07 M.S.)
Founder and Chief Technology Officer at POWR.io

Jason Ryan
Engineering Science ('06 M.S.), Materials Science and Engineering ('10 Ph.D.)
Project Leader, Magnetic Resonance Spectroscopy at the National Institute of Standards and Technology

Robert Salko
Mechanical Engineering and Nuclear Engineering ('06), Nuclear Engineering ('10 M.S., '12 Ph.D.)
Staff Research Scientist at Oak Ridge National Laboratory

Brodie Schultz
Mechanical Engineering ('15), M.B.A. ('17)
Lead Launch Engineer at Ford Motor Company

Guneet Sethi
Engineering Science and Mechanics ('04 M.S., '08 Ph.D.)
Senior Manager, Hardware Reliability Engineering at Amazon

Jill Seubert
Aerospace Engineering ('05)
Navigation Engineer IV at NASA's Jet Propulsion Laboratory

Joseph Sinclair
Mechanical Engineering and Nuclear Engineering ('15) and Additive Manufacturing and Design ('18 M.Eng.)
Founder of Verde Mantis, LP

Josh Sorkin
Industrial Engineering ('05)
Vice President, Solutions at Science Applications International Corporation

Umamahesh Srinivas
Electrical Engineering ('09 M.S., '13 Ph.D.)
Senior Scientist at Apple Inc.

Paul Suhey
Chemical Engineering ('14)
Co-founder and Chief Operating Officer at Revel

Kate Tice
Industrial Engineering ('12)
Senior Program Reliability Engineer at SpaceX

John Waldeisen
Engineering Science ('07)
Entrepreneur

Xiaolong "Tom" Zhang
Biomedical Engineering ('15 Ph.D.)
U.S. Head of Bioanalysis and Senior Director of Large Molecule at WuXi AppTec

Rear Admiral Blake Converse delivers remarks to sailors assigned to the Los Angeles-class fast attack submarine USS Oklahoma City (SSN 723) after presenting the Battle "E" Award on the pier at Apra Harbor, Guam, on Feb. 7, 2020. IMAGE: U.S. NAVY/ MASS COMMUNICATION SPECIALIST 2ND CLASS KELSEY J. HOCKENBERGER

Penn State education sets course for Navy rear admiral

by Erin Cassidy Hendrick

As commander of the submarine force of the U.S Navy's Pacific Fleet, Rear Admiral **Blake Converse**, 1987 mechanical engineering (ME) alumnus, understands the importance of creative problem solving and effective leadership.

"The work ethic I learned at Penn State taught me how to succeed—I learned to work hard, keep your nose to the grindstone, and never give up," he said.

Converse is responsible for the Navy's undersea forces in the Pacific, comprised of over 45 ships and submarines, 11,500 sailors and civilians, and a range of nuclear-powered fast attack, guided missile and ballistic missile submarines. It also includes five acoustic surveillance ships, two submarine maintenance and logistics support ships, an undersea rescue command, and the global undersea surveillance system.

He has earned several honors, including the Defense Superior Service and four Meritorious Service Medals and the Rear Admiral Jack N. Darby Award for Inspirational Leadership and Excellence of Command.

Converse credits his strong technical foundation to the rigorous ME program at Penn State.

"When you jump into a career driving submarines and operating nuclear propulsion plants, your credibility as a leader is grounded in your engineering competence and your ability to learn and apply scientific concepts to a broad range of new systems," he said. "Penn State taught me those skills." ■

$2 million estate gift to create faculty chair in aerospace engineering

by Mariah Chuprinski

Robert "Bob" Lengel, a 1968 aerospace engineering alumnus, and his wife, Sandy, have committed approximately $2 million of their estate to establish an endowed department chair to be known as the Dr. Robert H. and Sandra K. Lengel Chair in Aerospace Engineering.

But more than giving monetarily, Bob hopes to introduce to stakeholders in the College of Engineering what he terms the "front porch initiative"—a communication and leadership concept he developed throughout his career. The metaphorical front porch provides a framework in which corporate leaders can converse about hard topics in a welcoming space.

"It is our hope that this gift can allow a new faculty member to develop their own front porch and to pass down communication and collaboration skills to their engineering students," Bob said. ■

Chemical engineering alumna named Woman of the Year in Engineering

by Tessa M. Pick

Chemical engineering and Schreyer Scholar alumna **Paula Garcia Todd** has been named Woman of the Year in Engineering by Women in Technology.

"I'm deeply passionate about introducing STEAM to students, especially underrepresented populations in STEAM, and serving as a role model to children who didn't grow up with an understanding of the importance and everyday applicability of STEAM," Garcia Todd said.

She has worked to promote STEAM educational tools in K-12 classrooms and has become an engineering role model in her community. ■

[FROM YOUR PRESIDENT]

Adapting to 'virtual' as a new reality

It has been a little over one year since the world had to adapt to new ways of living, working, meeting, learning, and socializing—all of which were initiated by the COVID-19 pandemic. At first, accepting these changes was far from normal for most of us, and for many, we still may not prefer or like many of the changes that were forced upon us. As engineers though, we are skilled at adapting to new ways and new environments, sometimes proving that there may be better, or more efficient ways of doing things, even when our resilience is tested over and over again.

Our Penn State Engineering Alumni Society (PSEAS) board and committees had to adapt to the new reality of a virtual world in order to keep our mission moving forward, to continue to engage alumni, and to foster interaction among alumni, students, faculty, and industry. As the oldest alumni society at Penn State (founded in 1959), some may think change could be hard, but I am proud to say that we, and the college, haven't missed a beat. Like many of you reading this, we decided to enhance the way we interact and communicate rather than waiting for "normal" to return. Surely, we would all rather be engaging with people on campus and in person, but our new virtual way of doing some of our meetings and programs may be here to stay. Let me share some of our successes.

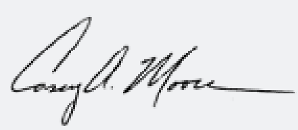
PSEAS board meetings, held three times per year on the University Park campus, quickly became Zoom meetings, which provided some board members to be fully involved and engaged in a virtual environment who otherwise have a hard time traveling to campus because of their job, location, or family situation. Going forward, we plan to use a hybrid of in-person and virtual options for our board meetings to boost the chances that everyone can participate as fully as possible, thus even encouraging alumni who live further away from State College, or even out of the country, to volunteer for the college or serve on the board or a committee.

Conservatively, we tallied over 50 planned, virtual events in 10 months in which more than 1,000 College of Engineering alumni were engaged. We likely had more interactions with alumni, and did more virtually in less than a year, than we may have ever imagined prior to this time.

While we all look forward to being able to reconnect with fellow alums, friends, and distant family in person again soon, virtual communication technology has been a gamechanger in opening up a new reality for engaging with one another.

Stay in touch with PSEAS on LinkedIn. If you are interested in becoming more involved with PSEAS, email us at alumni@engr.psu.edu and join us as we work together to help engineer solutions and build a better tomorrow.

For the Glory,



Casey A. Moore, P.E., '89 CE
President, Penn State Engineering Alumni Society
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THE PENN STATE ENGINEERING ALUMNI SOCIETY

Building an active, engaged community of engineering alumni since 1959

The alumni society provides:

- Membership in a worldwide network of 100,000 engineering alumni.
- Fellowship among engineering alumni, faculty, staff, and students.
- Volunteer and service opportunities on campus and in your own community.

We want to hear from you! **Visit PSEAS** on the web to submit your latest news and to learn more about becoming a member.

FOR MORE INFORMATION, CONTACT:

Events and Volunteer Engagement
101 Hammond, University Park, PA 16802
alumni@engr.psu.edu

PennState
College of Engineering

The Pennsylvania State University
101 Hammond Building
University Park, PA 16802-1400

WE ARE

Celebrating 125 years

The Penn State College of Engineering is commemorating its 125th anniversary throughout 2021. By visiting **raise.psu.edu/ENG125** and making a gift to the College of Engineering General Scholarship, you can help to keep an engineering degree accessible for hard-working students from every background. Those who give $125 this year will receive a commemorative anniversary pin.

Enjoying new flavors

The college's 125th anniversary ice cream flavor, Chocolate E-Chip, is now available for purchase at the Penn State Berkey Creamery or online at **creamery.psu.edu/e-chip**. Last fall, engineering community members suggested hundreds of possible names for the Creamery's temporarily renamed Scholar's Chip flavor, with Chocolate E-Chip winning out in a final student vote.

Helping you to define your legacy

When you include a gift to the College of Engineering in your will or other estate plans, you create opportunities for generations of engineering students, faculty, and alumni. Define your enduring legacy on our campus, create a brighter future for our college, and ensure your estate and your heirs receive the full tax benefits of your gift. To learn more, please contact Penn State's Office of Gift Planning at 888-800-9170 or GiftPlanning@psu.edu, or visit giftplanning.psu.edu.