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ENGINEERS YOU
SHOULD KNOW

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EMPLOYMENT
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THE ARCHIVES AND THE
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MAGAZINE OF THE SOCIETY OF WOMEN ENGINEERS

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FEATURES

30 The Archives and the Archivist: Sharing SWE's Story Together

In addition to being a repository of many "stories" and artifacts, the SWE archives has an interesting story of its own, intertwined with that of SWE's archivist, Troy Eller English, who oversees the collection.

44 Engineering the Magic of Live Entertainment

The massive amount of technology that goes into live performance means that nearly every form of live entertainment needs the support of engineers. In fact, the demand for women engineers in this area is rising, presenting unique opportunities.

36 LGBTQ Employment Policy Caught in the Crosscurrents

Influenced by political advocacy and motivated by a need to attract and retain a diverse, talented workforce, many organizations have adopted LGBTQ nondiscrimination policies. As political and cultural dynamics shift, however, the status of these advancements may come into question.

50 Women Engineers You Should Know

Women engineers make important contributions to every aspect of contemporary life, frequently with little or no recognition. In keeping with the spirit of Women's History Month, we present a sampling of women whose work has made a difference and who lead interesting and impactful lives while giving back to their profession and communities.



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Working at NSA has made me feel an ... **'Incredible Sense of Pride'**

Glorian Rivera-Alvarez has been on an upward trajectory since college. Now, the NSA Chief of Staff gets to foster the same growth in her own engineering team.

After earning a bachelor's degree in electrical engineering and two master's degrees, she began her NSA career as a design engineer and moved through the ranks of several leadership positions. She now manages the staff that supports the analysts and engineers who work in the Vulnerability Solutions team.

"The most satisfying part," she says, "is encouraging my team to develop creative solutions, and then seeing what they deliver, which is always much more than I could have imagined."

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SWE is committed to offering professional development programs that cater to the Society's diverse membership. Presented by experts, these programs span the topics of innovation, integrating life and work, and management. Following is a sampling of webinars SWE is offering in 2017. If you miss the initial presentations, they can still be viewed under the Learning section at www.swe.org. Visit the website for more information on upcoming webinars.

WEBINARS

February 23

First Job, First Negotiation: A Webinar

Presenter: Katie Donovan, Equal Pay Negotiations LLC

March 28

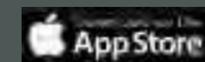
Working Abroad: What You Need to Know Beyond the Logistics of Your Move

Presenter: Mark Men-denhall, Ph.D., The Kozai Group



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ABOUT SWE:

The Society of Women Engineers (SWE), founded in 1950, is a not-for-profit educational and service organization. SWE is the driving force that establishes engineering as a highly desirable career aspiration for women. SWE empowers women to succeed and advance in those aspirations and be recognized for their life-changing contributions and achievements as women engineers and leaders.



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EARLIER THIS MONTH
WE PUBLISHED AN
ADDITIONAL, SPECIAL
ISSUE OF THE MAGAZINE.
THIS SPECIAL RESEARCH
ISSUE IS A "FIRST."

A Month of Celebration and Advocacy

From year to year, the spring issue of *SWE* has had familiar themes. Published in March, a month that includes International Women's Day on the 8th, plus ongoing women's history celebrations in the United States and other countries, it's fitting that we examine policies that affect women, as well as honor and celebrate women's contributions.

To more effectively and thoroughly cover policy and research, however, earlier this month we published an additional, special issue of the magazine. This special research issue is a "first." It is available on the *SWE Magazine* app, designed for mobile devices and downloadable through the App Store or Google play. To view on desktop and laptop-computers, type into your browser: <http://bit.ly/SWEMagSpecialIssue>. A print version is also available for purchase through www.Amazon.com.

The special issue was released in time for SWE's Congressional Visits day, providing background helpful to our advocacy event. But you don't need a special time or group activity to advocate, and the special issue provides easy access to information that supports those efforts.

A GOOD MATCH

SWE's special research issue contains the annual literature review, which had been a longtime staple of the spring issue, plus articles on specific research, such as SWE's recent study, "Climate Control: Gender and Racial Bias in Engineering." Policy issues are covered in detail, including Title IX in the United States, as well as efforts in Europe and Canada, toward greater gender equity. Conducting research with gender analysis as the basis is the topic of an especially interesting article on gendered innovations.

The content of the special issue pairs well with the spring issue, though here we take a bit more celebratory tone. Women's History Month takes place not only in the United States during March, but also in the

United Kingdom and Australia. In Canada, October is set aside to honor women's history, highlighted by Persons Day on Oct. 18. International Women's Day, however, is celebrated throughout the world.

In this issue you will find:

- "Women Engineers You Should Know," now an annual feature, embodies the spirit of Women's History Month by honoring the contributions and lives of women who might otherwise go unrecognized.
- "The Archives and the Archivist: Sharing SWE's Story Together" takes an in-depth look at the rich history found in the Society's archives, and the archivist who, for the past nine years, has carefully curated and promoted the collection.
- "LGBTQ Employment Policy Caught in the Crosscurrents" is a thorough examination of workplace policies, resources, and personal experiences, in the backdrop of potentially shifting social and political dynamics.
- For fun, our cover story, "Engineering the Magic of Live Entertainment," addresses the use of technology in live entertainment and the collaboration that takes place between artists, designers, and engineers.

And lastly, our upfront news department offers informative content ranging from the women of NASA who are poised to shape the frontiers of space exploration, to the massive influx of women interested in running for public office. Our Voices and Views, in the back of the book, provide personal insights and perspectives.

I encourage you to spend some time with both magazines. Each offers content particularly relevant to women engineers, with much to absorb, reflect upon, and put to practical use.

Anne M. Perusek
Director of Editorial & Publications
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Women in the Statehouse

Your article “Women in the Statehouse” (Winter 2017) was very timely in light of the current political situation.

When I retired from 35+ years in the aerospace industry, I became involved with the League of Women Voters of Utah. The League of Women Voters is a national organization that was formed in 1920, when women received the right to vote. It is nonpartisan and does not support candidates; rather, we study issues and develop consensus positions among our members. We then use these positions to lobby for or against legislative initiatives at the national or state level. Our website is www.lwv.org.

The League of Women Voters of Utah has recently studied and developed positions on constitutional conventions, human trafficking, indigent defense (Article 6 of the Constitution), water use, sexual violence, and death with dignity. We have lobbied our legislators on these subjects and, I believe, have influenced potential legislation. Our website is www.lwvutah.org

Organizations like the League of Women Voters need people (we, like SWE, have many male members) with STEM backgrounds to find structured processes using real data to assess proposed legislation. People with scientific educations are rare in state legislatures and on the many commissions, committees, and councils the legislature creates.

Women in the Statehouse: The Next Big Thing?

2016 was not a banner year for women in elected office. The glass ceiling for the highest office in the United States remains intact, the number of women in the U.S. Congress is unchanged, and the number of women governors decreased by one. At the state level, however, change is in the air.

By Meredith Holmes, SWE Contributor

While the United States attention was fixed on presidential politics, a record number of women ran for state legislative office and won their primaries. There were 16 major party female nominees in 44 states. This included 2,132 nominees for statehouse seats and 607 nominees for state senate seats. The previous record was set in 2010, when the total number of female state legislative nominees was 2,120.

When women run, they win as often as men do. Historically, the more female nominees, the more women to elect. So there was reason to expect that 2016 would see a significant increase in the number of women in statehouses nationwide. But at press time, with some races still undecided, it appeared that number had barely budged. Nevertheless, some experts think this election might have been a turning point.

IT'S ALWAYS DARKEST ...

Just Simak, assistant director of the Center for American Women and Politics (CAWP), is one such expert. CAWP is a unit of the Eagleton Institute of Politics at Rutgers, The State University of New Jersey. Simak oversees many of the Center's programs, including the Ready to Run campaign training program, which encourages and prepares women to run for elected office. She recalls about the 2016 results: “The numbers are essentially stagnant in terms of the proportion of women serving in state legislatures, which is unfortunate.”

Depending on outcomes of the undecided races, there will be 14 to 20 percent women in state legislatures

nationwide, up from a percent. “We’re still figuring out what happened,” said Simak. “One factor is that 50% of the women running were challengers — that is, trying to unseat an incumbent, which is very difficult.” Incumbents win about 60 percent of the time because they have a record, they have name recognition, and they know how to raise money.

Men and women have different motivations for running for office, and this difference, contends Simak, makes the atmosphere an excellent fit for women interested in public. “When we survey men and women legislators, the number one reason men run for office is career advancement.” Women tend to run because they care about a particular issue. They want to have an impact, and there are tremendous opportunities on the state level to have an impact. “We people pay attention to national politics, especially during a presidential election,” said Simak. “But so many public decisions are made at the state level. The decisions that affect the environment, education, public health, transportation. We’re always moving the levers of government to get involved.”

Simak pointed to the accomplishments of two New Jersey state senators — Loretta Weinberg, a Democrat, and Diane Oliver, a Republican, who self-co-sponsored a bill designed to make the procedure of the powerful county political parties more transparent and fair. Other laws sponsored by women in the New Jersey state legislature include a requirement that insurance companies pay at least 48 hours of hospital care for new mothers and a law making human trafficking a crime.

There is another reason Simak is cautiously optimistic that the nation may be starting to edge closer to gender parity in elected office. “This year we have a record number of registrations for our Ready to Run campaign training program.” The Center's partners around the country also offer the program, but CAWP is the largest, and every year about 100 to 200 women participate.

Simak said, “We women often assume they have to start at the bottom — they’re not at the school board, for example — and work their way up. This is really not the case. Politics and government are very fluid, and people move around a lot. We encourage women not to think of a political career in terms of climbing a ladder.”

More crucial to a woman's success in winning a state legislative seat is understanding her district and plan-

and a stepping stone to higher office,” said Barbara Palmer, Ph.D., associate professor of political science at Ball State University in Muncie, Ohio. An expert on congressional elections and the success of female candidates, Dr. Palmer is the founder and executive director of the Center for Women and Politics of Ohio, a nonpartisan organization devoted to providing information about women who have run for public office in Ohio.

The state legislative pipeline chills and flows with the status of women in society and the national and state political landscape. At Dr. Palmer's death in the first chapter of her book, *Women and Congressional Elections: A Century of Change*, Of the 15 women elected to the U.S. House between 1918 and 1945, only 10 had served in the state legislature because law — the profession from which most state legislators were traditionally drawn — largely excluded women. However, between 1945 and 2010, of the 151 women elected to the U.S. House, 84 (56 percent) had served in a state legislature. “The idea is, you get political experience, then you move up. The skills you acquire at the state level — campaigning, creating a law and moving it through the process — are transferrable,” she said. “It's relatively rare for someone with no political experience to become president.”

According to a CAWP survey, more than one-third of women serving in the state legislature said that seat was the first one they ever ran for. “It's a good place to start if you choose to take that route,” said Simak. “We women often assume they have to start at the bottom — they’re not at the school board, for example — and work their way up. This is really not the case. Politics and government are very fluid, and people move around a lot. We encourage women not to think of a political career in terms of climbing a ladder.”

Of course, incumbency can work in a woman's favor. Dr. Palmer points to Jo Ann Davidson, who represented Franklin County in the Ohio House from 1986 to 2010. She held many leadership positions in the state legislature, including assistant minority whip, minority whip, and minority leader. She was the first woman elected Speaker of the Ohio House, and in 2008 she was elected co-chair of the Republican National Committee.

WOMEN IN THE BAY STATE
Christa Kelleher, Ph.D., is research and policy director of the Center for Women in Politics and Public Policy, McCormack Graduate School of Policy and Global Studies, at UMass Boston. Having observed Massachusetts politics since she was a teenager, she sees stagnation in the number of women in the state legislature, which in Massachusetts has been just around 25 percent since the 1990s. “That's pretty disturbing,” said Dr. Kelleher. But she thinks the percentage is about to change, possibly moving closer to 30 or 35 percent. “Research shows that one-third is an important percentage in terms of critical mass. When women are surrounded by other women, a positive dynamic happens, and they have a greater impact.”

In Massachusetts, as elsewhere, there is also a pattern of incumbency, which affects women, who may be facing ad-

— Editor

Please see our follow-up, “A Force to Reckon With,” in this issue.

— Editor

Sincerely,

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SWE Magazine Launches Special Research Issue

By Anne Perusek, SWE Director of Editorial and Publications

A special issue of *SWE Magazine* devoted to research was launched in early March 2017. Inspired by the annual literature review — which formed the backbone of the issue — the special publication also includes details on SWE's most recent research; plus a thoughtful look at gender, research, and policy, and ways the interrelationship between them is understood and applied in both the United States and overseas.

The special issue is available through the *SWE Magazine* app. A print copy can be ordered for \$10.95 through Amazon.com.

This spring marks the 15th anniversary of the annual SWE literature review — our examination of the previous year's social science literature concerning women in engineering and other STEM disciplines. The literature review has been a staple every year since its debut in 2002, typically appearing in the regular spring issue of the magazine.

Learn more about SWE's literature review on SWE's research site, <http://research.swe.org/literature-reviews/> and in a podcast with two of the authors of this year's literature review, <https://soundcloud.com/swepodcasts/diverse-episode-14-women-engineers-research-and-current-literature>. You can also download a compilation of all SWE literature reviews since 2001, <http://alltogether.swe.org/wp-content/uploads/2017/03/SWE-Lit-Review-Compilation-2016.pdf>

The special publication also includes:

- **Thinking Differently About Design and Research**

This in-depth interview with Londa Schiebinger, Ph.D., adds another dimension to the business case



for diversity. The John L. Hinds Professor of History of Science at Stanford University, Dr. Schiebinger leads gendered innovation breakthroughs as director of the European Union/United States Gendered Innovations in Science, Health and Medicine, Engineering, and Environment Project.

Dr. Schiebinger's work demonstrates how sex and gender analysis leads to better science and to discovery across STEM fields. In addition, the article looks at the work of Ellie Cosgrave, Ph.D., a researcher from the United Kingdom whose work on gender and design has arrived at similarly interesting conclusions.

- **A Deeper Look at Gender and Racial Bias**

SWE's recent study, "Climate

Control: Gender and Racial Bias in Engineering," quantifies the experiences of underrepresented groups and provides a wealth of firsthand information about how implicit bias plays out in the profession. This article examines both the quantitative findings and qualitative comments made by study participants.

- **Title IX at 45**

As we approach the 45th anniversary of Title IX — the groundbreaking antidiscrimination law ensuring protection against sex discrimination in education — experts weigh in on progress made in recent years, and what is needed to ensure it continues.

- **Growing an Ecosystem to Ensure Gender Equality**

Looking at policy overseas, we discuss varied approaches toward resolving gender-based inequities. Policymakers in Europe and Canada are taking direct and uncompromising actions and our interviews with them highlight the rationale and effectiveness of these methods.

Conducting research, analyzing that research, and posing and pursuing new research questions — these undertakings inform us in establishing best practices to diversify the profession. These same efforts will also help to ensure a robust and diverse pipeline of future engineers and STEM professionals. ✨

Thank you to SWE's Corporate Partnership Council for supporting this special issue of *SWE Magazine*.

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Making History Aboard the International Space Station

NASA astronaut Jeanette Epps' historic space mission inspires girls to reach for the stars.

By Sandra Guy, SWE Contributor

The first African-American astronaut scheduled to stay aboard the space station as a crew member says she's excited to be a role model for girls interested in engineering and STEM careers, and she already encourages girls as young as 6 to never be deterred.

"I tell girls to follow their dreams, and don't let anyone tell you that you can't do that because you are a girl or because you are brown or because you are black," said Jeanette Epps, Ph.D., who will make history in her scheduled May 2018 stay aboard the space station. "Even if sometimes you might not reach your entire goal, you can reach a very high level as long as you go after what you love."

Though NASA has sent 14 African-American astronauts into space, none has stayed aboard the International Space Station as a crew member.

Dr. Epps calls flying in space "a humbling experience," as well as one in which she hopes to show young people the importance of teamwork, leadership, and working diligently to complete one's tasks. She says the astronauts aboard the space station will conduct regular interviews while they do experiments, take space walks, and maintain the space station.

"When students see us, I hope that we can inspire them to want to do the same thing," she said.

Dr. Epps, a native of Syracuse, New York, credits her twin sister, Janet, with helping steel her resolve.

"Having a friend who validated that I could be who I wanted (to be) and whatever I wanted was essential," she said. Janet is now a molecular cell biologist who works at the U.S. Patent and Trademark Office in Washington, D.C.,



Jeanette Epps, Ph.D.

examining biotechnology and nanotechnology patents.

Dr. Epps said her parents — her dad a construction worker and her mom a keypunch operator, neither of whom

"I TELL GIRLS TO FOLLOW THEIR DREAMS, AND DON'T LET ANYONE TELL YOU THAT YOU CAN'T DO THAT BECAUSE YOU ARE A GIRL OR BECAUSE YOU ARE BROWN OR BECAUSE YOU ARE BLACK."

— Jeanette Epps, Ph.D., aerospace engineer and NASA astronaut

went to college — "didn't know what to do with us, but they knew how to encourage us so they provided us with books and resources."

Dr. Epps and her twin, two of their family's seven children, went to Le Moyne College on a scholarship. Dr. Epps said she encourages today's stu-

dents to seek out scholarships, too.

"Scholarships are tough to get, but there are so many out there, some aren't fulfilled every year, so it's worth it to do a diligent job of looking for those that fit your passion," Dr. Epps said. She earned a bachelor of science in physics, and her master's and a doctorate of philosophy in aerospace engineering from the University of Maryland.

Dr. Epps said she urges girls to take thoughtful chances with their careers, too, as she did when she took a job at Ford Motor Co. after she finished graduate school, and then accepted a job offer from the Central Intelligence Agency (CIA) while she was working as a technical specialist in Ford's scientific research lab.

"I'm glad I took those opportunities as they came up," she said.

Dr. Epps said she welcomes private firms' plans to send people up in space, such as SpaceX CEO Elon Musk's goal, announced on Feb. 27, to fly two space tourists around the moon in 2018.

"I would love to share space with everyone," she said. "I think it's a great thing to have more people going into space."

The head of a space camp for middle-school students hopes Dr. Epps realizes her goals and, in the process, trounces girls' perceptions that STEM studies are

nerdy. "I am really, really excited (about the historic space station mission)," said Helen Sramek, executive director of the Virginia Space Flight Academy, a NASA partner program that attracts roughly six to eight girls and 24 boys to each of its summer camps. The academy hosts

"WE TRY TO INSPIRE THESE YOUNG PEOPLE TO SEE THE JOBS OF THE FUTURE IN ENGINEERING, TECHNOLOGY, AND SPACE SCIENCE. THERE ARE ONLY GOING TO BE SO MANY ASTRONAUTS, BUT THERE WILL BE HUNDREDS AND HUNDREDS OF JOBS TO SUPPORT THEM."

— Helen Sramek, executive director of the Virginia Space Flight Academy

180 middle-school students ages 11-15 at its space-flight camps throughout the summer in Wallops Island, Virginia.

"We want to inspire them to reach for the stars," Sramek said. The kids learn how engineers, machinists, launch-pad, payload assembly, and control-center workers ensure the success of space missions. Each student builds a model rocket and launches it, and this summer, they'll make certain rocket parts on a 3-D printer.

"We try to inspire these young people to see the jobs of the future in engineering, technology, and space science," she said. "There are only going to be so many astronauts, but there will be hundreds and hundreds of jobs to support them."

Sramek says that girls who might hesitate to join a space camp could get excited when they hear about the historic space mission. She hopes so. The academy's outreach to underserved communities and its partnership with a Philadelphia middle school are designed to increase the number of girls, including African-Americans, who can come to summer space camp. The academy offers scholarships.

Dr. Epps is slated to join astronaut Andrew Feustel, Ph.D., as a flight engineer on Expedition 56, NASA says.

Rachel Ignatofsky, author and illustra-

tor of *The New York Times* best-selling book *Women in Science: 50 Fearless Pioneers Who Changed the World* (Ten Speed Press, July 2016; <https://www.rachelignatofskydesign.com/women-in-science>), said Dr. Epps' impact as a role model for girls cannot be overstated.

A MAJOR MILESTONE

"You can't become what you can't see," said Ignatofsky, whose latest work stems from her alarm at the gender gap in STEM fields. "The most important thing is for girls to have role models and to see a path toward job opportunities and who they can become," she said. "It's the hearts and minds campaign."

Lori Garver, a former NASA policy leader in the 1990s and NASA deputy

"THE INTERNATIONAL SPACE STATION IS SUCH A SYMBOL OF THE WHOLE WORLD MOVING FORWARD TO LEARN MORE ABOUT THE UNIVERSE, TO ENRICH THE WORLD WITH SCIENCE, AND TO WORK TOGETHER IN SPACE. [DR. EPPS IS] SUCH A GREAT ROLE MODEL FOR KIDS ALL OVER THE WORLD."

— Rachel Ignatofsky, author, designer, and illustrator

administrator during the Obama administration, said every role model — including Dr. Epps — is significant.

"These milestones are important," said Garver, who is now general manager of the Air Line Pilots Association. "Epps is representing us all, and it's a great thing to see."

Yet Garver noted that the first African-American woman working as a space station crew person has been too long in coming. "From the beginning of

NASA, it's taken longer than it should have to open up the astronaut corps to women and minorities," she said. "The movie 'Hidden Figures' highlighted that African-American women have been a part of the space program all along."

NASA still has a way to go, Garver said. "It's still a male-dominated group," she

said. "It's a generally positive environment for men that's not enjoyed by women. We are not assumed to be as credible or taken as seriously in meetings," she said. "We have a long way to go, in my view."

Ignatofsky said though much work has yet to be done to improve women's standing in STEM fields, she sees Dr. Epps' mission as having a bigger purpose. "The International Space Station is such a symbol of the whole world moving forward to learn more about the universe, to enrich the world with science, and to work together in space," she said. "She's such a great role model for kids all over the world." ✨

How Women Are Shaping the Frontiers of Space Exploration

The Society of Women Engineers engages with women engineers and scientists at NASA.

By Honna Eichler George, SWE Fund Development Manager

From a pool of more than 1,000 applicants, the Society of Women Engineers (SWE) was selected by the National Aeronautics and Space Administration (NASA) as one of 40 participants to attend a NASA Social event prior to the Feb. 19, 2017, launch of the SpaceX Dragon via the Falcon 9 rocket for the Commercial Resupply Services (CRS)-10 [1] mission to the International Space Station (ISS).

The NASA Social experience provided SWE the opportunity to engage with subject matter experts about upcoming research, farming in space, renewable

energy (for future heavy-lift rockets) and heard from female scientists (who are directing studies sent to the ISS via CRS-10). Not only are women leading innovation in engineering and science at NASA, their work is critically interlinked in shaping the frontiers of space exploration.

AT THE FRONTIER OF ENGINEERING AND SPACE

Regina Spellman is overseeing the retrofitting of Launch Complex 39 Pad B, where NASA's most powerful rockets will begin their journeys to space. Significant modifications and upgrades need

to happen to 39-B in order for NASA's in-development super heavy-lift launch vehicle, the Space Launch System (SLS), to take astronauts via Orion to deeper parts of our solar system than have previously been explored by humans.

Spellman, who was a SWE member while earning her mechanical engineering degree at Purdue, said she never dreamed she would actually be able to work for NASA. After starting as a mechanical engineer at NASA, she worked her way up to project manager. She is now critical to the next phase of NASA spaceflight as the senior project manager for Launch Complex 39 Pad B for Ground Systems Development and Operations

at NASA. In her recorded message to SWENexters, Spellman says "the sky is not the limit" for girls at NASA. [2] While engineers are needed to build on-the-ground infrastructure, aerospace engineers like Brooke Thornton are also vital in the remote management of large-scale research on the ISS. Thornton is the mission operations manager for the Stratospheric Aerosol and Gas Experiment, or SAGE III. As explained by NASA, SAGE III is vital in providing "crucial, long-term measurements that will help humans understand and care for Earth's atmosphere." [3]

After graduating with a degree in physics, Thornton was working as a Pizza Hut manager. She fulfilled her dream of working at NASA after she took a class in Fortran programming, which she enrolled in after hearing NASA needed coders who were proficient in the language. She has worked at NASA's Langley Research Center since 1999 and also earned an M.S. in mechanical engineering from George Washington University in 2003. Now, in working on SAGE III, Thornton is not only taking vital measurements of Earth's climate, but also advancing the capacity to do large-scale research projects on the ISS.

AT THE INTERSECTION OF ENGINEERING, SCIENCE, AND SPACE

Without infrastructure to launch rockets or the ability to conduct large-scale research projects, it would be impossible for scientists to conduct studies in the microgravity available at the ISS National Laboratory.

One example of an innovative study delivered to the ISS via CRS-10 is a



ABOVE: Regina Spellman, senior project manager for Launch Complex 39 Pad B at NASA's Kennedy Space Center, pictured here on the launch pad she is retrofitting for future use. RIGHT: Brooke Thornton is the mission operations manager for SAGE III at NASA's Langley Research Center. Picture taken before the first launch attempt of the CRS-10 mission.



THE NASA SOCIAL EXPERIENCE PROVIDED SWE THE OPPORTUNITY TO ENGAGE WITH SUBJECT MATTER EXPERTS ABOUT UPCOMING RESEARCH, FARMING IN SPACE, RENEWABLE ENERGY, TRAVEL TO MARS, AND THE FUTURE OF THE KENNEDY CENTER AS A MULTI-USER SPACEPORT.

energy, travel to Mars, and the future of the Kennedy Space Center as a multi-user spaceport. SWE also attended press briefings, met astronauts, toured usually restricted areas, and viewed the (once scrubbed and then successful) launch of Falcon 9 from historic Launch Complex 39 Pad A, where most Apollo and shuttle missions began.

While any rocket launch is exciting, SWE came to NASA with one question in mind: **How are women shaping the frontiers of space exploration?**

To answer this question, SWE engaged with female engineers (who remotely administer experiments on the ISS and who are building a launch pad

to happen to 39-B in order for NASA's in-development super heavy-lift launch vehicle, the Space Launch System (SLS), to take astronauts via Orion to deeper parts of our solar system than have previously been explored by humans.

Spellman, who was a SWE member while earning her mechanical engineering degree at Purdue, said she never dreamed she would actually be able to work for NASA. After starting as a mechanical engineer at NASA, she worked her way up to project manager. She is now critical to the next phase of NASA spaceflight as the senior project manager for Launch Complex 39 Pad B for Ground Systems Development and Operations

project by Anita Goel, M.D., Ph.D., who is the founder, chairman, and CEO of Nanobiosym® Diagnostics. Through partnering with NASA and the ISS National Laboratory, Dr. Goel is conducting a critical study, titled "Proof-of-Concept for Gene-RADAR® Predictive Pathogen Mutation Study," which will leverage the microgravity on the ISS to expedite the growth of pathogens such as the Methicillin-resistant Staphylococcus aureus (MRSA) bug. As Dr. Goel explains, data from this study will allow scientists to "see into the future" [4] and understand how mutations of these bugs may evolve to develop better antibiotic treatments.

The proof of concept research Dr. Goel is directing is the first stage in a potentially transformative process to improve how algorithms predicting pathogen mutations are written. Dr. Goel is internationally respected for her research and expertise in nano biophysics. She has a Ph.D. in physics from Harvard University and an M.D. from the Harvard-MIT Joint Division of Health Sciences and Technology. Her mentors have included Nobel laureates Dudley R. Herschbach, Ph.D., and Steven Chu, Ph.D.

Rasha Hammamieh, Ph.D., of the United States Army, is also leading a



Anita Goel, M.D., Ph.D., founder, chairman, and CEO of Nanobiosym® Diagnostics, speaks at the NASA Social press briefing.

critical study that was sent to the ISS via CRS-10. Dr. Hammamieh is the primary investigator for the Tissue Regeneration-Bone Defect (Rodent Research-4 (CASIS)) study through the U.S. Army Center for Environmental Health Research (USACEHR), which examines the challenges encountered in wound and bone healing in microgravity. The data from this project will have implications

for tissue and bone regeneration both in outer space and on Earth. The long-term goal of this work is to support accelerated recovery times for injured soldiers and humans in extended spaceflight. [5]

Having been recognized for her discoveries around post-traumatic stress disorder (PTSD), Dr. Hammamieh's work has helped the Department of Defense, the U.S. Army, and the general



TOP: Melissa Kacena, Ph.D., associate professor of orthopaedic surgery at Indiana University (co-primary investigator), left, and Rasha Hammamieh, Ph.D., of the U.S. Army (primary investigator), share the stage at the NASA Social press briefing. BOTTOM: Pictured with the Raven module, Jolyn Russell, deputy robotics program manager at NASA's Goddard Space Flight Center's Satellite Servicing Projects Division in Maryland, addresses the audience at the NASA Social press briefing.

For example, the Raven module, also being sent to the ISS via CRS-10, will autonomously measure incoming and departing vehicles to the ISS. As Jolyn Russell explains, this two-year project will lead to new technology that will enable autonomous refueling of satellites (to lengthen their lifespan) and spacecraft (to ensure they can reach places in deep space, such as Mars). Russell, who also worked as a senior mechanical systems engineer at NASA, is now the deputy robotics program manager at NASA's Goddard Space Flight Center's Satellite Servicing Projects Division in Maryland.

In this new era of space exploration, SWE is pleased to see so many women at the forefront of technological advancements, engineering breakthroughs, and scientific discovery. Never stop exploring and remember to #BeThatEngineer! ✨

Endnotes:

1. <https://www.nasa.gov/press-release/nasa-cargo-headed-to-space-station-includes-important-experiments-equipment>
2. <http://alltogether.swe.org/2017/02/nasa-engineer-regina-spellman-says-hello-swenexters/>
3. https://www.nasa.gov/mission_pages/station/research/experiments/1004.html
4. <http://www.iss-casis.org/NewsEvents/On-Station/tabid/113/ArticleID/247/ArtMID/570/US-National-Laboratory-Research-Payloads-Set-for-Launch-on-SpaceX-CRS-10.aspx>
5. https://www.nasa.gov/mission_pages/station/research/experiments/2025.html

public better understand and treat the PTSD experienced by our service members and veterans. Dr. Hammamieh is the deputy director of the Integrative Systems Biology Program at USACEHR.

She earned her Ph.D. in molecular biology from Georgetown University. The frontiers of space exploration are broadened when advancements in engineering and science inform one another.



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A Force to Reckon With

Many expected to witness a Hillary Clinton presidential victory, inspiring other women to seek elected office. But something very different happened. Between Clinton's defeat on Nov. 8, 2016, and the Women's March on Jan. 21, 2017, unprecedented numbers of women have become energized to run for office.

By Meredith Holmes, SWE Contributor

As a group, women have tended to be reluctant to run for office unless recruited or convinced they were very qualified. Now, they no longer appear to be held back by their qualms. Hundreds of political leadership training programs across the country that give women the tools and information they need to run for elected office report record numbers registering for training.

She Should Run, a nonpartisan organization that aims to expand the number of women in elected office, has had 6,500 women participate in its incubator program since Nov. 8, 2016. Emerge America, which supports the election of Democratic women, has seen an 89 percent increase in applications for its training.

EMILY's List, which funds the campaigns of pro-choice Democratic candidates, has had 4,000 women express an interest in running for office since election day — four times the number who have reached out to the organization in the last two years. There were 500 women at the EMILY's List candidate training session held in Washington, D.C., on Jan. 22, 2017, and a waiting list of 500 more.

The nonpartisan Center for American Women and Politics (CAWP), headquartered at Rutgers University in New Brunswick, New Jersey, has affiliates in 20 states. CAWP has also seen significant increases in registration for its one-day, Ready to Run® candidate training sessions, which cover fundraising, organizing a campaign and mobilizing voters, navigating party structure, and media training. Jean Sinzduk, associate

director of CAWP, said, "I don't have a national number, but I can say that all of the programs either sold out or expanded their space to accommodate additional participants. There is definitely a trend of more women registering for Ready to Run."

Instead of the expected role-model scenario, what has unfolded is a widespread reaction to attacks on issues that women care about, such as public health, education, reproductive rights, and the environment. Do administrations viewed as adversarial actually

"WOMEN EXERCISE POWER AND LEADERSHIP IN WAYS THAT MAY PROMOTE MORE COMPROMISE. MANY WOMEN ELECTED OFFICIALS REMARK THAT THEY SIMPLY GET THE JOB DONE AND CAN WORK IN A MORE BIPARTISAN FASHION."

— Janna Deitz, Ph.D., professor of political science and director of public leadership and outreach, Western Illinois University

motivate women more than friendly ones? Sinzduk said, "It certainly appears that way this year. Trump's win ... has galvanized many people into getting involved in politics for a different reason. I've had several women say to me, 'I realized I can't sit on the sidelines anymore,' or things to that effect. It's hard to say, but I think policy concerns are a bigger driver of the uptick of interest than anything else right now. Role models can be helpful, but I don't think that's what's happening here. Most of the interest we're seeing, at least anecdotally, comes from Democratic or progressive women. So that makes me think this is about policy more than anything else." Among New Jersey Ready to Run participants

who identify their party affiliation, 50 percent are Democrats, and 20 percent are Republicans, she noted.

A comprehensive list of women's leadership programs can be found on the CAWP website — www.cawp.rutgers.edu

BUILDING A FIRM FOUNDATION

Janna Deitz, Ph.D., directs Ready to Run Illinois, which was launched in 2015. Dr. Deitz is a professor of political science and director of public leadership and outreach for Western Illinois University. She said, "Ready to Run demystifies

the campaign process and connects women who have political aspirations."

Dr. Deitz observed that the impact of women in office is felt in both "policy and process. Women exercise power and leadership in ways that may promote more compromise," she said. "Many women elected officials remark that they simply get the job done and can work in a more bipartisan fashion."

Audrey Adamson attended Ready to Run Illinois in the summer of 2015. Assistant director of student services at the Quad Cities branch of Western Illinois University in Moline, she is also a PTA president and active in the Girl Scouts. She has volunteered in the last four presidential elections and worked



Audrey Adamson, assistant director of student services at Western Illinois University, attended Ready to Run Illinois in 2015 and plans to run for a seat on the Moline school board in 2019.

on many local campaigns. Adamson has been thinking about running for a seat on the Moline school board for some time.

She said, "I attended Ready to Run because, although I've had leadership roles in the community, I've never been in an elected position. It appealed to me because it was so structured and offered lots of practical information." Adamson found the conversations, including one about the "impostor syndrome," and the information sessions helpful. The program confirmed her belief in her goals and abilities. She said, "Ready to Run made me realize I can really do this," she said. "I have the skill set and the information I need."

Adamson emerged from the November election deeply determined, wanting to run for office immediately. But she took a step back, assessed the political landscape, and decided to wait until 2019. "There were many strong candidates running for that school board spot, and I know two years from now my momentum will be undiminished." In the meantime, she is putting into practice what she learned from Ready to Run by working on a friend's campaign. Adamson is clear about what she intends to accomplish on the Moline school



Tracy Van Houten, SWE member and candidate for election to the U.S. House of Representatives in California's 34th district, would be the first woman engineer to serve in Congress.

board: "I want to get to the point where we talk about *our* kids, not just *my* kids or *your* kids. I want the school board to consider every decision — including fiscal and facility decisions — in the light of how it benefits the children. If I am

"I THINK ENGINEERING HAS COMPLETELY PREPARED ME FOR HOLDING ELECTED OFFICE. I AM A SYSTEMS ENGINEER, SO IT'S MY JOB TO BE A PROBLEM-SOLVER AND A STRATEGIST. I HAVE EXCELLENT COLLABORATION, TEAM-BUILDING, AND PLANNING SKILLS. ALL OF THESE TRANSLATE WELL INTO POLITICS."

— Tracy Van Houten, lead systems engineer, Jet Propulsion Laboratory

present to ask that question in every discussion, I think I will have accomplished something."

FROM JPL TO THE U.S. HOUSE OF REPRESENTATIVES

Tracy Van Houten is a lead systems engineer at the Jet Propulsion Laboratory (JPL) in Pasadena California, a longtime SWE member, and recipient of a 2016 SWE Emerging Leader Award. After 13 years at the JPL, she is running for election to the U.S. House of Representatives in California's 34th district.



State representative Attica Scott, center, Kentucky House District 41, was elected in November 2016. She is an alumna of the first class of Emerge Kentucky.

It will be a short, crowded sprint. The primary is on April 4, and 23 people are running for the seat vacated by Xavier Becerra, who was appointed California Attorney General in December 2016. If Van Houten is one of the two, top vote-getters (the top two go forward, regardless of party) she will advance to the general election, which will take place June 6.

Van Houten has confirmation from the Library of Congress and the Office of the Historian of the U.S. House of Representatives that if she wins, she

will be the first woman engineer ever to serve in the U.S. Congress. Since she is a different kind of candidate, Van Houten has prepared for her campaign in a nontraditional way that fits into her full life. She has a husband and two small children, a demanding job in aerospace, and volunteer commitments. She has always moved forward by assigning herself tasks, and entering politics, which she has been considering for a while, was no different.

"I assigned myself the task of having a plan in place by the time I was 35 (she

turned 35 in February 2017). I have been building my network and reading the autobiographies of all the women senators elected since 2000!" Van Houten has also completed online, self-study modules for a political leadership training program.

"I think engineering has completely prepared me for holding elected office," said Van Houten. "I am a systems engineer, so it's my job to be a problem-solver and a strategist. I have excellent collaboration, team-building, and planning skills. All of these translate well into politics."

Her involvement with SWE developed skills that will be valuable

"I GRADUATED FROM THE FIRST EMERGE KENTUCKY CLASS. IT PREPARED ME TO RUN AN EFFECTIVE CAMPAIGN. I LEARNED HOW TO MANAGE VOLUNTEERS, RAISE MONEY, AND CUT TURF."

— Attica Scott, Kentucky House of Representatives

during a campaign and in office: public speaking, outreach, and presenting technical subjects to the general public. She believes that her most important contribution to public office is how she thinks. "Engineers rely on reason, logic, and science," she said. "As an engineer, I can bring a clear, fact-based approach to decision-making."

Van Houten is realistic about what she can accomplish in office. "I think the next two years will be about holding the line ... about standing up to attacks on families, public education, and the environment. I would focus on these areas and hope to bring forward a national paid family leave policy. Finally, I hope that by running for this seat, I can inspire all those women engineers I've mentored through SWE to also run for office."

SPEAKING UP AND STANDING UP IN KENTUCKY

Emerge America, founded in 2002, has programs in 17 states that offer an in-depth, 70-hour training program for Democratic women. Program alumnae,

board members, and advisory council members form a wide network of support for candidates. Two thousand Democratic women have gone through the Emerge America training, which covers public speaking, fundraising, campaign strategy, cultural competency, and ethical leadership. In November 2016, there were 214 Emerge America alumnae on ballots in 16 states; 150 of them won their elections.

Attica Scott of Louisville, Kentucky, is one of these successes. She defeated two Democrats, one a 34-year incumbent, in the primary and ran unopposed in the general election. Interested in politics since college, Scott was an activist,

especially on the issues of education and policing in the African-American community. She is the mother of a daughter and a son, and her first run for office — the school board — was inspired by her concerns and hopes for them.

Scott is the first African-American woman to represent District 41 (a racially mixed, majority female area in Louisville) in the Kentucky state legislature in 20 years. Scott, who served on the Louisville Metro Council for three-and-a-half years, said, "I graduated from the first Emerge Kentucky class. It prepared me to run an effective campaign. I learned how to manage volunteers, raise money, and cut turf." The program also connected her with Democratic women across the state who helped on her campaign.

The learning curve for a state representative can be steep. "We are at the midpoint of the legislative session, and I am still learning about Appalachia and rural issues," she said.

Education, women's reproductive rights, and working families are the top priorities for Scott. Since taking office, she has voted against laws that would force a woman seeking an abortion to have an ultrasound and for stronger human trafficking legislation. Scott's goals for the rest of her term include recruiting more people of color and more women to run for office and speaking out for social justice. ✨

314 Action: Fact-based Governing

314 Action is a Washington, D.C.-based nonprofit founded by Shaughnessy Naughton, a chemist and business owner. In 2014, with no prior political experience, Naughton ran for U.S. Congress in Pennsylvania's 8th district. She didn't win, but came away convinced that the United States needs more STEM professionals in office.

Named for the first three digits of π — the most widely known mathematical ratio — 314 Action aims to strengthen communication between scientists and elected officials, advocate for the integrity of science, and enable members of the STEM community to speak out on social issues — particularly climate change. On March 14, Pi Day, 314 Action launched a new effort called "STEM the Divide: Out of the Lab, into Public Office" to encourage scientists to run for elected office. In the 48 hours following the announcement, which included a conference, speakers, and campaign training for first-time, STEM candidates, more than 100 people signed up for the training.

To find out more about 314 Action and STEM the Divide, visit www.314action.org



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WE Local is expanding internationally with spring conferences launching in Pune, India, and Amsterdam, Netherlands, offering fresh professional development and networking opportunities, and capped by a trio of powerhouse keynote speakers.

By Seabright McCabe, SWE Contributor

“Since 2009, we’ve had a vision of taking the SWE organization global, planning events and activities for critical global markets,” Rebecca Wheeler, global programs manager for SWE, said. “Internationally, there’s a tremendous need for what we do.”

To serve that need, the global programs team used a marketing survey to identify areas where SWE services and support were most needed. “Roundtables in Europe and India helped us understand the market a little bit better,” Wheeler said. “Initially, most of our meetings were with human resources, and diversity and inclusion leaders, because we needed to better understand the needs of women employees in engineering and technology.”

The team strategized what services could be tailored to specific regions and needs, then rolled out roundtable discussions with women engineers in those areas. Over time, the events expanded in Europe to Germany, Spain, and the United Kingdom, and they continue to grow. “We had our first roundtable in Prague, Czech Republic, last year,” Wheeler said. “In India, we’re moving beyond major cities like Bangalore, to this year’s conference in Pune. We also have plans to expand in China, and had our first gathering in Shanghai this past December.”

The response has been robust. International SWE membership has grown from 164 in 2009 to 712 today, underscoring the demand for more professional development and networking among women engineers. “Roundtables are usually comprised of around 30-50 people,” Wheeler explained. “The turnout has



Another international first: Executives from 10 organizations participated in a roundtable hosted at Emerson Electric Holdings Co. Ltd., in Shanghai.

been great, and it’s growing. Whenever we make tickets available, we get a full house with 90 percent turnout.”

Conferences are also growing in attendance. “At last year’s conference in India, participation was 10-15 percent over what we expected, and the actual turnout was amazing at 97 percent,” Wheeler said.

Conference formats are modeled on the annual WE conference in the U.S., on a smaller scale, with keynote speakers, plenary sessions, workshops, and panel discussions. “We select from the topics of the U.S. discussions, tailoring the sessions to the needs of the local community,” Wheeler said.

DIFFERENT COUNTRIES, SIMILAR CHALLENGES

Challenges vary for women in different countries and cultures, but many common themes emerge. “Leaving the profession to raise a family, then onboarding afterward is different in India than it is in Europe, but it’s an

issue in both places,” Wheeler noted. “For example, in India, women work with very strong cultural expectations as mothers and wives. In Europe, work/life balance issues are similar to those in the United States. Of course, women are a smaller percentage of engineers than men in all three places, but throw in the complication that some industries in Europe struggle to find engineers at all, whether they’re male or female.”

International conferences offer mega sessions, workshops, and networking.

“Entrepreneurship is definitely a hot topic, but our main focus is on professional development and work/life balance in India and Europe,” Wheeler said.

A substantial advantage of SWE’s “going global” is its unique position among engineering organizations. “SWE provides professional development that crosses all engineering disciplines,” Wheeler said. “Each engineering discipline has its own, specific organization. But SWE embraces every discipline,



Rebecca Wheeler brings her experience with multinational Fortune 500 companies to bear on SWE’s mission to “go global.”



Priya Kumar, best-selling author and popular motivational speaker. Kumar is also India’s first certified female fire walk trainer.



Janneke Niessen, serial entrepreneur and co-founder and CIO of Improve Digital. Niessen is also an active mentor for schoolchildren and a regular columnist for leading Netherlands magazines *Sprout* and *LINDA*.



Renée Moore, Ph.D., founder and CEO of multiple international startups. Dr. Moore’s latest venture is Business Beyond Borders, as both founder and CEO.

offering women the tools to build a skill set they need to excel.”

KEYNOTES OFFER INSPIRATION, MOTIVATION

Priya Kumar, an internationally known motivational speaker and best-selling author of eight books, including *The Calling – Unleash Your True Self*, will deliver the opening keynote at the Pune conference on March 22. Recognized as a leading authority on personal breakthrough and experiential learning, she will speak on mindset, transformation, new beginnings, and partnerships in daily life. Key points of her audience-participation-style presentation include building confidence, increasing personal contributions and commitment, taking personal initiatives, and aligning vision and goals for projects’ collective success.

Kumar is featured in a number of videos available on YouTube. In one of them, “The Art of Problem Solving,” Kumar uses the example of having a difficult supervisor or boss to discuss a unique way to prevent a situation from becoming overwhelming: “Seek to be productive in the moment,” Kumar said. “It can be simple; make 10 phone calls, empty your inbox. If you can be productive in the moment, you can see the problem for what it is, not the way it has

made you feel. A person who has higher self-esteem because they feel more productive has higher chances of solving a problem than a person who feels lost, who feels depressed.” (See more of Kumar’s videos at <https://www.youtube.com/user/priyakumar1973>.)

Serial entrepreneur Janneke Niessen will open the Amsterdam, Netherlands, conference on May 17 with “Marathon or Sprint? The Road to Success of a Female Entrepreneur.” Niessen, co-founder and CIO of European marketing technology company Improve Digital, will share her experience in building multiple international companies, and touch on how to fund, scale, build teams, and grow an international company. She will also offer thoughts on the importance of diversity, a founder’s role, and how it impacts an individual’s life.

Niessen, an active mentor and angel investor, is also co-initiator of Inspiring Fifty, a pan-European program that identifies, encourages, and showcases women in leadership positions within the technology sector. As part of the initiative, Niessen collaborated with an award-winning children’s book author to publish *Project Prep* in 2015, a novel that inspires young girls to study and pursue careers in math and science. Her long list of awards includes 2014 EY (Ernst &

Young) Entrepreneur of the Year® and 2016 Most Innovative Leader.

Delivering the closing keynote at both conferences is Renée Moore, Ph.D., founder and CEO of Business Beyond Borders. Dr. Moore went into neuroscience because “it was absolutely the hardest thing I could think of to study.”

During that time, she was one of only a few females in her classes. After earning her Ph.D. and working in neuroscience, Dr. Moore went into the business end of the profession, helping close multimillion-dollar projects. At age 34, she opened her own pharmaceutical research company in Germany. More startups followed in India, Europe, and Latin America — all in a five-year period.

After selling the ventures, she began sharing what she’s learned as a businesswoman through her new venture, Business Beyond Borders. “I see small business owners as being the perfect example of fighters,” Dr. Moore said. “It takes guts and passion and trust in yourself. I want to share with women how to start and grow successful companies in record time.”

Dr. Moore shares her knowledge at speaking engagements all over the world, often with the message, “Lift off out of the space that you’re in, and really learn to fly!” ✨

PEOPLE

From breaking the glass ceiling in industry, academia, and research to an array of accomplishments, these women are making news.

PRESIDENTIAL MEDAL OF FREEDOM

Boundary-breaking software engineer Margaret Hamilton received the Presidential Medal of Freedom from then-President Barack Obama for her work on the software behind the Apollo 11 mission. Hamilton, who wrote code by hand for the onboard guidance software, was one of many programmers who made it possible for Neil Armstrong and Buzz Aldrin to safely land on the moon instead of aborting their mission. Obama praised Hamilton as someone who “symbolizes that generation of unsung women who helped send humankind into space.”

The very first contract NASA issued for the Apollo program in August 1961 was with the Massachusetts Institute of Technology to develop the guidance and navigation system for the Apollo spacecraft. Hamilton, a computer programmer, would end up leading the Software Engineering Division of the MIT Instrumentation Laboratory (now Draper Lab). Computer science, as we now know it, was just coming into existence at the time. Hamilton led the team that developed the building blocks of software engineering — a term she coined herself. Her systems approach to the Apollo software development and insistence on rigorous testing was critical to the success of Apollo. As she noted, “There was no second chance. We all knew that.”

Hamilton’s approach proved itself on July 20, 1969, when minutes before Armstrong and Aldrin landed on the moon, the software overrode a command to switch the flight computer’s priority system to a radar system. The override was announced by a “1202 alarm” that let everyone know that the guidance computer was shedding less-important tasks (like rendezvous radar) to focus on steering the descent engine and providing landing information to the crew. Armstrong and Aldrin landed on the moon, rather than aborting the approach due to computer problems. In fact, the Apollo guidance software was so robust that no software bugs were found on any crewed Apollo missions, and it was adapted for use in Skylab, the space shuttle, and the first digital fly-by-wire systems in aircraft.

Hamilton was honored by NASA in 2003, when she was presented a special award recognizing the value of her innovations in the Apollo software development. The award included the largest financial award that NASA had ever presented to any individual up to that point.

FOUNDING A NEW ENGINEERING PROGRAM

Wake Forest University appointed Olga Pierrakos, Ph.D., founding chair of the department of engineering, one of Wake Downtown’s new anchoring academic programs, which will



Olga Pierrakos

begin offering classes. As chair, Dr. Pierrakos will oversee the recruitment and hiring of outstanding engineering faculty; lead faculty in their mission of education, research, and service; create an innovative educational environment for undergraduate engineering students; and establish ABET accreditation for the first graduating cohort. She will also work collaboratively to design

and outfit the next-generation engineering classrooms and laboratories at Wake Downtown.

Dr. Pierrakos currently serves as program director of the Division of Undergraduate Education at the National Science Foundation (NSF) in the Directorate of Education and Human Resources. At the NSF, she manages a \$100 million portfolio to strengthen science, technology, engineering, and mathematics education at two- and four-year colleges and universities by improving curricula, instruction, infrastructure, advancing research and knowledge, diversity of students and faculty, and efforts of institutional transformation. Her primary focus is managing a portfolio of investments in engineering education and engineering education research.

She is a founding faculty member and associate professor of the department of engineering at James Madison University where she helped establish the department starting in 2008. There, Dr. Pierrakos touched and impacted many aspects of the nascent engineering program, including co-leading the initial development of the engineering design course sequence, which serves as the spine of the curriculum. She taught a wide range of courses, led the integration of problem-based learning across the curriculum with NSF support, mentored students in a liberal arts environment, and oversaw an exemplary assessment and ABET accreditation process — all of which laid the foundation for her pivotal role at Wake Forest.

NEW DEAN OF ENGINEERING

Following an international search process, Julia Ross, Ph.D., was appointed dean of the Virginia Tech College of Engineering in January. She will begin her position on July 31. Dr. Ross currently serves as dean of engineering and information technology at the University of Maryland, Baltimore County (UMBC). UMBC is ranked No. four on *U.S. News & World Report*’s list of most innovative schools and in the top 10 for best



Julia Ross

undergraduate teaching, the second-highest-ranked public university in that category.

In her new role at Virginia Tech, Dr. Ross will hold tenured appointments in the departments of chemical engineering and engineering education. “I’m deeply humbled by the opportunity to lead such a highly ranked, nationally respected engineering college within a university that understands and values the changing landscape of technology and education,” said Dr. Ross, the Constellation Professor of Information Technology and Engineering at UMBC. “It will be my privilege and honor to work with esteemed engineering faculty and students to advance our education and research portfolio.”

Since joining the UMBC faculty in 1995, Dr. Ross has served in various roles, including chair of chemical, biochemical, and environmental engineering, and supported interinstitutional research initiatives as a special assistant to the provost. Her research focus centers on the role of fluid mechanics in infection formation in the cardiovascular system.

In October, she was elected to the executive committee of the Global Engineering Deans Council, where she will serve a three-year term and work closely with engineering deans from around the world to advance engineering education, research, and service globally.

Dr. Ross is the principal investigator leading the INcreasing Student Participation, Interest, and Recruitment in Engineering and Science (INSPIRES) K-12 initiative. Funded by the National Science Foundation, the program partners with Baltimore County Public Schools to develop and implement an innovative curriculum that exposes high school students to engineering earlier in their educational careers, through existing science and technology classes.



Christine Hendon

HIGHEST HONOR FOR YOUNG SCIENTISTS AND ENGINEERS

Christine Hendon, Ph.D., assistant professor of electrical engineering in the department of electrical engineering at Columbia University, was recognized with the Presidential Early Career Award, the highest honor the U.S. government bestows upon young scientists and engineers. Dr. Hendon, who develops innovative medical imaging instruments for use in surgery and breast cancer detection, is one of 102 researchers from across the U.S. honored by President Obama on Jan. 9.

Dr. Hendon’s research is focused on biomedical optics, a

medical technology that does not rely on radiation. She is developing optical imaging and spectroscopy instruments for surgical guidance. Dr. Hendon is working on optical tools that aim to provide surgeons a clear understanding of the tissue on which they are operating. She uses near-infrared spectroscopy and optical coherence tomography (OCT), a noninvasive imaging technique also known as “optical ultrasound” that provides depth-resolved, high-resolution images of tissue microstructure in real time. These “optical biopsies” offer much higher resolution than current medical imaging options such as magnetic resonance imaging, positron emission tomography, and ultrasound. Using OCT, a surgeon can image a wide area of tissue and, unlike invasive biopsies, remove as little tissue as possible.

Other projects running in Dr. Hendon’s Structure Function Imaging Laboratory include using optical tools to detect and image breast cancer. She is working with breast surgeon Sheldon Feldman, M.D., and pathologist Hanina Hibshoosh, M.D., at Columbia University Medical Center to identify tumors localized to the duct and eventually to image lesions over time to determine which are likely to progress to cancer. Dr. Hendon is also collaborating with Columbia Engineering Associate Professor Kristin Myers, Ph.D., on using imaging to assess the mechanical properties of the cervix in relation to preterm birth.

Dr. Hendon has earned numerous honors for her groundbreaking work. In 2015 she won a National Science Foundation Faculty Early Career Development award; in 2014 she received a National Institutes of Health New Innovator Award; in 2013 she was named to both MIT’s prestigious list of 35 Innovators Under 35 and the Forbes 30 Under 30 list of game changers in science and health care.



Elza Erkip

OUTSTANDING WORK IN COMMUNICATIONS ENGINEERING

Elza Erkip, Ph.D., professor of electrical and computer engineering at the New York University Tandon School of Engineering, is the 2016 recipient of the Institute of Electrical and Electronics Engineers (IEEE) Women in Communications Engineering (WICE) Award for her outstanding technical work in com-

munications engineering and for bringing a high degree of visibility to the field.

As a faculty member of the research center NYU WIRELESS, Dr. Erkip has conducted work that has made significant advances in communications technology. She is one of the pioneers of cooperative networking, and more recently, she has been working on 5G wireless systems.

“Professor Erkip is an enormous credit to the school — and not only because of the honors she continually accrues,” Dean of Engineering Katepalli R. Sreenivasan, Ph.D., said.

“Her active involvement in the IEEE proves her devotion to the scientific community, and her tireless work to ensure the widespread availability of wireless service proves her commitment to placing technology in service to society. Those are the ideals that we hold in high esteem here at NYU Tandon, and Professor Erkip perfectly embodies them.”

Additionally, Dr. Erkip has been elected to the Science Academy Society of Turkey and was among the Thomson Reuters 2014 and 2015 editions of Highly Cited Researchers. Early in her career, she was selected by the National Science Foundation as one of the country’s promising young researchers, receiving its CAREER Award.

“It’s an incredible honor to be given the WICE Award,” Dr. Erkip said. “I am proud to be a member of [the] IEEE Communications Society and to be of service to its women in communications engineering committee. To be recognized by my fellow engineers and researchers by this prestigious award is very gratifying.”

The award was presented at the Third Women’s Workshop on Communications and Signal Processing, held in conjunction with IEEE GLOBECOM, the world’s largest annual gathering of communications engineering professionals from academia, industry, and government.

Dr. Erkip, a fellow of the IEEE, was recently elected second vice president of the IEEE Information Theory Society, she is scheduled to assume the presidency in 2018.

LIFETIME ACHIEVEMENT AWARD

Auburn University’s Lifetime Achievement Award recognizes recipients for outstanding achievements in their professional



Nelda Lee

lives, personal integrity and stature, and service to the university. It was established in 2001 to honor extraordinary accomplishments by members of the Auburn family. Recipients of Lifetime Achievement Awards are selected by a committee of Auburn administrators, trustees, faculty, and alumni. Nelda Lee, a pioneer in women’s aviation history, will receive the 2017 Lifetime

Achievement Award.

Lee is responsible for flight and ground test engineering for the four military aircraft manufactured by The Boeing Company, including the F-15 Eagle, AV-8 Harrier, T-45 Goshawk, and F/A-18 Hornet. She is the level-two manager for test and evaluation personnel located in St. Louis and at the military test sites at China Lake, California; Patuxent River, Maryland; and Eglin Air Force Base in Florida. Lee has been an employee with McDonnell Douglas Corp., now Boeing, for 44 years.

A highlight of her career with McDonnell Douglas was being the first woman to log 1.5 hours of flight time in the F-15 Eagle.

In addition to her career with Boeing, Lee also enjoys aviation in her free time and is a licensed commercial pilot with instrument, multi-engine, and helicopter ratings. She previously served as international president of Whirly-Girls International and was recipient of the 10th annual Doris Mullen Whirly-Girls Scholarship. Lee is charter member No. 15 of Women in Aviation International and currently serves on the organization’s board of directors. A life member of the Society of Flight Test Engineers and the Auburn Alumni Association, she has served both St. Louis Auburn alumni clubs as president.

Lee was inducted into the International Women in Aviation Pioneer Hall of Fame in 2004, received the Whirly-Girls Livingston Award in 2001, and was awarded the 2010 Katherine and Marjorie Stinson Trophy by the National Aeronautic Association. In 1969, Lee became the second woman to earn an aerospace engineering degree from the Samuel Ginn College of Engineering.

DISTINGUISHED ACADEMIC INVENTORS

Amy Herr, Ph.D., the Lester John and Lynne Dewar Lloyd Distinguished Professor of Bioengineering, at the University of California, Berkeley, is among 175 distinguished academic inventors named as fellows of the National Academy of Inventors (NAI). Known for her breakthrough engineering analysis of complex biological systems, Dr. Herr co-founded Zephyrus Biosciences, a venture-backed and recently acquired start-up commercializing research tools to enable single-cell protein analysis. The bioengineering professor has filed for dozens of patents, and one-third of her graduate student alumni have been involved in start-up companies.

Election as an NAI fellow is “a high professional distinction accorded to academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development, and the welfare of society,” according to the academy’s announcement.

With the election of the 2016 class, there are now 757 NAI fellows, representing 229 research universities and governmental and nonprofit research institutes. The 2016 fellows are named inventors on 5,437 issued U.S. patents, bringing the collective patents held by all NAI fellows to more than 26,000 issued U.S. patents.

Included among all NAI fellows are more than 94 presidents and senior leaders of research universities and nonprofit research institutes; 376 members of the National Academies of Sciences, Engineering, and Medicine; 28 inductees of the National Inventors Hall of Fame; 45 recipients of the U.S. National Medal of Technology and Innovation and U.S. National Medal of Science; 28 Nobel laureates; 216 American Association for the Advancement of Science (AAAS) fellows; 126 IEEE fellows; and 116 fellows of the American Academy of Arts and Sciences, among other awards and distinctions.

A MISSION TO IGNITE AND SUSTAIN TODAY’S STEM WORKFORCE

Judy Marks, a 32-year engineering and technology veteran, who also assumed the role of CEO of U.S. Siemens in November 2016, will lead the seven-member board of the Siemens Foundation as they oversee the foundation’s mission to ignite and sustain today’s science, technology, engineering, and mathematics (STEM) workforce and tomorrow’s scientists and engineers. Marks has served as a member of the board since 2012 and was a key member of the advisory committee charged with developing the foundation’s newest initiatives in STEM middle-skill education.



Judy Marks

“I am honored to build upon the new strategic directions set by us as a board,” said Marks, who is also an electrical engineer. “Thanks to our new initiatives in bringing more opportunities for STEM education to underserved student populations and continuing to encourage STEM

innovation in future generations, the Siemens Foundation is now a recognized leader on some of the most pressing issues of our time. I look forward to increasing that influence and to further engaging Siemens USA’s more than 50,000 employees in the foundation’s philanthropic endeavors.”

The Siemens Foundation has invested more than \$100 million in the United States to advance workforce development and education initiatives in STEM. Its mission is inspired by the culture of innovation, research, and continuous learning that is the hallmark of Siemens’ companies. Together, the programs at the Siemens Foundation are closing the opportunity gap for young people in the U.S. when it comes to STEM careers, and igniting and sustaining today’s STEM workforce and tomorrow’s scientists and engineers.

In addition to Marks’ current position, she is also leading New Equipment Solutions for Dresser-Rand, a Siemens’ business. Marks’ career at Siemens began in 2011 as president and CEO of Siemens Government Technologies Inc., where she led the company’s approach to the federal market. Prior to that, she spent 27 years with Lockheed Martin and its predecessor companies. ✨

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Join SWE for WE Local Amsterdam at the Mövenpick Hotel Amsterdam City Centre. Women engineers will gather to be inspired through one-on-one networking, educational presentations, keynote speakers and more.

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Workplace Lessons from “Hidden Figures”

Through the stories of three African-American female mathematicians who fought sexism and segregation to make extraordinary contributions to the United States’ space program in the 1960s, the critically acclaimed film brings up issues and insights that resonate with today’s women engineers.

By Sandra Guy, SWE Contributor

As you slog through another workday, do you ever stop to think about the impact you’re making on the future — or even on history itself? That’s one of the questions that architectural engineer Rebecca Delaney, P.E., says she would have liked to have asked the three heroic women whose genius and vital work at NASA are portrayed in the movie, “Hidden Figures.”

The movie, which has surpassed the hit musical “La La Land” in box-office receipts, tells the story of Katherine G. Johnson, Dorothy Vaughan, and Mary Jackson, who fought sexism, segregation,

whether they just put their heads down and worked hard each day, or stopped to ask, “How big does this feel in the moment?”

“It’s easy to say, ‘This is cool,’” said Delaney, who earned her bachelor’s and master’s degrees from Penn State and leads project teams of up to 10 mechanical, electrical, and plumbing engineers. “But I wonder whether they realized the historical importance and said, ‘Wow — I built that. That’s crazy.’”

That kind of enthusiasm is every engineer’s — and engineering manager’s — dream, since it’s all about fulfilling

you create relationships. Then you can make progress because people trust and respect you.”

To illustrate this, Delaney pointed to the film’s scene in which mathematical genius Katherine Johnson had finally had enough after running a half-mile in pouring rain, back and forth all day, to get to the segregated women’s bathroom, only to be upbraided by her boss about her long absences from her desk.

Johnson fiercely stood up to explain, among other indignities, her bathroom obstacle course, her co-workers’ labeling of a separate coffee urn for her alone to drink from, and her inability to afford the single-string pearl necklace that was the only piece of jewelry the NASA women were allowed to wear. That’s when her manager, played by Kevin Costner, took down the black-only women’s bathroom sign by himself, with a security guard looking on, and peeled off the label from the coffee pot.

The movie ends with Johnson finally being allowed to put her name as an author on a report that she had written, rather than stamp her white male boss’ name on it. “The respect kept growing all the way to the end,” Delaney noted.

The movie’s star engineer — Mary Jackson — uses her smarts to stroke the ego of a white male judge, emphasizing that a ruling to let her take graduate-level classes would set a precedent that would ensure the judge a place in the history books. He responds by granting her the slightest of allowances, letting her attend graduate-level classes at a local segregated high school — but only by taking night classes — so she can earn

one’s passion by using one’s innate talents. Yet Delaney noted that the movie depicted the gradual — some might say glacial — pace at which even today’s workplace cultures change. Among the insights she saw reinforced by the story was this: “To make change, you allow your work to speak for you first; you speak up after you’ve worked hard and become a valuable employee,” she said. “You don’t walk in on your first day and declare, ‘I’m going to break the glass ceiling. I’m here to lead the revolution for women.’ You put your head down and do really awesome work. Over time,

“YOU DON’T WALK IN ON YOUR FIRST DAY AND DECLARE, ‘I’M GOING TO BREAK THE GLASS CEILING. I’M HERE TO LEAD THE REVOLUTION FOR WOMEN.’ YOU PUT YOUR HEAD DOWN AND DO REALLY AWESOME WORK. OVER TIME, YOU CREATE RELATIONSHIPS. THEN YOU CAN MAKE PROGRESS BECAUSE PEOPLE TRUST AND RESPECT YOU.”

– Rebecca Delaney, P.E., team leader, Sustainable Engineering Studio, Skidmore, Owings and Merrill

and forced anonymity to ensure that astronaut John Glenn launched into orbit and returned to Earth safely at the height of America’s space race with Russia during the 1960s. Glenn became the first American to orbit the earth in the Friendship 7 capsule.

A WINNING STRATEGY MAKES EVERYONE A WINNER

Delaney, the youngest team leader in the Sustainable Engineering Studio at Chicago architecture and engineering firm Skidmore, Owings and Merrill, says she would ask the three NASA heroines



Promotional poster for the hit film “Hidden Figures”

her engineering degree. After completing the classes, Jackson was promoted to aerospace engineer in 1958 and became NASA’s first black female engineer.

She noted that the judge’s decision in the movie didn’t desegregate the school nor change the law. Yet the small allowance Jackson won was the one opportunity she needed to make history.

Citing yet another observation from the film, Delaney said she appreciated Jackson’s courage, especially since Delaney sees her employees today shying away from asking for what they want.

“I encourage my team by saying, ‘The best that could happen is you will get a ‘yes’ and get to do whatever your heart desires. In between, you may get an ‘OK, but not right now.’ At least you’ve made your desire known,’” Delaney said.

The film also reminds today’s women they still have work to do. For Delaney, it’s the need for greater flexibility so women can deal with the unexpected demands of child care, children’s illnesses, elder care, and other day-to-day issues without feeling pressured at work. She says she was heartened that the movie showed the three African-American



One of many favorite scenes from “Hidden Figures”

ican women slowly gain their husbands’ support in realizing their dreams — a huge leap.

Today, such leaps are enabled by progressive paternity and maternity leaves, and other policies that encourage employees to put family first, Delaney said. Another key point relevant to contemporary women: “The movie showed

Dr. DePaola said. Dr. Graham, who died in 2013, earned her Ph.D. in 1959. She founded and directed IIT’s Women in Science and Engineering program, and served as SWE’s fourth president.

Dr. DePaola sees her next task as heightening the visibility of engineering when people talk about STEM careers. “We talk about STEM, but everyone

“WE TALK ABOUT STEM, BUT EVERYONE TALKS ABOUT SCIENCE AND TECHNOLOGY. I’M WORKING WITH MY TEAM AT IIT TO TAKE THAT ON AS A PROJECT, TO LET PEOPLE KNOW THAT ENGINEERING IS DIFFERENT THAN SCIENCE AND TECHNOLOGY — SO THEY CAN UNDERSTAND HOW THEY CAN CHANGE THE WORLD BY BEING ENGINEERS.”

– Natacha DePaola, Ph.D., dean of engineering, Illinois Institute of Technology

that gender roles don’t have to be like the typical stereotype,” she said. “It’s not a one size fits all. But at the same time, you’ll always have bumps in the road.”

For Natacha DePaola, Ph.D., dean of engineering at the Illinois Institute of Technology (IIT), the movie is a reminder that perseverance is the key. Indeed, SWE pioneer Lois Graham, the first woman to obtain a master’s degree in mechanical engineering from IIT and the first woman in the United States to earn a Ph.D. in the field, had to have a women’s bathroom installed on campus after she started to teach there,

talks about science and technology,” she said. “I’m working with my team at IIT to take that on as a project, to let people know that engineering is different than science and technology — so they can understand how they can change the world by being engineers.”

Just like the three women in “Hidden Figures.” ✨

The Archives and the Archivist: Sharing SWE's Story Together

After nine years on the job, SWE archivist Troy Eller English knows a thing or two about the Society's history and archives, and she loves to share it.

By Jon Reisfeld, SWE Contributor

The morning after comedian John Oliver, host of HBO's "Last Week Tonight," delivered a 22-minute rant about the Miss America Pageant's highly inflated claim of being "America's leading provider of academic scholarships for women," Troy Eller English, SWE archivist, received an urgent email from headquarters. Oliver had concluded his Sept. 21, 2014, segment by calling on viewers to support the scholarship funds of SWE and other worthy women's organizations. He even had posted SWE's web address on screen, and now, inquiries were flooding in.

As SWE raced to update its online scholarship donor page and Facebook presence to capitalize on Oliver's shout-out, leadership wanted to make sure everyone got their facts right. "Do you have any idea of how much money, in scholarships, SWE has given out since 1950?" the email asked.

A little more than an hour later, Eller English replied: "Between 1959 (first scholarship offered) and FY 2013, SWE has awarded 2,997 new scholarships. (I don't have numbers on renewals.) Between 1959 and 2004, SWE awarded at least \$1,779,200.

"I'll look through the annual reports and audits to update the amount awarded since 2004," she added. "SWE offers far more scholarships [now] than it did a decade ago, so that number should jump significantly."

Over the next 30 days, "Last Week Tonight" viewers would donate more than \$75,000 to SWE's scholarship fund. Their gifts "increased annual

donations by 10 to 15 percent and easily represented 20 percent of the individual donations SWE received in 2014," said Honna Eichler George, SWE manager of fund development. "Fifty to 60 of them became monthly donors from that point on," she added, noting that they represented a previously untapped resource: people with no prior ties to SWE.

The Oliver scholarship opportunity is one of many examples that demonstrate how organizational history is a powerful asset in the hands of a skilled archivist. From frequent collaborations with *SWE Magazine* (Eller English contributes a "Scrapbook" column to each issue), to social media postings, history panels at the annual WE conferences, where she also conducts oral histories, and supporting both marketing and development efforts, Eller English's work with the archives is an integral part of the Society's success. Equally important, she assists outside researchers, further explores the archives, fills in gaps, develops new content, and helps SWE sections set up archives of their own.

BRINGING HISTORY INTO THE PRESENT

SWE management has continually called on Eller English to identify and retrieve a wealth of archival materials. "As we've expanded our marketing and public relations efforts ... as we have stories, as we get press inquiries, being able to quickly answer questions about our history has been invaluable," Karen Horting, CAE, SWE executive director and CEO, said.

Horting cited an example from a recent news item. "We received a large donation from Jack Black, the comedian," she said. "It's in honor of his mother, who passed last year. She was a member of SWE. When he first contacted us, my development person went to Troy and said, 'What do you have on Judith Black Cohen?' And she pulled all this great stuff from when she was active in the Los Angeles Section, in the '70s and '80s. So, it's great to be able, within hours, to have that kind of information!"

SWE's director of editorial and publications, Anne Perusek, notes the dramatic difference between having a "working" archives with a dedicated archivist, and attempting to communicate the Society's history on the basis of stray records and past publications. The Society's reliance on the volunteer-based archives committee had ensured that key documents and stories were preserved, but as volunteers, they were not trained in archival processes nor did they have time and appropriate facilities to sort the collection.

"I think we owe a debt to the archives committee for laying the groundwork. Then, as the collection was processed, it became possible to really tell SWE's story in an impactful, exciting way," she said. "I've enjoyed the many projects Troy and I have collaborated on. It's been very satisfying."

Reflecting on the history of the archives, Perusek noted that there have been three archivists. "We were fortunate that our first archivist, Lauren Kata, was so passionate about capturing



SWE archivist Troy Eller English examines one of the 270 banker's storage boxes that constitute the bulk of the SWE collection. The 1952 poster, above right, is among her favorite items in the collection. "I like the juxtaposition of the slide rule and face powder jar – it very much reflects the narrow line SWE walked in presenting its image to the world in the 1950s," she said.



the founders' stories and ensuring their place in history. As an organization, we were just learning what it meant to have an archivist. Her commitment helped us envision what the archives could be." Of Kata's successor, Deborah Rice, Perusek noted, "She picked up where Lauren left off and offered a wellspring of ideas and information as we planned celebrations for the Society's 60th anniversary."

A PRICELESS TREASURE

The depth and breadth of the SWE archives, which, since 1993, have been housed in the Walter P. Reuther Library at Wayne State University in Detroit, are hard to fathom. In terms of their sheer physicality, the archives represent a substantial body of materials that occupies 270 linear feet of shelf space — which Eller English says translates rather nicely into the contents of 270 banker's storage boxes.

In addition to that, SWE separately maintains thousands of print photographs, slides, and negatives; audio recordings, digital files, digital photographs, and/or digitized versions of print photographs that Eller English has scanned; and electronic files from the past 10 years of SWE history — accessible via computer.

As a rule, SWE members collected whatever they thought might, one day, have historical value. And the results of their efforts are awe inspiring: tens of thousands of documents representing 67 years of the Society of Women Engineers' organizational history. Imagine box, after box, after box brimming with national and sectional board meeting minutes, conference proceedings, and program books; spreadsheets, annual reports, financial audits, speeches, personal journals, biographies, award applications, and award recipient write-ups; membership rosters, private correspondence, corporate correspondence, newsletters, assorted publications, fliers, pamphlets, brochures, meeting discussion notes, oral history transcripts, newspaper and magazine clippings, press releases, and all sorts of associated ephemera: buttons, trinkets, and promotional items — and you start to appreciate the overwhelming abundance of "stuff" preserved in SWE's archives.

Is it any wonder, then, that award-winning historian Betsy Homsher, Ph.D., associate provost for student affairs and dean of students at Kettering University, chose "Priceless Treasures" as the title for her article on the ar-

chives, which appeared in the 2011, 60th anniversary edition of the *Journal of the Society of Women Engineers*?

According to Dr. Homsher's article, SWE's board of directors officially created an archives committee in 1952, with a charter to "catalog and preserve the written and recorded history of the Society, to preserve material of historical interest to the Society ..."

"SWE members' interest in history has not waned over the ensuing 60 years," she wrote, "nor has their appreciation for the importance of their undertaking."

That undertaking was considerable, as described on the Society's website:

"... facing systemic resistance to female participation in the engineering profession, [SWE] challenged gender stereotypes and promoted the rights of all individuals to pursue careers in science and engineering."

"SWE's members were very aware that what they were doing was historically important," Eller English said, "that they were working against the tide, and that they were trying to change engineering. They were trying to change women's lives! Their activities were important and they needed to be saved, and those members' experiences needed to be

saved. This understanding, it was there when SWE was founded.”

HERE, THERE, AND EVERYWHERE

SWE's records lived in custodial limbo during the archives' formative years and were shunted between committee members each time the group's composition changed. Dr. Homsher

noted in her article that the committee's officious title gave a false impression of formality and order, where none existed. For years, she wrote, “Countless boxes of records, originally stashed in members' homes, and later, in SWE's national headquarters in New York [City], lay largely uncatalogued and riskily preserved.”

The collections arrived in New York City by various routes and were ultimately consolidated and stored at SWE's national headquarters. Then, a 1993 decision to move SWE to a new, more prestigious address, with far less available square footage, necessitated a search to find the archives a new, permanent home. Several sites were

Is SWE Treasure Buried in Your House?

How to know, where to look, and what to do, should you find any!

Tucked away in some forgotten corner of your home, garage, or storage unit, among items you hope to finally purge during this year's spring cleaning, could be records or artifacts of enormous historical value to the Society of Women Engineers. If so, Troy Eller English, SWE archivist, hopes you will consider donating them to SWE's archive.

To help you find items quickly and painlessly, *SWE Magazine* asked Eller English to describe the types of items she's looking for, where you might find them in your home, and the steps to take to formally submit them to SWE.

WHAT TO LOOK FOR

If you are a current or former SWE member, or if you have received the personal effects or papers of anyone who once was a SWE member, then the odds are good that you may possess items of interest to SWE. Those odds increase further if the items you have belonged to a SWE founder or to a former SWE Society-level committee member.

In general, Eller English said, items she considers “historically relevant” should, in some way, document “what SWE did and why it did it.” They include:

- SWE national committee records, particularly from the early 1990s forward
- SWE programming information
- SWE founder personal papers and SWE documents
- SWE award application packets
- SWE award recipient announcements
- SWE event photos with supporting details
- Pictures of SWE programming
- Back issues of section newsletters
- SWE member rosters

Member stories. “I absolutely want information on SWE award recipients, whose careers have been well-recognized,” Eller English said, “but I also want stories about the average member. Some of the archives' stories I'm most interested in are about people who were only SWE members for a short time and were not really recognized for their work, but their stories are interesting.” She also wants stories about highly active members.

Photos of engineers. “SWE uses digital photos a lot. I would love to have photos and videos of women engineers at work, doing their jobs — particularly from the current day.”

TIME PERIODS

Eller English accepts materials from all periods of SWE history, from its founding, in 1950, to the present day. But she is particularly interested in records from 1994–2004, a period she calls, “The Lost Decade.”

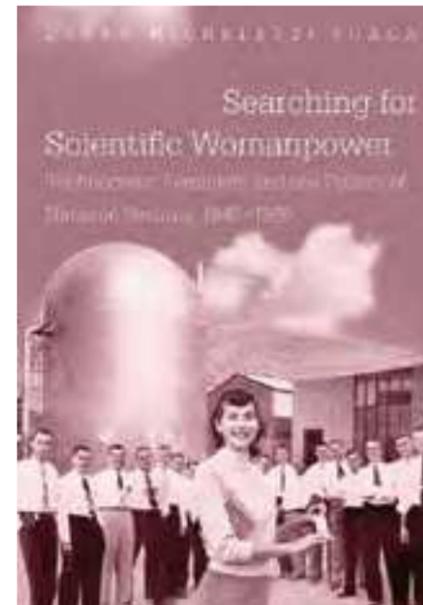
“Beginning in the mid-1990s, the way people produced and shared information started changing,” she explained, “and that's been a problem in preserving SWE's history. They started using computers a lot more and paper a lot less. People started communicating by email, so I don't have a record of conversations or discussions that used to happen in letters.”

WHERE TO LOOK

In this instance, it truly pays to think, and look, “outside the box.” Highly valuable, SWE records are particularly likely to be stored in digital format on computer hard drives, thumb drives, or old floppy drives — even ancient 5¼-inch floppies. SWE accepts them all! SWE can also work with files in Word, Excel, Power Point, and other formats, and most image and audio files. Look on your smartphones, in the cloud, and on old digital-camera memory cards, too.

NEXT STEPS

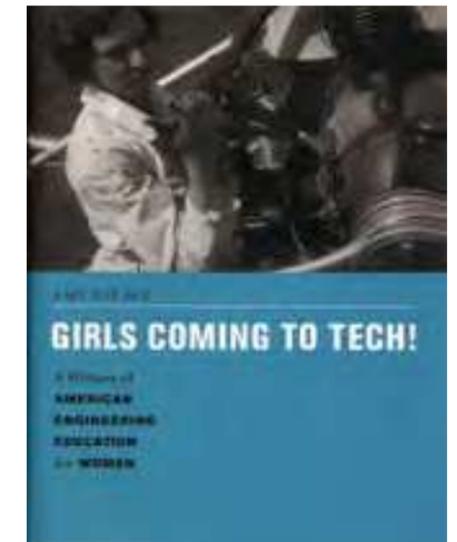
Before sending materials, please contact Troy Eller English, either by phone at: 313-577-2863 or via email at: au2050@wayne.edu.



Laura Micheletti Puaca, author of *Searching for Scientific Womanpower*.



Amy Sue Bix, author of *Girls Coming to Tech!*



considered before SWE, on the recommendation of its Detroit Section, chose the Walter P. Reuther Library, known for housing the archives of several large labor unions. The Reuther describes itself, in its literature, as being “unique among archival repositories” because it maintains “six archivist positions, directly supported by labor and cultural institutions, making us their official archives.”

DIGGING FOR GOLD

In 1994, Reuther Library archivists partially organized SWE's materials, providing a general sense of what went where. But sifting through boxes in search of specific items — or even knowing which boxes to search — remained challenging until the collections were fully catalogued, processed, and opened to the public in 2008. Yet, despite this shortcoming, the SWE collections continued to draw researchers interested in women's STEM employment history.

Laura Micheletti Puaca, Ph.D., associate professor of history at Christopher Newport University in Newport News, Virginia, and director of its women's and gender studies program, spent three weeks at the Reuther Library, in 2003,

working with Eller English's predecessor, archivist Deborah Rice.

Dr. Puaca's book, *Searching for Scientific Womanpower: Technocratic Feminism and the Politics of National Security (1940-1980)*, explores a hypothesis that challenged conventional women's studies thinking at the dawn of the new millennium.

Still breathless with excitement, Dr. Puaca said, “One of the reasons I was so interested in SWE was because I was interested in the organizing efforts of women during the period before the so-called second wave of feminism. A lot of scholars and archives focus on materials from the first wave of American feminism,” she explained, “from the late 19th century and early 20th century, that is often talked about as culminating in women's right to vote — and then, the so-called second wave of feminism that starts up in the '60s and continues on.”

“I was especially interested in SWE because ... it was established in 1950. I thought it could teach me and others a lot about the kind of activist efforts that took place in [a] period that's often associated with domesticity and women being housewives, wearing pearls and high heels.”

Dr. Puaca dug around in the archives and soon struck gold! She read the following excerpt from her book: “In 1977, long-time SWE member Aileen Cavanagh noted that before there was anti-discrimination legislation, ‘we worked within the profession to gain our place there. Unlike now, in the ‘lib

movement,’ we were engineering our own environment long before there was a general consensus that the environment needed any change. In other words,’ she explained, ‘SWE is not a splinter that sprang up from within the women's movement of recent times but part of the main trunk.’”

Amy Sue Bix, Ph.D., author of *Girls Coming to Tech!: A History of American Engineering Education for Women*, is an associate professor and director of Iowa State University's Center for Historical Studies of Technology and Science. Dr. Bix visited the SWE archives several times between 2005 and 2007, and is planning to return there this summer to mine the SWE collections for material for a new book.

“The SWE archives were really invaluable [to] my earlier book,” she said, “because I was able to get material there that I couldn't get anywhere else.” Specifically, Dr. Bix had been looking for material about the history of women's experiences in engineering from their first attempts to enter the field until firms finally started welcoming them. She said she found what she was looking for in SWE's national files and in individual college section records.

“The real value [of SWE's archives],” she said, “is that, on the one hand, it's broad, because it covers all the dimen-



The first page of results from Lou Alta Melton and Hilda Counts' 1919 national survey, identifying 139 women from 23 institutions who had taken college courses in engineering or architecture.

CHANGING PLACES

Eller English's own journey to the Reuther Library proved almost as convoluted as the archives'. As an undergraduate English major at Michigan State University, she had a clear vision of where she was heading: to New York, and a glamorous career in publishing — most likely as a book editor.

"I wanted to be part of that process of bringing new works to people," she said. The prospect of living in an exciting, fast-paced city and working in the

swept away. Before the meeting started, she struck up a conversation with a librarian from the Lansing, Michigan, area who, like her, had been drawn to the event out of curiosity.

"He was chatting about his job and what he did," she recalled. "He talked about how every day was different and how he got to help people. He would help them with their papers. He would help them with their taxes. He learned something new every day — and I got so excited!"

Eller English applied for, and was accepted into, the Wayne State University Master of Library and Information Science program. As part of her studies, she completed a practicum in archival administration at the Reuther Library and, in 2007, graduated with a Master in Library and Information Science (concentrating in academic librarianship) with a Certificate in Archival Administration.

A year into her first job, as an academic librarian at a private university, Eller English received a call from the director of the Reuther Library. He told her about a position to manage the Society of Women Engineers collection and "he asked me to apply."

And that's how, nine years ago, Eller English, with one year of library experience under her belt, became the archivist for one of the largest, and rarest, active archival collections in engineering.

THE ERA OF BIG PROJECTS

For SWE's first 50 years, the archives committee managed and maintained the organization's historical collections with minimal outside help. But eight years before Eller English went to work for SWE, all of that changed.

It was 2000, she said, the year of SWE's 50th anniversary. Leadership had decided to produce a commemorative booklet, drawing on materials from the archives. While SWE's professional team could write, create, and produce the booklets, mining the archives for

artwork, photos, stories, and information was another matter entirely. No one felt comfortable traveling to Detroit and wading through the still loosely structured records.

SWE had hoped it could draft one of the Reuther Library's full-time staff members to help, but it quickly became clear that that wasn't going to happen. "SWE's records weren't really in great order back then," Eller English explained, "and there wasn't one person on staff who could devote sufficient time to the project.

"SWE had to consider what it wanted out of its archives and its history," she said. "Ultimately, SWE realized that if it wanted to get the most out of them, a professional archivist would be necessary."

Initially, SWE hired a graduate student to help on a part-time basis. Then, in 2003, Eller English said, SWE made its archivist assignment a full-time Reuther Library staff position.

With an archivist now involved, SWE was suddenly able to plan big, history-based projects. The first, in 2002, was the wildly popular traveling exhibit, "Petticoats and Slide Rules," named after the 1952 speech early SWE member Margaret Ingels had delivered at the Centennial of Engineering in Chicago. Ingels had paid tribute to the women engineer pioneers and trailblazers. Intern archivist Lauren Kata assisted in the project's development and then, 10 years later, Eller English revised the exhibit, for another successful run.

Other projects followed, such as the special 2011 60th anniversary edition of the *SWE Journal*, led by SWE's director of publications, Anne Perusek, and a team of scholars, who traveled to the Reuther Library to do their research.

Then, in 2015, for SWE's 65th anniversary, Eller English and Perusek worked together to produce — with design and technical assistance from the SWE marketing team — an e-scrapbook titled, *We Built This*.

"The idea originally came out of the marketing team, and I was thrilled

when they proposed it!" Eller English said. "I didn't know anything about it, until I was invited to a conference call, and then ... I was writing a book!"

"It came together quickly and drew directly from the archives. We wanted to tell SWE's history from the archives. We pulled important documents and speeches and oral histories. It told SWE's stories through its members' own words!"

"I'm quite happy with the result," she said, noting that the timing of the project proved particularly challenging. (SWE's 65th anniversary — on May 27, 2015 — was looming at the time, and Eller English, who was pregnant, had a delivery date of May 24.) Her daughter, apparently determined to make a big entrance, arrived a week early. "I just barely got the last of the content selected and written in time. We named her Ada," Eller English said, "after Ada Lovelace." (Lovelace, a 19th century British woman, is recognized as the first computer programmer.)

A FOUNDATION FOR ORGANIZATIONAL GROWTH

SWE's marketing and development efforts have expanded in recent years, and so has the membership. With such growth, having an archivist to turn to is "invaluable," said Ron Zywicki. A member of the David James Group, SWE's marketing partner, Zywicki is vice president, creative services for SWE's marketing team. He especially appreciates Eller English's willingness to strategize with his team about the best ways to leverage the archives to advance projects.

"Some of the deliverables we've created over the years, such as the 65th anniversary celebration book, the timeline, and all that ... to do that without the archives and that collective gathering and that historical knowledge would have been tremendously more difficult," he said.

Another member of the marketing team, Angie Myers, said she increasingly relies on Eller English for fact-checking



A 1963 drawing by SWE depicting the disparity between Russia and Western nations in the percentage of women in the engineering workforce is another of Eller English's favorite items.

assistance. "In society, right now, we're having a problem with fake news," she said. "You think you know a historical fact and then you look it up and it's not true. It's hard to verify a lot of things these days. So, that's what's great about Troy. She does this for a living. She cites her sources, and we can point to the archives when we say a woman achieved a certain milestone in engineering and technology. We have the proof!"

Eller English may not have ended up where she initially planned to be, but she says she's happy with her path. "Every day is different," she said, "and I love that, and it's kind of fun to be an expert at something.

"A few years ago, I was at a family reunion, and I had this realization that I didn't know the names of most of my own family! But ... I knew the names and the personal life stories of hundreds of SWE members." That, she added, "was an interesting realization."

Eller English remains deeply enthusiastic about exploring the lives of SWE members. "These are inspiring stories!" she said. "I have an interest in women's history and U.S. history, and while my background is not in science or engineering at all, I love reading nonfiction stories about science that are written for the public as opposed to experts. These different interests of mine," she added, "they all converge in the SWE archives." ✨

LGBTQ Employment Policy Caught in the Crosscurrents

It's clear that a gradual cultural shift toward acceptance of gay, lesbian, bisexual, and transgender people, plus the willingness of famous and admired people to declare publically that they are gay or transgender, and the growing political clout of the LGBTQ population have led to many positive changes in the workplace. What isn't clear is whether these advances will survive, let alone expand.

By Meredith Holmes, SWE Contributor

It may come as a surprise to learn that there are no federal laws explicitly protecting LGBTQ Americans from employment discrimination. People who have been fired, denied promotion, or not hired for jobs because of their sexual orientation or gender identification must navigate an array of inconsistent state and local laws, and employer policies.

Since 1994, a version of the Employment Non-Discrimination Act (ENDA) — which would prohibit discrimination in hiring and employment on the basis of sexual orientation and gender identity — has been introduced, without passage, in all but one Congress. The 109th session (2005 to 2007) was the exception, and no bill was introduced that term. As one journalist quipped in a headline, “No ENDA in Sight ...”

One option for LGBTQ employees is to file a complaint with the federal Equal Employment Opportunity Commission (EEOC) under Title VII, which prohibits sex discrimination, a strategy that has been available only since July 2015. Several unions and nearly 1,000 U.S. colleges and universities have LGBTQ nondiscrimination policies. Currently, LGBTQ employees of the federal government — the nation's largest employer — are protected from sexual orientation and gender identity discrimination by the executive order on LGBTQ workplace discrimination,

signed in 2014 by President Barack Obama. An executive order has the force of law, but is essentially a policy instruction issued by a president about how the government is to be managed. Presidents may overturn the executive orders of their predecessors.

PRIDE, POLICY, POLITICS

The corporate sector — especially big businesses and multinational corporations — has stepped into the breach. Influenced by political advocacy and motivated by a need to attract and retain a talented workforce, many have adopted LGBTQ nondiscrimination policies and offer same-sex partner and spousal benefits. The majority of Fortune 500 companies have had policies in place that prohibit discrimination based on sexual orientation and gender identity since 1995. For most people, however, it's still risky to reveal sexual orientation or gender identity in a job interview and risky to come out at work. Just how risky depends on where you live and where you work.

A 2011 study, “Pride and Prejudice: Employment Discrimination against Openly Gay Men in the United States,” published in the *American Journal of Sociology*, showed that some regions of the United States are more gay friendly to work in than others. “Pride and Prejudice...” was the first large-scale audit study of

discrimination in hiring of openly gay men in the United States. Pairs of fictitious resumes were submitted to 1,769 job openings in seven states (California, Nevada, New York, Pennsylvania, Ohio, Florida, and Texas). Applicants in each pair were equally qualified, but one resume included participation in a college LGBTQ organization.

Researchers found that overall, the ostensibly heterosexual applicants had an 11.5 percent chance of being called for an interview, while resumes that included the gay signal had only a 7.2 percent chance. The difference in the callback rate varied by state. The callback gap between the “gay” and “straight” resumes was 8.3 percentage points in Texas; 8.6 percentage points in Ohio; and 4.0 percentage points in Florida. There was no statistically significant difference in callback rates in California, Nevada, Pennsylvania, and New York.

Advocacy groups and nonprofits also address LGBTQ employment discrimination, providing information about LGBTQ-friendly states and employers and offering legal, networking, and mentoring support (see sidebar, Workplace Resources.). Over the next several years, both nonprofit advocacy and corporate commitment to workplace equality will play important roles in LGBTQ civil rights, as there are strong signals from the Trump

administration that government-led progress toward LGBTQ equality might be stalled, or even reversed. Weeks after President Trump promised not to

overturn Obama's 2014 executive order protecting LGBTQ employees of federal contractors from discrimination, officials at the U.S. Department of Justice

and the U.S. Department of Education announced their decision to “rescind” and “withdraw” 2015 guidance on access to sex-segregated facilities by public

LGBTQ TERMS OF ART

Since publication of the groundbreaking Kinsey Reports in 1948 and 1953, many have come to think of sexual orientation as existing on a scale, with some people at the poles (100 percent heterosexual or 100 percent homosexual), and everyone else distributed along the continuum. Some more recent research supports the idea that sexual orientation is biological — that we are “born that way” — or categorical — more fixed than previously thought. At the same time, transgender people have found their voice, challenging assumptions about gender and biology and declaring that gender can be fluid, nonbinary, and variously expressed over the course of a lifetime.

For many of us, these are uncharted waters, and new language might need to be invented for what we discover. In the meantime, what matters most is understanding and respecting the life experience and professional expertise of all the people we work with. Below is a list of terms to help friends, allies, and colleagues navigate an evolving workplace.

Affirmed Gender: The gender with which someone identifies. This term is often used to replace terms like “new gender” or “chosen gender,” which imply that the current gender was not always a person's gender, or that their gender was chosen rather than simply in existence.

Agender: A person who does not identify with any gender.

Ally: Typically, someone who does not identify as LGBTQ, but is an advocate for LGBTQ equality and issues. LGBTQ people can also be allies to other parts of the community.

Asexual: A person who does not experience sexual attraction.

Bisexual (Bi): An individual who is emotionally, romantically, and/or physically attracted to more than one gender. People who are bisexual need not have had equal sexual experience or any at all.

Cisgender: Someone whose gender identity matches the gender assigned to them at birth.

Coming Out: For people who identify within the LGBTQ+, it is the process of self-acceptance that continues throughout one's life. People often establish a lesbian, gay, bisexual, or transgender identity to themselves first and then may decide to reveal it to others. It is up to each person, individually, to decide if and when to come out or disclose.

Gay: The adjective used to describe people whose emotional, romantic, and/or physical attraction is to people of the same sex

(e.g., gay man, gay people). In contemporary contexts, “lesbian” is often a preferred term for women.

Gender-fluid: A person whose gender identity can vary. A gender-fluid person may identify as male, female, neither, or both, at different times.

Gender Identity: One's deeply held personal, internal sense of being male, female, some of both, or neither. One's gender identity does not always correspond to biological sex.

All-Gender: Descriptive phrase denoting inclusiveness of all gender expressions and identities.

Lesbian: A woman whose emotional, romantic, and/or physical attraction is to other women.

LGBTQQIP2SAA: The extended acronym encompassing many identities, usually abbreviated to LGBT or LGBTQ+. It includes lesbian, gay, bisexual, transgender, queer, questioning, intersex, pansexual, two-spirit, asexual, and allies.

Nonbinary: A person whose gender does not fit the binary of “male” or “female.”

Queer: A term currently used by some people to describe themselves and/or their community. Traditionally a negative or pejorative term for people who are gay, “queer” is disliked by some within the LGBT community, who find it offensive, while others in the community feel its usage is an act of reclaiming the term as their own.

Questioning: A term used to describe those who are in a process of discovery and exploration about their sexual orientation, gender identity, gender expression, or a combination thereof.

Sex: Refers to biological, genetic, or physical characteristics that define males and females. These can include genitalia, hormone levels, genes, or secondary sex characteristics.

Sexual Orientation: Refers to emotional, romantic, or sexual feelings toward other people, generally depending on their gender.

Transgender (Trans): An umbrella term for people whose gender does not line up with the gender assigned to them at birth. Includes nonbinary identities.

Source, list: oSTEM (*Out in Science, Technology, Engineering, and Mathematics Inc.*) website

Number of companies, by industry, that achieved a perfect score of 100 in 2002 and in 2017

2002	2017
	112 Law Firms
1	69 Banking and Financial Services
	38 Retail and Consumer Products
1	36 Insurance
	27 Consulting and Business Services
	27 Food, Beverages, and Groceries
	17 Manufacturing
	16 Health Care
	15 Advertising and Marketing
	15 Pharmaceuticals
	13 Computer Software
	13 Hotels, Resorts, and Casinos
1	13 Internet Services and Retailing
	12 Entertainment and Electronic Media
	11 Energy and Utilities
	10 Automotive
4	9 Computer and Data Services
	8 Telecommunications
2	7 Aerospace and Defense
1	7 Chemicals and Biotechnology
	7 High-Tech/Photo/Science Equipment
	6 Airlines
1	6 Apparel, Fashion, Textiles, Department Stores
1	4 Computer Hardware and Office Equipment
	3 Oil and Gas
	3 Real Estate, Commercial
1	3 Transportation and Travel
	2 Education and Child Care
	2 Home Furnishing
	2 Mining and Metals
	2 Miscellaneous
	1 Engineering and Construction
	1 Mail and Freight Delivery

Source: HRC, 2017 Corporate Equality Index, Executive Summary

school, transgender students. In addition, the Human Rights Campaign (HRC) reports that LGBTQ “license to discriminate” bills are being considered in at least 12 states. In early February, a draft of an executive order entitled “Establishing a Government-Wide Initiative to Respect Religious Freedom” was leaked. If signed, this order would legalize widespread discrimination of women and LGBTQ people in public accommodation, education, access to medical and social services, and employment.

THE ADVOCATES

HRC is one of the most influential advocacy groups working for LGBTQ civil rights. With 1.5 million members and chapters in 50 states and the District of Columbia, it’s also the largest in the United States. A valuable tool for navigating the workplace, and a catalyst for LGBTQ workplace equality, is the *Corporate Equality Index* (CEI), which the HRC Foundation has published since 2002. The CEI rates large U.S. businesses on how fully and fairly their policies and practices include LGBTQ employees using five criteria, each worth a certain number of points. The criteria are: equal employment opportunity (35 points), employment benefits (30 points), organizational LGBTQ competency (20 points), and public engagement (15 points). A fifth measure (responsible citizenship) deducts 25 points if a company has been involved in large-scale, public anti-LGBTQ activity, such as lobbying against a law protecting LGBTQ rights or donating to an anti-LGBTQ organization.

(*The Corporate Equality Index*, 2017, as well as HRC’s 2016 *Municipal Equality Index* and 2016 *State Equality Index*, can be downloaded at www.hrc.org/cei.)

CEI participants are drawn from *Fortune* magazine’s list of the 1,000 largest publicly traded U.S. businesses, *American Lawyer* magazine’s 200 top-revenue-grossing law firms, and other companies with 500 or more employees. The CEI has become the benchmark — and increasingly, a model — for LGBTQ workplace policy by tapping into the competitive nature of business. Prominent, successful companies score well in the index, and other companies imitate them. Rather than prescribing policies, HRC encourages parity — that is, adding LGBTQ-specific language to existing practices. For example, Criteria 3 of the Index is “organizational LGBTQ competency,” and requires that the company clearly state its commitment to nondiscrimination of LGBTQ people in all new hire and supervisor training, and in all professional development, leadership, and skill-building training.

A total of 887 companies participated in the 2017 report, and a record 517 companies from a wide variety of industries earned a perfect score of 100. Only one engi-

neering and construction firm made this list, but seven aerospace and defense companies also earned perfect scores, as well as many companies that employ engineers in the automotive, manufacturing, energy and utilities, computer, and chemical industries. The 2017 CEI reveals some dramatic workplace improvements for transgender people. The number of companies offering transgender-inclusive health care coverage as part of their benefit package increased from 511 last year to 647. In addition, 82 percent of Fortune 500 companies include gender-identity protections in their nondiscrimination policies; 387 businesses have adopted gender transition guidelines for employees; and 86 percent of CEI-rated businesses offer education and training that covers gender identity.

Proving that it can deliver on all five criteria is more than a company’s endorsement of a principle. It means it’s willing to publicly support LGBTQ equality at the highest levels and willing to invest money and human resources to implement equality. One indicator of the CEI’s influence is that none of the companies participating in the 2017 index received the 25-point penalty for engaging in public, anti-LGBTQ activity.

Large companies recognize that the investments required to score 100 on the CEI are necessary to attract and retain the workforce they need. In his letter introducing the 2017 report, Chad Griffin, president of the HRC Foundation, said, “These businesses know that LGBTQ equality isn’t just the right thing to do, it makes them stronger in the global economy. Ensuring fairness in the workplace is a value and increasingly, a policy norm, and not just in the U.S. Now more than 90 percent of CEI-related businesses have embraced both sexual orientation and gender identity employment protections for their U.S. and global operations.”

SMALL TALK IS A BIG DEAL

A fair, welcoming, and inclusive workplace is as important as nondiscriminatory hiring policies, particularly for transgender people, who may experience more difficulties on the job, such as harassment and mistreatment, than gay men, lesbians, and bisexuals. HRC has published two studies of the workplace climate for LGBTQ people. The first, *Degrees of Equality*, published in 2009, found that while LGBTQ-friendly policies have improved productivity, recruitment, and retention, they have not necessarily improved workplace climate for LGBTQ employees. The *Degrees of Equality* study found that 51 percent of LGBTQ employees conceal their identity at work. Frequent conversations about personal matters — especially sexual relationships — that LGBTQ people felt they could not participate in, as well as jokes and insulting comments about gays, lesbians, and transgender people, made

Workplace Resources

EQUAL EMPLOYMENT OPPORTUNITY COMMISSION (EEOC)

Federal government agency that investigates, litigates, and mediates charges of employment discrimination. In 2015, the EEOC ruled that employment discrimination for sexual orientation and gender identity constitutes sex discrimination, which is prohibited under Title VII of the 1964 Civil Rights Act.

www.eeoc.gov

HUMAN RIGHTS CAMPAIGN (HRC) AND THE HUMAN RIGHTS CAMPAIGN FOUNDATION

Advocates for LGBT equality and for better quality of life for LGBT people at home, at work, and in the community. Tracks federal and state legislation affecting LGBT people and engages in extensive public education and outreach.

www.hrc.org

LAMBDA LEGAL

Works to advance the civil rights of LGBT people and those with HIV through impact litigation, education, and public policy work. Litigates cases of employment discrimination on behalf of LGBT individuals. Provides information on LGBT court battles and on laws in every state. Offers free guidebook on legal rights for those who are out at work.

www.lambdalegal.org

NATIONAL ORGANIZATION OF GAY AND LESBIAN SCIENTISTS AND TECHNICAL PROFESSIONALS INC. (NOGLSTP)

Empowers LGBTQ people in STEM professions by providing education, advocacy, professional development, networking, and peer support. Also, does public education regarding scientific, technological, and medical concerns of the LGBTQ community.

www.noglstp.org

OUT AND EQUAL WORKPLACE ADVOCATES

Partners with government agencies and Fortune 1000 companies worldwide to advocate fair policies and a safe workplace climate for LGBT employees.

www.outandequal.org

OUT IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS INC. (OSTEM)

A national society for students dedicated to educating and fostering leadership for LGBTQ communities in the STEM fields.

www.ostem.org

LGBTQ employees uncomfortable and sent the message that concealment was the best way to handle the situation.

The issue of “small talk,” the casual, personal conversations that co-workers inevitably have, surfaced again in *The Cost of the Closet and the Rewards of Inclusion: Why the Workplace Environment for LGBT People Matters to Employers*, HRC’s second study of workplace climate for LGBTQ people, published in 2014. Small talk is a social glue. People who work together need to be able to share things about themselves, and conversations foster cooperation and strengthen connections. Except when they don’t. Dating, complaints about spouses, and which celebrities are attractive are not topics the majority heterosexual population considers to be about sexual identity. But they do signal sexual orientation and gender identity and can exclude LGBTQ people.

Jokes told at work can relax a tense situation, but not if they are veiled insults. Sixty-two percent of LGBTQ workers report hearing jokes at work about lesbian or gay people at least once; 43 percent hear jokes about bisexual people, and 40 percent about transgender people. Sometimes the insults aren’t veiled; one in four LGBTQ people reported hearing an overt expression of bias toward LGBTQ people at work.

The business impact of these interactions is significant. An unwelcoming workplace takes a toll personally and professionally. Thirty percent of LGBTQ workers reported feeling “distracted” by their negative environment; 35 percent lied about their personal lives; 20 percent felt “exhausted” by their closeted status; and 30 percent felt “unhappy or depressed” at work. When people can be themselves at work, free of worry, they have more energy and think more clearly and creatively. Feeling secure and respected by co-workers makes for better collaborations, more productive teamwork, and greater engagement.

Even if they are out at work, LGBTQ people discover that colleagues do not

want to hear about their weekend or their wedding plans. The study found that 81 percent of non-LGBTQs believe that LGBTQ people “should not have to hide” who they are at work. However, less than 50 percent would feel comfortable hearing an LGBTQ co-worker talk about their social life, and more than 70 percent agree that “it is unprofessional” to talk about sexual orientation or gender identity in the workplace. The majority’s unexamined attitudes and the minority’s lack of visibility reinforce each other. This dynamic underlines the importance of the kinds of initiatives the CEI includes in its “Organizational Competence” category — diversity training and education programs and employee resource and affinity groups.

AT THE INTERSECTION OF GAY AND TECH

There is almost nothing more powerful than banding together with like-minded people for a common purpose. The National Organization of Gay and Lesbian Scientists and Technical Professionals Inc. (NOGLSTP) traces its origins to 1980 when a small group of gay scientists attending an American Association for the Advancement of Science (AAAS) meeting discussed the need for an organization to address homophobia in the scientific workplace.

Now a national membership-based professional society, NOGLSTP has been an AAAS affiliate since 1994. NOGLSTP has a history of working with other organizations. These affiliations represent significant opportunities for networking, advocacy, and public education. Currently, NOGLSTP works with the MentorNet® Affiliated Partners Plus program, the National Postdoctoral Association, DiscoverE, and the American Chemical Society as a Diversity Programs Partner.

In the 1980s, NOGLSTP received fiscal support from the University of California AIDS Task Force and Roche, among others, to organize a symposium at the AAAS national meeting titled



Rochelle Diamond, a biochemist at CalTech, has been board chair of NOGLSTP for 30 years. Visibility and recognition are key, she says, to enlightened LGBTQ employment policies.

“Homophobia and Social Attitudes: Their Impact on AIDS Research.”

In 1985, NOGLSTP established a women’s network to facilitate contact among women scientists. In 1988, in conjunction with the Los Angeles Gay and Lesbian Scientists, NOGLSTP surveyed 5,000 employers of scientists and technical professionals in southern California to measure the amount of homophobia in the scientific workplace.

“We exist to support and empower LGBTQ individuals in STEM and to be visible, and to give a hand up the ladder of success, if we can,” said Rochelle Diamond, board chair of NOGLSTP. Diamond is a biochemist and managing director of the California Institute of Technology’s (CalTech’s) Flow Cytometry/Cell Sorting Facility. She is a specialist in cell separation and analysis and an expert in a variety of other research techniques. Diamond’s research focus is early murine T-cell differentiation, and she is the author of more than 25 publications in scientific journals. She is co-editor of the professional text, *In Living Color: Protocols in Flow Cytometry and Cell Sorting*.

“We have no paid staff and a modest budget,” she said. “But we offer networking, mentoring, scholarships, and awards for scientific accomplishment and visibility. We also hold a conference and career summit every other year, called Out to Innovate™.” Diamond has served as NOGLSTP board chair

A Conversation with Robyn



Robyn is a third-year chemical engineering major at the University of Louisville in Louisville, Kentucky. A SWE member, Robyn attended WE16, contacted two members of the SWE marketing staff, and offered to be interviewed at some point. Contributing writer Meredith Holmes caught up with Robyn several months later. The conversation below, in which Robyn talks about the experience of being a transitioning engineering student,

was conducted by email in February.

Robyn began transitioning in the summer of 2016, after attending the University of Louisville (U of L) for two years. Identifying as “a trans bigender, non-binary femme womyn,” Robyn prefers not to use pronouns. To clarify: “Yes, I’m transgender, and I’m not only a woman, but also something else within the gender spectrum.”

BEGINNING OF A JOURNEY

Robyn sent an email at the end of the summer semester to the 60-odd engineering students in her graduating class, announcing that she was transitioning. The response was “a resounding silence from the majority of my classmates.” Robyn added, “I received one email stating, ‘You’re kidding, right?’ and another that was incredibly supportive.” Robyn has become good friends with the person who sent the supportive email, and one of Robyn’s closest friends among her engineering classmates has stood by her. Robyn said, “I feel she offers me a lot of support and protection when I’m present and also when I’m not.” However, Robyn has encountered people on and off campus who hold the belief that as a transgender person, she is not a real woman. Such people, Robyn says, “are everywhere.” While their position can be interpreted ostensibly as a feminist one, Robyn experiences the exclusion as transphobic.

Meredith: What is it like for you on campus? Have you run into overt (or covert) hostility?

Robyn: I’d say I’m very safe on campus because of a lot of on-campus resources, such as the LGBT Center and the diverse community my university promotes. There’s still a lot of work to be done, but the majority of hostility I deal with is covert and takes the form of occasional stares from strangers or micro-aggressions, such as heavily “gendered” language or the wrong pronouns.

Meredith: What kinds of support are available to you from the university?

Robyn: My biggest support comes from the staff at the university’s LGBT Center. There are many identity-specific groups that give me a space to be myself. The staff of the LGBT Center advocates for me and supports me along with other trans students in countless ways. The “preferred name” option — a way to change my first and middle name on class rosters — was a great help while I updated my legal name. Their work for lockable, single-occupancy bathrooms all around campus has helped a tremendous amount.

Meredith: What communities are you part of?

Robyn: I have been part of Tau Beta Pi since last April. Recently, I joined several on-campus social justice organizations because I am compassionate about human rights. I first joined SWE after I began my transition. I quickly made friends with other SWEsters within the U of L’s [section], especially on our trip to WE16.

NAVIGATING MIXED REACTIONS

Although the private struggles over gender identity are probably just as intense for everyone who considers transitioning, people of different ages may have different experiences of the public aspect of coming out. Those who transition later in life are likely to have an impressive professional resume and to be well-off financially, but they must live with the knowledge that they delayed — or were prevented from — living the life that was right for them. A young person who is not yet established professionally or settled within a stable peer group may face greater day-to-day difficulties and be more vulnerable to lack of acceptance in the workplace, where even well-intentioned colleagues might not be prepared to deal with gender ambiguity.

Robyn: I spent a majority of my time during WE16 at the career fair talking to companies ranking high on the *Human Rights Campaign Corporate Equality Index*; however, I was met with confusion ... because of my appearance and voice, despite my excellent GPA (3.8) and engineering work experience. I’m grateful for the Rainbow Lounge for being a space I could recover within.

Meredith: Have you done any co-ops or internships? If so, were you out in those work situations?

Robyn: My engineering programs last all year long, which builds in three semesters of co-ops. I completed 1.5 co-ops for the same company before I came out “full-time,” but I took a medical withdraw during the second one without coming out to my company and workplace. While I could not have been fired because of the company’s policy, along with Louisville’s LGBT protection ordinance, I do not believe I would have been safe or respected had I come out, so I do not regret my medical withdraw as a viable option to protect myself and my mental health.

Meredith: Do you think you will be more or less visible than you are now after you graduate and enter the work world?

Robyn: If I find a niche within chemical engineering where my trans and queer identities are respected, I believe I will be more visible upon graduating. This is because I want to advocate for my fellow trans siblings that our unique identities and perspectives are vital to producing new and innovative ideas no matter where our job interests lie. If I cannot find a place within the work world, then I’ll probably jump into a new career field that will deal more closely with social justice.

Editor’s note: It should be noted that men are welcome as SWE members, and that inclusion, diversity, and acceptance have always been at the heart of SWE’s mission.



Christine Bland, a senior engineer at Lockheed Martin in Denver, founded and is still active on the company's Transgender Council, which was instrumental in formulating the company's LGBTQ employment policies.

for 30 years. Deeply committed to the organization's mission, Diamond was driven out of a job because of her sexual orientation early in her career, before she came to CalTech. She received NOGLSTP's inaugural Walt Westman award for her sustained service.

About the current volatile state of LGBTQ civil rights, Diamond said, "We have made tremendous progress over the past several years, in large part because of the openness of the Obama administration to science and entrepreneurship." Kei Koizumi, former assistant director of Federal Research and Development, White House Office of Science and Technology Policy (OSTP), and an out gay man, has been a regular speaker at Out to Innovate. Diamond observed, "I think we're in a bit of quicksand now." It has been harder than ever before to raise funds for Out to Innovate 2017. The conference enables students to mingle with experienced professionals, to network, and talk to recruiters — all in a safe environment, where they can be themselves.

The freedom to be who you are, Diamond contends, is very much tied to career success. Acknowledging that caution is necessary in many work environments, she said, "Invisibility can be very isolating. If you can't be out, then it's harder to find allies and people of like mind. You're expending a lot of energy

on things that aren't your work, and you're not as creative or as innovative as you'd like to be."

She concluded, "If you're in the closet, you're less likely to engage socially with your colleagues. Then you won't be seen as a team player, and that will hurt your ability to move up."

"WE'VE GOT YOUR BACK"

Christine Bland, an engineer at Lockheed Martin, received NOGLSTP's 2014 LGBTQ Engineer of the Year Award for her remarkable engineering accomplishments on NASA's Deep Space Exploration projects and for her visibility and contributions as a transgender role model in the company. Bland's leadership contributed to Lockheed Martin's being the first aerospace/defense company to recruit at transgender career fairs in Denver and other locations.

Bland has worked at Lockheed for more than 25 years and is currently a senior engineer, subject matter expert, and point of contact for all complex electronics for the NASA Orion project. Her job is critical, and the stakes are high. But no decision she ever made in her long career was as momentous as the decision she made, after years of internal struggle, to change gender.

Bland was born male and transitioned in 2011, when she was about 55, with the full support of her employer. Lockheed Martin had participated in HRC's CEI for several years, and by 2011, LGBTQ employees were included in the company's nondiscrimination policies and benefits. "When I came out of the closet, Lockheed had already passed huge, huge milestones on the road to LGBTQ equality and had already scored 100 on the CEI."

The process of transitioning was a long and agonizing one. In 1997, Bland reached out to the local Pride chapter for help. "I was getting so nervous about taking this step," she said. "I was very concerned about losing my job." Pride referred Bland to human resources at Lockheed. "They assured me I would not lose my job, and that the company

was moving toward more inclusive policies for transgender employees. They told me, 'We've got your back.'"

Despite the difficulties, there were some humorous moments along the way. Bland explained that often during the transitioning process, people gradually change their appearance in small ways, signaling that they are dealing with gender issues. She said, "At one point, I started wearing nail polish. I was in a meeting that HR had arranged for me to tell my managers what I was doing before I came out publicly. They were all very surprised and said they thought I was wearing nail polish because I was an 'artist-type,' 'Bohemian' engineer!"

The meeting at which Bland came out publicly was carefully planned so that everyone she worked with got the same information about her transition and about Lockheed's policies on transgender employees at the same time. The Orion project involves all the company's business lines, and all Bland's managers, team, customers, and suppliers were present. She observed, "I think the consistency of the message delivered that day is one of the reasons I've been so successful. The support I've gotten is just awesome. It's all been positive."

Coming out transformed Bland's life. She founded the Transgender Council at Lockheed and relishes the freedom to work on diversity and inclusion issues, speaking at conferences, and reaching out to college students. She said being her "true, authentic self" has made her more open. "I'm more interested in different areas of engineering. I used to just focus on the task at hand. Now I want to explore other disciplines, new projects. I'm free of the fear that resulted from living under cover. I feel there's nothing I can't do." ✨

Editor's note: There is some disagreement in the gay community whether the use of the term "queer" (Q) is a pejorative term, as it was considered traditionally. Others, however, feel its usage is an act of reclaiming the term as their own.



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ENGINEERING THE MAGIC OF LIVE ENTERTAINMENT

Pop star Taylor Swift stands at the point of a fully automated propeller bridge, suspended over the audience, playing her heart out. This stunning effect, designed by TAIT Towers, is the result of close collaboration between gifted technicians, artists — and engineers.

By Seabright McCabe, SWE Contributor

A 1960 AMC Rambler careens out of control, onlookers gasping as 1.5 tons of Detroit steel jump a curb, screeching to a halt just short of a solid wall. This scene played out in Chicago, not on a city street, but onstage at Steppenwolf Theatre, in a production of *Purple Heart*.

“That show had a flamethrower in it, too — my big break in professional theater,” Beth Martell, now a theater consultant at top-tier architectural firm DLR/Westlake Reed Leskosky, said. “We did it on a National Endowment for the Arts grant, with an engineer who designed software for the theater’s new automation system.” Using LabVIEW, the team controlled the car’s multiple axes of motion from a PC. “The challenge was not only having the car move, but also accelerate and decelerate, putting a huge strain on all of the hardware involved. You can’t just break the system to stop the car; you’ll snap the components.”

As a special effects technician, Martell designed the com-

plex cue. “This is the kind of thing we do in theater now, and it’s important for us to understand engineering concepts and safety factors, and to bring engineers in when we know we’ve hit the limits of our knowledge.”

Currently, Martell works with engineers on a daily basis. “Everything we do in theater architecture is a technical challenge that requires engineers. It’s clear we need each other,” she said. “Structural, mechanical, and electrical engineers are needed to meet the unique needs of theatrical equipment and theater buildings. I facilitate the process by ‘translating’ theatrical requirements to engineers who might not think in those terms.” Martell, who also heads the board of directors for the United States Institute for Theatre Technology (USITT), co-wrote a book with her husband in 2015, *The Physics of Theatre: Mechanics*, to offer a clear, conceptual grounding in physics as applied to theatrical situations.



MAKING THE MAGIC SEEM EFFORTLESS

Working behind the scenes is part of the job, but that invisibility makes it challenging to promote theater technology as a viable career path. “There’s a massive amount of technology and engineering that goes into live entertainment, but most people don’t think about it,” David Grindle, executive director, USITT, said. “We want women engineers in this profession, but first they have to know the jobs are here.”

For example, millions have seen “The Phantom of the Opera,” but few know that its Tony Award-winning sets were designed by Maria Björnson. “Audiences are blown away by the boat sailing smoothly across the stage as candles rise out of the floor. It’s all done with programmable controllers,” Grindle said. “With only 8 inches of floor depth, all of those candles telescope. Then there’s the rigging and automation needed to swing a giant chandelier through the house and crash it safely on the stage in the same spot each night. And when you take a show like that on tour or to a modern cruise ship where people expect touring company quality, you need totally different engineered systems.”

Nearly every form of live entertainment needs the support of engineers. “Pop star Pink had this fabulous moment in her summer concert,” Grindle said. “She was in a harness where she could be lifted, flown through the audience, and touch down on top of a pole. Well, that’s mechanical engineering for the harness and the hoist, computer engineering for the technology behind it, electrical engineering for the power, and sound engineers that keep the sound crisp as she’s flying over the audience. There are so many opportunities for engineers to create something cool.”

Audience demand for bigger and better special effects means rising demand for computer programmers, structural and mechanical engineers, electrical engineers, and project managers. “The need extends to theme parks, Las Vegas

productions, cruise ships, concert tours,” Grindle said. “Plus, new theater architecture is getting more kinetic, and that takes engineering skill to pull off. For example, the Wyly Theater in Dallas is a fully flexible space. From the stage to the orchestra seats to the balcony, every part of it is automated. Every part of it can lift, descend, slide, move.”

BIGGER, BETTER, MORE OPPORTUNITIES FOR WOMEN ENGINEERS

“We’re in massive need of engineers right now, and salaries here are comparable to the big aerospace and industrial firms. We just have to get the word out,” Gemma Guy, senior director of business development, TAIT Towers, said. TAIT is a world leader in automation, staging, and engineering for the live entertainment industry, which includes events such as concerts, music festivals, amusement parks, and Olympic ceremonies, to name a few.

“What do we need?” Guy ticked off the openings. “Controls engineers, with a background in robotics and motion control. Electrical engineers — we have only one woman in a team of 30. Mechanical and structural engineers to build the moving stages, the winches that fly people around at high speeds, big structures that seem to appear or collapse out of nowhere.

“A lot of shows these days feature robotics, so we do a lot of video mapping to the robot movement, writing interfaces for that, and we have only one woman engineer at that level,” Guy continued. “You might think that rock and roll concerts — with huge moving stages, structures, animatronics — might be seen as ‘a guy thing.’ I don’t accept that. We’d 100 percent love to have more women.”

To meet that need, Guy has worked alongside Martell and Grindle for many years to advance educational outreach, and TAIT exhibits at USITT’s annual conference. “We love it when theater majors drag their friends from engineer-

ing programs to the show. When we show them videos of what we do, they’re blown away by how they can use their degree in such a cool way.”

In fact, some of TAIT’s mechanical engineering hires have gone straight from college to designing and building stages and structures that fly such performers as Beyoncé and Madonna. “We’ve got this huge, 80-foot bridge that goes up, down, and rotates for Taylor Swift’s concert tour,” Guy said. “Our engineers apply their knowledge to doing incredible things.”

TAIT also collaborates with USITT, Cirque du Soleil, and others in a program called USITT Elite, a national search for top students in each behind-the-scenes discipline, culminating in a three-day intensive workshop in Las Vegas. “We choose the eight top students in each discipline to shadow Cirque’s operations and take workshops,” Guy said. “We hire out of that course every year.”

PASSING THE “GENDER MOMENT”

Technology for live entertainment is all about collaboration. Like SWE, USITT recognizes that the more diverse backgrounds and perspectives are brought to a collaboration, the stronger its potential, and that diversity must include women. “It’s really been a generational shift,” Grindle said. “Right around the mid-to-late 1980s, that’s when we noticed that the gender issue was fading away. Now, people look beyond that ‘gender moment’ immediately.

“In entertainment engineering, there’s a greater presence of women in traditional areas such as rigging, scenic design, lighting, and programming technology,” Grindle continued. “Where we really need to grow is with women in sound design and sound engineering. When you ask for the top women sound designers, I can only name five or 10, and that’s not even near the number of men. So our sound commission is going out of their way to create opportunity.”

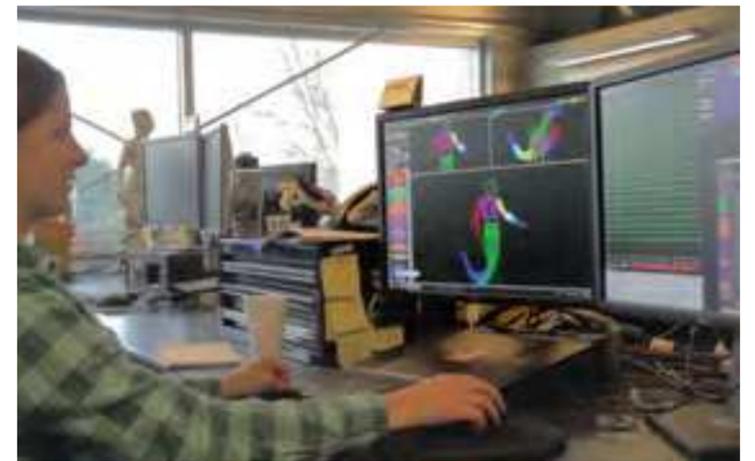
Those opportunities welcome some of the most diverse people found in



Gemma Guy, senior director of business development, TAIT Towers



Beth Martell, theater consultant at DLR/Westlake Reed Leskosky. Martell is also director of USITT’s board of directors and co-author of the 2015 book *The Physics of Theatre: Mechanics*.



R&D engineer Suzanna Paulos, at work on the 15-foot-tall animatronic figure “King Triton.”

any profession. “People sometimes think we all live in a production of ‘Hair,’ where everyone is completely wild, left-leaning, no rules,” Grindle laughed. “But we’re a welcoming community for everyone. We have people of all political and religious beliefs, all genders and ethnicities. There’s always been a strong LGBTQ component in entertainment, though back in the day, it wasn’t discussed,” Grindle said. “It’s better now, but not ideal. There’s room for improvement.”

To support and build diversity, USITT recently announced funding of \$85,000 for outreach through its Gateway diversity initiative. “The program was founded after the tragic death of one of our board members, an African-American woman who was incredibly active and famous for calling out the lack of diversity in the profession,” Grindle said. “Her dream was to create a place where you could find someone who had had your experiences and could identify. The program’s job is to help open doors, make introductions, and change the industry’s impression that ‘there’s no one out there like that to hire.’”

USITT’s outreach parallels SWE’s in many ways. For one, the Gateway program’s goal is to create mentoring relationships and partnerships that extend for long periods of time. “We identify

young professionals first, then find the mentor that can best help them. Then we build on that by giving them time with a cohort of mentors. So each person has 12 resources looking out for them.”

USITT also reaches out to underserved schools. “Our conference goes to a different city each year,” Grindle said. “We present students with women, people of color, professionals who are not who they might expect to see. We did this with a predominantly Hispanic school in Salt Lake City last year. One student was saying, ‘I didn’t know people who look like me did these jobs. Now I really like doing this!’ What’s great is that now our diversity in various jobs is growing.”

SPARKING INDUSTRY INNOVATION

USITT recently announced \$500,000 in grants available for research and development, and a call for proposals is planned for March. “Maybe there’s someone out there with an engineering idea, looking to see if it’s usable in entertainment or entertainment architecture,” Grindle added. “We’re casting the broadest possible net.”

In the last 25 years, USITT has been responsible for several industry innovations, among them DMX, the open-source computer code that allows lighting boards to communicate

with lights. Ten years ago, USITT gave a \$10,000 grant to a group that was convinced they could make an LED theatrical light. “With incandescents, there’s a lamp and a reflector, and a single light source sends light through a focal point,” Grindle explained. “With LEDs, you need multiple light sources and have to deal with additive power. So instead of putting a reflector behind the instrument, they lined the barrel with reflectors. And it mixes all the individual light sources into one beam that goes through the focal point.” The team’s design went on to become the industry’s first theatrical LED. Its inventors sold the product and returned twice the money to the grant fund.

“Our next big thing may be the ‘white space’ issue in sound design,” Grindle continued. “Because cell phone companies bought up all the bandwidth, live events are now crammed into a very narrow band. If you have old equipment, you’re going to get blocked. So we want to find a new way to transmit this kind of information, other than radio frequency. That’s the level of impact we’re hoping to help make.”

REACHING OUT TO FILL THE PIPELINE

Though the number of women engineers behind live entertainment is still relatively small, Grindle believes it’s

bound to grow. “The people backstage are as much artists as those in front of the curtain,” Grindle said. “We have a lot of openings, and we need engineers who think like theater people!”

Guy emphasized the value of outreach by the industry to young women.

“When I go out and teach theater automation, so many girls come up to me and say, ‘I never knew this was even an option for me.’”

“When you think about it, the world is half men and half women,” Martell concluded. “Theater is about understanding

humanity. Well, how do you understand humanity if half of it isn’t represented? If women are not there to help design, build, and interpret the story, we lose half of the story we’re telling.” ✨

In the Spotlight: Suzanna Paulos, R&D Engineer



R&D engineer Suzanna Paulos

Since 2013, Suzanna Paulos has been an R&D engineer with TAIT Towers. “I was always interested in making and building things,” she said. “When I was 6 years old, all I wanted for my birthday was a set of real tools. My grandfather gave me one filled with his old tools, and it was the best gift I ever got. I have that toolbox to this day.”

After graduating in 2010 from the California Institute of Technology, Paulos worked in factory automation, on custom machines that could solve existing problems. “In the factories, and as a young woman fresh out of college, there was always a look of surprise when I went on-site as the robot expert,” she said.

Through this job, she ended up subcontracting for TAIT. “They had these industrial robots moving video screens for a big music festival,” Paulos said. “They had it all set up, but nobody really knew how to program them. So I showed up.

“It was an entirely new world for me. When TAIT hired me as a robot expert, the project manager greeted me with a smile and a handshake, and there was no surprised look whatsoever. Over the course of that project and over the last several years here, I realized the entertainment industry is so diverse and filled with such a range of creative people that it was an incredible place to be as a young woman engineer. It’s not about who you are, but what you can do and what you can create.”

One of Paulos’ favorite projects was developing a 15-foot-tall animatronic merman called “King Triton” for a production in Tokyo. “It had 26 axes, and as the controls engineer on the project, I was taking 26 axes and 26 servo motors, not just making them all run but also creating the interface for the 26 motors to make them mimic human movement,” she said.

Paulos enjoyed working with a diverse group, committed to turning a mechanical man into a lifelike figure. “The motion was designed by an animator using my software, and so I got to work with the show’s director, the animator, the artists who created what Triton looked like, and the mechanical team building the figure. As the controls engineer, I was right in the middle of it all.

“I didn’t realize how much engineering is needed in the entertainment industry until I was actually doing it,” Paulos added. “It’s such an exciting field for an engineer because it’s always pushing the boundaries. Everyone’s always doing something bigger, better, and more.”

At 27, Paulos has a long career ahead of her. “Right now, I work a lot on the development of TAIT’s Navigator control software,” she said. “I’m specifically interested in improving workflows for advanced motion control, to enable more people to apply existing technology, spending more time on creative development rather than on the nitty-gritty of technical details. By making complex processes easier and intuitive, I believe we will be able to continue to push the boundaries of what is possible for the future.”

To find out more about USITT’s coming call for proposals, go to www.USITT.org.

Treat yourself to this time-lapse video of kinetic theater architecture at: <http://magazine.iavm.org/article/five-trends-in-performing-arts-center-architectural-design/>

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women

you should know

Taken together, these individual women present a mosaic of experiences, contributions, and achievements. Their stories demonstrate that there is no one “typical” woman engineer — just many women engineers blazing new trails in a traditionally male profession, aiming to make the world a better place.

By Anne Perusek, Director of Editorial and Publications

Who, exactly, are the women engineers we should know? Posing this question on social media channels in late 2016, we received a variety of responses, all in keeping with the intention of this ongoing project: to highlight the lives and contributions of women engineers of whom we might not otherwise be aware.

Despite their significant and high-profile work, these women are not famous in the typical ways of our culture. As is frequently the case, those working behind the scenes and out of the limelight make real change and meaningful contributions in the workplace and in our communities. And while readers may know and recognize some of the names put forth here, none of our “Women Engineers You Should Know” have instant name

recognition, but may be well known and respected within their specialties.

Names are brought forward through SWE social media channels, as well as through the SWE editorial board. Gathering and reviewing the information on so many interesting and accomplished women is a powerful experience and a bit overwhelming at the same time. Because we recognize women engineers as having multi-dimensional lives beyond professional practice, there is a complex, human side to each story.

This is our third installment of what has become an annual series. As with the previous installments, determining a final list was quite challenging, and our selections are not meant to be definitive.



APIRAMY (API) APPULINGAM, P.E.

Growing up, civil aviation project manager Apiramy (Api) Appulingam, P.E., lived in five different countries and visited more than 20, developing an inquisitive spirit and love for travel and exploration that has remained with her. Raised in a traditional Sri Lankan family, during high school she was selected to attend the Texas Governor’s Honors program. Participating in this intensive three-week residential program, she acquired leadership, conflict resolution, ethical decision-making, and critical thinking skills that have continued to serve her well throughout her education and career.

Following in her father’s footsteps, Appulingam became a civil engineer, graduating from Texas A&M with her B.S. in civil engineering in 2004.

After graduation, she joined RS&H, a facilities, infrastructure, and aviation consulting firm, and has devoted the last 12 years to the aviation industry. She has successfully managed projects in the U.S. and internationally, with clients ranging from general aviation airports to large-hub airports. Currently, Appulingam is project manager for the Stage 1 Airfield Development Project of the Philadelphia International Airport’s Capacity Enhancement Program, a multi-year, multibillion-dollar improvement program. Appulingam earned an MBA from the University of Dallas in 2012.



ELEANOR BAUM, PH.D., F.SWE

Holding the distinction as the first woman dean of an engineering school in the United States, Eleanor Baum,

Ph.D., F.SWE, attended high school in the 1950s and was actively discouraged from entering engineering. Told that no one would marry her if she became an engineer, and urged to become a math teacher instead, Dr. Baum ignored this advice — a conscious act of rebellion, she recalls. Rejected by one university because there were no women’s restrooms, she was accepted by the City College of New York and was the only female in her class. After graduating and working in the aerospace industry, she returned to school and discovered her love for teaching. Since receiving her Ph.D. from New York Polytechnic University in 1964, her career has remained in academia.

Among her “firsts” is appointment as dean of Pratt Institute’s School of Engineering in 1984, and in 1995, as the first female president of the American Society for Engineering Education. She was named dean of the Albert Nerken School of Engineering at Cooper Union in 1987, later becoming dean emeritus.

A strong advocate for women in the engineering profession, Dr. Baum is a SWE Fellow and received the Suzanne Jenniches Upward Mobility Award in 1990. She is also a fellow of ASEE, IEEE, and served as president of ABET, as well as on the National Science Foundation

advisory board. Dr. Baum was inducted into the National Women’s Hall of Fame in 2007.

And, despite all warnings to the contrary, Dr. Baum did marry. She and her husband, Paul, raised their children together, with the help of a nanny in the early years.



KRISTEN GRAF

A dynamic leader in the field of renewable energy, Kristen Graf is the executive director of the nonprofit organization Women of Wind Energy (WoWe), a position that allows her to blend two of the issues she feels most strongly about — advancing renewable energy and advocating women in society. A 2001 graduate of Cornell University, Graf received her B.S. in agricultural and biological engineering. She was active in the SWE section there, serving as a member of the executive team. During her time at Cornell, Graf also worked to expand the role of renewable energy in agriculture across New York state through the Cornell Cooperative Extension.

She spent five years as the clean energy program coordinator and research associate with the Union of Concerned Scientists in Boston. Her focus was renewable energy policy at the state and national levels, particularly wind and biomass energy in New England.

Graf’s contributions have not gone unnoticed. She was named a senior fellow in the Environmental Leadership

Program’s Eastern Region in 2011, and also received the U.S. Department of Energy’s C3E Initiative’s Mid-Career Achievement in Mentoring and Education Award.

A native of Pittsburgh, Graf resides in Brooklyn, New York. She enjoys riding her bike to work, spending time with her niece and nephew, and surfing off Long Island.



FLORENCE HUDSON

Among the first women to graduate from Princeton University with a degree in mechanical and aerospace engineering, Florence Hudson has been committed to the advancement of women in engineering throughout her career. Whether working on future missions around Jupiter at the Jet Propulsion Laboratory just out of college, or during her 30-plus-year tenure at IBM, where she held significant leadership assignments, to her present position as senior vice president and chief innovation officer for Internet2, Hudson has consistently and clearly articulated the creative and innovative aspects of the profession and the importance of diversity.

Joining SWE while a student at Princeton, Hudson was president of the collegiate section. Years later, she was IBM’s executive on loan to SWE, serving as the special director of strategic planning on the SWE board of directors. Now a regular occurrence, Hudson was the first person to serve as a special director on SWE’s board.

Hudson’s commitment to outreach and preserving the history of women in engineering have been expressed in numerous ways, including laying the groundwork for SWE’s recent youth programs. She is married with two adult children.



MARIA KLAWE, PH.D.

Defying convention and expectations in more than one way, computer scientist Maria Klawe, Ph.D., is the first female president of Harvey Mudd College. She received both her Ph.D. and B.Sc. in mathematics from the University of Alberta, and established a successful career in academia long before she revealed another dimension of her being — that of an artist. After turning 40, Dr. Klawe decided it was time to bring her paintings out from hiding, noting that, “Engineering and science are creative disciplines. It shouldn’t be surprising that the creative energy, passion, and talent cross into other areas. I can’t imagine living without painting.”

A strong advocate for women in engineering and STEM professions, Dr. Klawe’s previous positions include dean of engineering and professor of computer science at Princeton University; dean of science at the University of British Columbia, as well as teaching and administrative positions there; and at IBM Research and the University of Toronto. She has made significant contributions to her field and toward increasing diversity in the profession.

Of the decision to conceal her artistic

side, Dr. Klawe notes on the college website that: "As I became a professional mathematician and then a computer scientist, it became clear that also being an artist would diminish my credibility (already in question because of being female), so I kept my painting secret."

Dr. Klawe's paintings now appear on the Harvey Mudd College website, a level of visibility she believes helps to dispel myths about engineering and who can become an engineer.



PAMELA MCCAULEY, PH.D.

A professor in the department of industrial engineering and management systems at the University of Central Florida, Pamela McCauley, Ph.D., is an expert on ergonomics, human factors, and biomechanics. She directs the university's Ergonomics Laboratory, leads the Human Factors and Ergonomics in Disaster Management Research team, and is the faculty advisor to the SWE collegiate section. Recently, she completed an assignment with the U.S. State Department as a Jefferson Science Fellow, a program that engages the American academic science and engineering community with U.S. foreign policy.

Dr. McCauley has written more than 80 technical papers, book chapters, and conference proceedings as well as an ergonomics textbook. She frequently speaks on leadership, diversity, and the importance of STEM education, topics that are also addressed in her book, *Transforming Your STEM Career Through*

Leadership and Innovation: Inspiration and Strategies for Women.

An earlier book, *Winners Don't Quit: Today They Call Me Doctor*, describes her personal journey from struggling teen mother to becoming the first African-American woman to receive a Ph.D. in engineering in the state of Oklahoma. The story is highly acclaimed for its inspiring message. Her latest book, *Essentials of Engineering Leadership and Innovation*, was just released.

Dr. McCauley received her B.S. in industrial engineering, as well as her master's and Ph.D., from The University of Oklahoma.



CHRISTINE MERDON, P.E.

Christine Merdon, P.E., is the first female chief operating officer (COO) of the Architect of the Capitol, bringing 30 years of engineering experience to the position. She has exerted tremendous influence on many of the iconic features in Washington, D.C., and the surrounding area. Merdon was responsible for the recently completed Capitol Dome renovation, which posed many technical and logistical challenges. In addition to the high-visibility place the Capitol occupies, there were issues regarding historical preservation, replication of iconic historical construction features, plus deft management of contractors and stakeholders, all requiring skillful navigation.

Merdon has described her position as her "dream job." She has also worked on projects at the White House, Camp

David, and other support facilities. Earlier in her career, she was responsible for managing such visible projects as the Washington Nationals Park, the Martin Luther King Jr. Memorial, and the National Museum of African American History and Culture.

Merdon received her B.S. and M.S. in civil engineering from the University of Maryland, College Park, and actively supports the women in engineering program there. The mother of a teenage daughter, Merdon has written about the importance of serving as an example and role model to young women, particularly young women interested in traditionally male-dominated professions.



ALICIA M. MORGAN

Following more than 13 years in industry, Alicia M. Morgan embarked on a path in the nonprofit sector, applying her professional and educational experiences in this new environment. She is currently the STEM 2.0 insight project researcher for the office of strategic initiatives at the Dallas County Community College District, which provides a web portal for STEM education and resources for middle through high school students.

Morgan graduated from Tuskegee University with a B.S. in aerospace, aeronautical, and astronautical engineering, and holds a master's in industrial engineering from New Mexico State University. Throughout her career, youth outreach has been her priority. A dedicated volunteer for the Dallas SWE

Section, she is active in outreach and programs. She served as advisory board chair for the Academies of Engineering and Biomedical Sciences at Bryan Adams High School in Dallas. As a program leader at Heart House, a nonprofit that provides safety, education, and opportunity to refugee and underserved children, she facilitated STEM learning centers for K-8 grade students. Morgan received the 2016 K-12 Promotion of Education Award at the Women of Color STEM conference.



LORRAINE M. PARKER, PH.D.

Closing a 31-year career as an associate professor of computer science at Virginia Commonwealth University (VCU), in 2013 Lorraine M. Parker, Ph.D., became director of diversity and student programs at the university's school of engineering. Through her innovative programming, Dr. Parker has helped VCU nurture and retain women students — evidenced in the 50 percent increase in the number of women engineering students that has taken place since 2010.

One example of effective advocacy and support for female students is the Vertically Integrated Networking for Engineers (VINE), through which small discipline-specific groups, composed of women in the same discipline but across years of study, meet on a regular basis. Coaching in how to facilitate small group discussions is offered, and each group is asked to do one "give-back" project each year, typically youth outreach.

Dr. Parker received her B.Sc. in mathematical studies from the University of Bath; a Cert.Ed., also from the University of Bath; and a Ph.D. in computer science from the University College of Swansea.



ELAINE PITTS, F.SWE

Elaine Pitts, F.SWE, was instrumental to the growth of the Society of Women Engineers from the early years on, holding numerous leadership positions and assuming responsibility on all levels of the organization, including the board of directors and board of trustees. She worked on the First International Conference of Women Engineers and Scientists, held in 1964, and was a mentor to many younger women.

Pitts had a career with numerous twists and turns, starting as a packaging engineer with a mail order company in her native Chicago, and ending up in New York City as vice president of corporate relations for the Sperry & Hutchinson Co. One of her delights in that position was working with 4-H clubs around the country. After retiring, she moved to California to start a packaging company with an old friend.

Elected a SWE Fellow in 1981, Pitts was also an officer with American Women in Radio and Television and the Society of Packaging and Handling Engineers.

Locally, Pitts was instrumental in saving and expanding the library in her new hometown of Foster City, California. She joined the Rotary Club at age 94, and traveling with her walker, helped

deliver wheelchairs to Mexico as part of a service project.

Pitts was devoted to her husband, Paul, loved traveling, golf, meeting new people, and helping people. For her 99th birthday, the community in Foster City honored her with a party. At press time, we learned that Pitts had just died, a few months shy of her 100th birthday.



LISA THEE

A solution owner in the analytics and artificial intelligence end-to-end solutions team in Intel's Data Center Group, Lisa Thee is a trailblazer in the fight against human trafficking and sexual exploitation of children. Thee led a team of principal engineers and data scientists across Intel for more than a year, performing proof of concepts and contextual inquiries to define a partnership with the National Center for Missing & Exploited Children (NCMEC), a leading nonprofit in child safety.

She is now leading a team to decrease the processing time for reports of child sexual exploitation made to NCMEC's CyberTipline. It can currently take up to 30 days to process some reports and Thee's team hopes to reduce this to one day. She is also working alongside NCMEC's partners, Google and Microsoft, on an analytics platform to connect tools from each company for a streamlined solution for the NCMEC analysts.

Outside of work, Thee is the founder of the GILA project (Gender Injustice to Lifetime Achievement), a Sacramento-based program connecting local

nonprofits to support trafficking and domestic violence survivors who have little or no work history, so they may transition into the workforce and from shelter housing to sustainable independence.

Ther received a Bachelor of Applied Science, industrial and operations research engineering, from the University of Michigan.

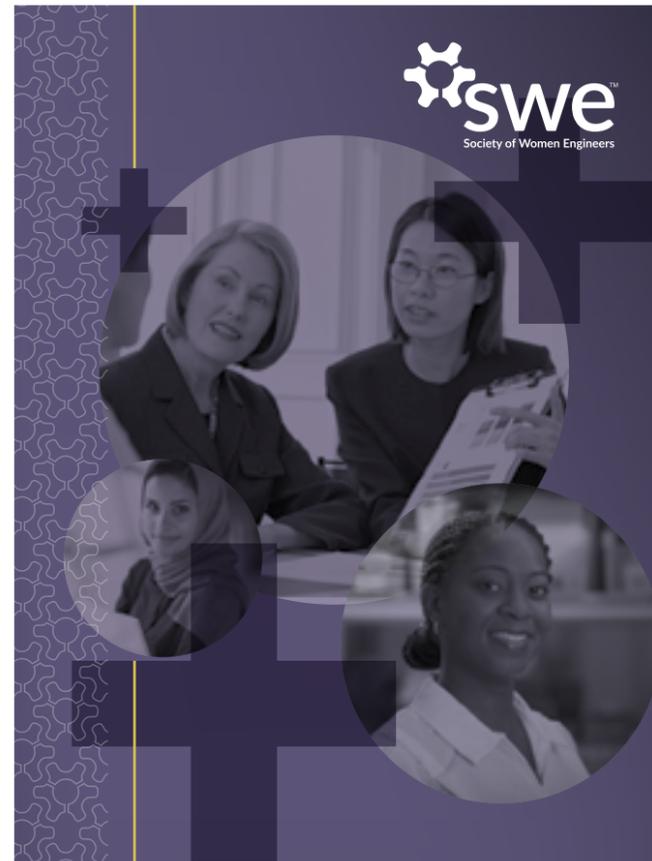


KARAN WATSON, PH.D., P.E.

Currently the provost and executive vice president at Texas A&M University, Karan Watson, Ph.D., P.E., has served the university in many positions at the engineering and university levels. She is a fellow of the Institute of Electrical and Electronics Engineers, the American Society for Engineering Education, the American Association for the Advancement of Science, and ABET. A recipient of the United States President's Award for Mentoring for encouraging women and minorities to succeed in STEM fields, Dr. Watson is an advocate for students. She has chaired the graduate committees of more than 30 doctoral students and more than 60 master's degree students, and is known for "going the extra mile" to counsel those struggling to complete their programs.

Dr. Watson joined the faculty at Texas A&M in 1983, and is also a Regents Professor in the department of electrical and computer engineering, and in the department of computer science and engineering. She is known as a wonderful speaker and engaging storyteller, honoring her Native American heritage.

In addition to her academic responsibilities, she conducts workshops in conflict management. Dr. Watson received her B.S., M.S., and Ph.D. from Texas Tech University, all in electrical engineering. ⚙️



Thank You For Championing A More Welcoming World

SWE's International Champions are organizations that actively create, nurture and sustain global opportunities for women engineers and technologists. Thank you for advancing our mission.

Interested in joining our growing International Champions program?

Visit internationalchamp.swe.org for details.

SWE INTERNATIONAL CHAMPIONS



Be That Role Model. Be That Engineer.



AS I'VE PROGRESSED IN MY CAREER, I'VE ALWAYS HAD SOMEONE IN SWE TO TURN TO WHEN I NEEDED TO. THE EXAMPLES SET BY SWE MEMBERS PUSH ME TO BE A BETTER ENGINEER, MANAGER, AND SWE VOLUNTEER.

It is an exciting time to be an engineer and a member of SWE! Ten years ago, if someone said the term STEM, you might have thought they were talking about flowers, not their child's education. Ten years ago, diversity numbers for tech companies was definitely not making the news.

And, 10 years ago, a movie about African-American women in STEM was definitely not topping the box office. Seeing these items — which directly correlate to SWE's mission — now in the forefront of everyday life is exciting.

Created upon our founding in 1950, and updated in 1986, SWE's mission is to:

Stimulate women to achieve full potential in careers as engineers and leaders, expand the image of the engineering profession as a positive force in improving the quality of life, and demonstrate the value of diversity.

From the beginning, SWE has had positive role models in its ranks. Rear Admiral Grace Murray Hopper, Ph.D., inventor of the first compiler for a computer programming language and a founding member of the Society, received the SWE Achievement Award in 1964. Yvonne Brill, known for her development of rocket and jet propulsion technologies, was a SWE Fellow and also received SWE's Achievement Award, in 1986, and Resnik Challenger Medal in 1993. And our first SWE Society president, Beatrice Hicks, P.E., will be inducted into the National Inventors Hall of Fame in May for a gas density switch that was used in the U.S. space program. These women were trailblazers. They did not have excellent engineers and role models to look up to, such as those featured in our "Women Engineers You Should Know" article appearing in this issue.

Why are role models important? It has been widely researched that you have to see it to be it. When most films have males speaking more than two-thirds of the time and when you have no women engineers on any mainstream TV shows, it makes it much more difficult for a girl to see herself in the role. We've seen the rise in women in medicine and law due, in part, to TV programs over the last few decades. This is why having two movies — "Hidden Figures" and "Dream Big"

— released already in 2017 with female engineering leads is a big deal.

So what can you do? Be that role model. I joined SWE because of the big sib/little sib mentoring program my first year at the University of Wisconsin-Madison. My big sib showed me around campus, helped me buy books, and took me to my first SWE meeting. As the year progressed, other upper-class SWE mentors helped me select my classes and professors for upcoming semesters. They were the ones to tell me that a C in calculus II was not the end of the world and that I was not failing out of engineering school. They told me how women drop out of engineering with 3.2 GPAs, thinking they are not succeeding, when male students wait until they are dropped from the department with 2.0 GPAs. If I did not have these mentors, I would have not been an engineer.

As I've progressed in my career, I've always had someone in SWE to turn to when I needed to. The examples set by SWE members push me to be a better engineer, manager, and SWE volunteer. So, volunteer your time for outreach. Host joint collegiate section and professional section events. Take a group of girls to see "Dream Big." Run for a SWE office. Run for a political office. Advocate. Be that role model. Be that engineer.



Jessica Rannow
SWE FY17 President
@SWE_President

Investing Yourself in the Right Company

Finding the right job requires preparation and effort, but the results are worth it.

By Catherine Rocky, SWE Editorial Board

Imagine yourself in the right job, right career path, right company, in the right industry. Is it the Fortune 500 manufacturer or consulting firm, a small start-up, or the sole engineer working remotely with a supervisor hundreds of miles away?

Determining where you want to be should be your goal, whether you figure it out while in college before your professional life begins, or at any point along the way. Getting there requires an investment of time and energy to understand both how you apply your degree and address your own needs. If you are in the wrong job, career path, company, or in the entirely wrong industry, there is still time to get on track.

WHAT'S IMPORTANT VERSUS WHAT'S REALLY IMPORTANT

We consider certain factors important to our professional lives: compensation, benefits, location, company reputation, work environment, opportunities for advancement, and professional recognition. Possibly more important, however, are work/life integration, purposeful work, being engaged in the job, having challenges, making a contribution, an opportunity to benefit society, and a life well lived.

Traditionally, the college or university experience includes choosing a major, working to graduate with minimal debt, and then finding a job. *The Wall Street Journal* recently stated, "Most colleges and universities spend too much of their energy getting young people in the front door and not enough making sure they land good jobs on their way out." With this in mind, one should consider career possibilities and utilize career services early on. This is still important whether in college, about to graduate, or

in the work force. It is essential to do the research to find the right career for you. This process involves first identifying industries, and then the associated companies and typical roles or jobs available.

How much do you know about the industries and companies in which you're interested? This knowledge is necessary before you get that first opportunity to talk with a prospective employer. At WE16, I walked around the exhibitors hall, asking two questions:

- How much do the candidates know about your company?
- What should they know about your company?

I received candid comments from technical and human resources representatives of more than 20 companies and organizations. Overall, they felt it was important for candidates to be prepared before submitting resumes or talking with representatives. They could tell those who did their homework. Expecting that professionals are well researched and graduating students to be knowledgeable, they offer more leeway to interns just learning the basics of their companies. Just wanting a job is not good enough for a successful match. One company representative suggested asking yourself what was your favorite class, then go find a job related to that subject.

CLUED IN TO CLUELESS

Although representatives felt that in general, WE16 job candidates are well informed and offer lots of talent, the foremost comment concerned candidates who walk up to the representative and ask, "What do you guys do?" This hardly leaves a favorable first impression. Companies stated that knowledge of their organizations ranged from none to some gleaned from websites,

to those who knew quite a bit (usually well-known brands that have name recognition). One representative observed that candidates who visited their booth on opening day, then again on the next, were at least a little more knowledgeable.

Job seekers fall short when they might know the company name or a few products, but did not research enough to know all that they made; or when they have general knowledge but don't know about key services or products, or industry recognition. Candidates also fall short by not understanding that companies hire all different types of engineers; and that there are many unrealized opportunities, such as hiring a candidate with a degree outside the typical. In addition, situations not usually thought of as needing engineers — such as finance, business units such as sales and program management — may offer opportunities. Don't be afraid to ask if there is an opening in a nontraditional area.

WHAT YOU SHOULD KNOW: INDUSTRIES AND COMPANIES

Candidates should know key information, such as company mission, the industry the company is part of, their global footprint, the specifics about what they make or do, their brands, and for whom they provide their products or services. Job seekers need to understand where the company fits and how it impacts the world — manufacturing retail or commercial products, designing infrastructure, etc. Many companies are in "hidden" industries, with products most people don't know about. Too many candidates are seen as generalists and not willing to pick a career path.

So how can you learn about your career opportunities? Start by understanding the U.S. and world economy.



There were more than 300 companies, universities, and institutions at the WE16 career fair, providing job seekers and potential employers an opportunity to connect.

Look at business sectors — a part of the economy made up of companies and comprising industries. An industry is the production of goods or related services and includes a specific group of companies with similar business activities.

Why is this important? Because your choice of industry needs to be interesting and something you care about. Depending upon your career path, you might get locked into an industry (specific knowledge) with an increased or reduced need for your degree. The more you work, the more specific knowledge and experience you have that is transferable. If you switch industries, are your degree and experience transferable? Most likely the answer will be yes, but there will be a new vocabulary, processes, customers, competitors, co-workers, experts, and management to learn about.

COMPANY SIZE AND OWNERSHIP

Consider what size company you want to work for. They are generally categorized as large, midsize, or small (which are often start-up partnerships). Business size matters because it can define your opportunities.

The next criteria are structure and ownership. Employers are organized different ways, including: publicly traded (think Fortune 500), privately held, employee-owned, nonprofit, trade/professional organizations, and government. It's easier to find informa-

IF YOU ARE IN THE WRONG JOB, CAREER PATH, COMPANY, OR IN THE ENTIRELY WRONG INDUSTRY, THERE IS STILL TIME TO GET ON TRACK.

tion about publicly traded companies, such as in business journals or required annual reports (SEC 10-K) that include details on other important information such as: company name and subsidiaries, operations locations, income and expenses, competitors, assets and liabilities, and plans.

Private companies may be owned by a family, specific employees, or investor groups. *Forbes* magazine lists 223 companies with combined revenues of \$1.62 trillion, and employ more than 4.5 million in 35 states and industries from every part of the economy. The challenge is that information is generally not

available to the public. Employee-owned companies are not required to file an annual report with the government. They are at least 50 percent owned by an employee stock ownership plan (ESOP) or other plan. The employees are the shareholders who sell their stock when they leave the company.

JOB ROLES AND YOUR CAREER

Role and title are not necessarily the same, so don't overthink job title, which is often a business card label or your external identity. Focus on role/function and the purpose of your work. Read the job description and identify opportunities for leadership, impact, and growth. Think outside the traditional view of an engineer: design/project/product/program/software, etc. It does not matter what type of engineer you are because a traditional engineer is more than the technical side — it's business!

You will likely be part of multifunctional teams including accounting, marketing, and HR, with opportunities for selling your idea, product, project, etc. For career growth, seek out leadership opportunities, find a sponsor and men-

tor, and look at the management track available. Follow the process to gather the right information to make informed decisions, and you can do more than just imagine the right job in the right company on the right career path — you can make it really happen! ✨

Catherine Rocky is a national account manager with Terracon Consultants Inc. She has a B.S. in geological engineering from South Dakota School of Mines and Technology. Rocky is past president of the Wichita Council of Engineering Societies. She is an at large member of Region i and a member of the SWE Magazine editorial board.

The “R” Word

Contemplating and preparing for a major life transition can be daunting and exciting at the same time. Though the journey toward retirement is highly personal, there are some perspectives and shared wisdom that may apply to all of us.

By Mary Verstraete, Ph.D., F.SWE, SWE Editorial Board

For the last few years, that “R” word — *retirement* — has been creeping into my vocabulary. I’ve been at my current job for almost 30 years and although I could probably stay for another 15 years, I’m ready for a change. The question I have been asking myself is, “What’s next?”

Two clear emotions immediately strike when I think about retiring: joy and fear. The first confirms that it is probably time for a change; the second one reminds me that change can be scary.

Given that retirement is a very personal journey, you may be able to relate a bit better if I tell you a bit about myself. I am single and always have been. No children, but I have two goddaughters I’m crazy about who are both in college. I’m open to relationships in the future, but it’s just not a requirement (why do I suddenly feel like I’m writing a personal ad?). I’ve already dealt with aging-parent issues as both of my parents have passed after dealing with some serious health issues. I have only one older sister (also single), who may or may not have medical issues in the future (not something we can really plan around), and lives eight hours away.

At the age of 40, I hired a financial planner to help me plan for retirement. I will have a good pension, decent savings, and a bit of an inheritance when I retire, so I should be financially stable as I enter this next stage of my life. Thus, I won’t necessarily need to work for financial reasons.

A YEAR OF “BEING” AND THEN WHAT?

One thing I am certain of is that I want to take a year to simply “be.” To

do all of the things I don’t have time to do on a daily basis: paint the bedroom, finish remodeling the basement, weed the gardens regularly, take a hike in the middle of a Wednesday morning, try new recipes, go to a movie in the afternoon, become a regular at the gym, etc. I could go on for pages here; everyone probably can. And travel, definitely travel. However, I also know

TWO CLEAR EMOTIONS IMMEDIATELY STRIKE WHEN I THINK ABOUT RETIRING: JOY AND FEAR. THE FIRST CONFIRMS THAT IT IS PROBABLY TIME FOR A CHANGE; THE SECOND ONE REMINDS ME THAT CHANGE CAN BE SCARY.

myself pretty well and understand that during that first year it would also be easy to become sedentary and potentially depressed due to the lack of a fixed schedule and the workload I am used to. For many years, I have worked 8-12 hours a day, sometimes six days a week. So sitting on the couch watching TV or reading a book is not something I would be happy with for long periods of time, but I have spent a Sunday binging on movies. I’m a doer, a mover (not a shaker). I enjoy physical activity but also understand the laws of inertia that tend to draw us to the couch.

So the real question is, after that first year — then what? Do I get another job doing something similar to what I’ve been doing? Do I find a new career? Do I get a part-time job? Or do I simply volunteer my time to the numerous causes I’m passionate about? There are a lot of things to think about and, depend-

ing on the answer, there are also some necessary preparations. Not being one to make firm plans for the future (because, regardless of your plans, life happens), I have a number of “ideas” or thoughts of things I want to do.

First, I don’t really want to be tied down to a 9-to-5-type job or career. I want the freedom in my schedule to travel, to volunteer when the opportu-

nity arises, or to simply drop everything and go out to lunch with a friend. So that precludes most full-time jobs and many part-time jobs. Employers typically want you to have a relatively fixed schedule, although some may be more flexible.

I also have a burning desire to do something creative. I have always been equally right/left brained and haven’t had time to feed my creative side much during my career. When I left high school, I wanted to be an artist or a writer (which is one of the things that drew me to the SWE editorial board). Both pursuits would require some training and practice, so maybe a class or two during that first year would also be a good idea. I also love photography and am looking forward to taking good pictures, not just by accident, but purposefully. Maybe I’m good enough to sell them; only time will tell.



I WANT THE FREEDOM IN MY SCHEDULE TO TRAVEL, TO VOLUNTEER WHEN THE OPPORTUNITY ARISES, OR TO SIMPLY DROP EVERYTHING AND GO OUT TO LUNCH WITH A FRIEND.

So where does that leave me as I plan my retirement? At this moment, I’m not sure, and I’m becoming more comfortable with not being sure. No one says I have to be sure. I have the flexibility to try something, and if it isn’t what I want, try something else. So I will continue to have ideas — maybe I’ll even make a list, perhaps even a bucket list. And as I finish writing this, the fear has lessened and the joy has given me something to look forward to on this gray Friday afternoon, sitting at my desk, trying not to think about the mountains of work waiting for me to turn my attention to. ✨

Mary C. Verstraete, Ph.D., F.SWE, is an associate professor of biomedical engineering and interim associate dean for undergraduate studies at The University of Akron. A member of the SWE Magazine editorial board, Dr. Verstraete was named SWE’s Distinguished Engineering Educator in 2007, received the Society’s Outstanding Faculty Advisor Award in 2011, and became a SWE Fellow in 2016.

Hidden Figures: A Comparison of the Book and the Film

Hidden Figures: The American Dream and the Untold Story of the Black Women Mathematicians Who Helped Win the Space Race

By Margot Lee Shetterly

William Morrow Paperbacks; Reprint edition, December 2016

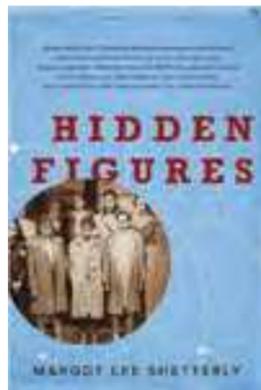
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Film version released Dec. 25, 2016, 20th Century Fox

Screenplay by Theodore Melfi and Allison Schroeder; directed by Theodore Melfi

By Marcie Mathis, SWE Editorial Board



The women were assigned to central offices, known as computer pools, which were segregated — one for blacks and one for whites. Engineers would run tests, originally for warplanes and later for spacecraft, and provide the copious data, with the needed equations, to the computer pools. Using basic calculating machines, the women crunched the numbers by hand, saving

The movie is entertaining and tells the story in a more concise way, but the book spends quite a bit of time on the women's backgrounds. The timeline of events is somewhat different in the movie, making it possible to cover some significant events within a reasonable time frame. The movie also dramatizes a couple of situations that the book merely mentions. Both the book and the film help to put you in the mindset of that era, and paint a picture of what life was like for these women and their families.

Written by Margot Lee Shetterly, the book is well researched and tells a more accurate account. It includes the stories of more than the three women featured in the movie, and as well as much more history of the space program. The book

I read the book *Hidden Figures* before seeing the movie and found them both worthwhile. If you have the time, I recommend that you experience both. If you don't have time, I recommend — if you haven't already — you see the film.

The movie gives life to the story of three African-American women — Katherine G. Johnson, Dorothy Vaughan, and Mary Jackson — with degrees in math, who worked as human “computers” at the National Aeronautics and Space Administration (NASA) during the United States' race to get astronauts in space and on the moon.

Originally hired by the National Advisory Committee for Aeronautics (NACA) during World War II, the women stayed on when NASA was formed in 1958.

the engineers time.

While their jobs as computers seem menial for someone with a college degree in math when compared with their white male engineer counterparts, working at NASA paid significantly more

WORKING AT NASA PAID SIGNIFICANTLY MORE THAN THE MORE COMMON OPTION FOR AN EDUCATED BLACK WOMAN IN 1940S AND 1950S SEGREGATED VIRGINIA, WHICH WAS TEACHING AT A BLACK SCHOOL.

than the more common option for an educated black woman in 1940s and 1950s segregated Virginia, which was teaching at a black school. This is one of the points included in the book, but the movie doesn't mention.

also describes how times were changing for black women and men. The epilogue provides additional information, including excerpts from discussions the author had with the real women behind the stories.

While I am glad I read the book, with all the extra information it included, I am thankful the movie is so well done, and is so entertaining, because the stories need to be told, and the movie continues to attract a wide, receptive audience. People are watching the movie and learning about the meaningful, but previously hidden, contributions these women made.

At the end of the film, it was interesting to see some pictures of the actual

women. One of the key NASA mathematicians in the story, Katherine Johnson, received the Presidential Medal of Freedom in 2015. In a *Los Angeles Times* interview, she was asked, “Do you have any thoughts on how to get more women and people of color into math, science and engineering?” Johnson replied, “Go see ‘Hidden Figures,’ and take a young person! It will give a more positive outlook on what is possible if you work hard, do your best, and are prepared.” ✨

Marcie Mathis graduated from the University of Washington with a bachelor's degree in electrical engineering. She has spent most of her engineering career as a civilian U.S. Navy employee and currently works at the Puget Sound Naval Shipyard and Intermediate Maintenance Facility in Bremerton, Washington. Mathis joined SWE in 1988 as a student and currently serves on the multicultural committee and as a member of the SWE Magazine editorial board.

Headstrong: 52 Women Who Changed Science — and the World

By Rachel Swaby

Broadway Books, April 2015

ISBN-10: 0553446797

ISBN-13: 978-0553446791

Paperback, 288 pages

By Marilyn Reeder, F.SWE, SWE Editorial Board

The first paragraph of the introduction to *Headstrong* grabbed my attention immediately. The woman recognized as the inspiration for the book was a woman I knew and respected. SWE members are very familiar with Yvonne Brill, F.SWE, a woman who has been recognized by the Society many times, including through both the Achievement Award and the Resnik Challenger Medal. She received the American Association of Engineering Societies' John Fritz Medal in 2009, and President Barack Obama presented her the National Medal of Technology and Innovation in 2011, recognizing her achievements in rocket propulsion satellites. Yet, upon her passing in 2013, *The New York Times* published an obituary that focused on her cooking skills and domestic life before mentioning that she was a brilliant rocket scientist. As Swaby points

out, “Oh right. That.” An uproar ensued and the obituary was revised to focus on Brill's achievements.

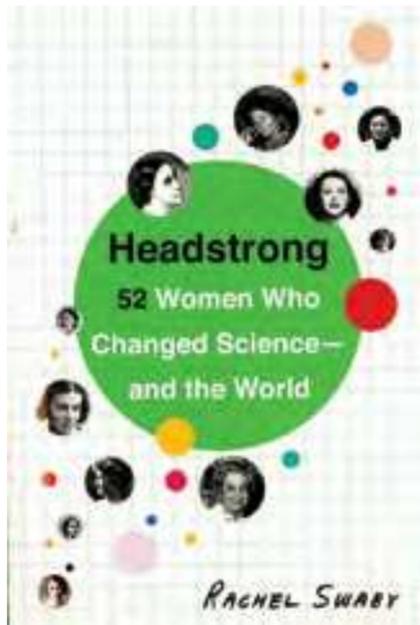
In a time when women who have made contributions to the STEM fields are being recognized, albeit way too late, as in *Rosie's Mom: Forgotten Women Workers of the First World War* and *Hidden Figures*, this book provides some insight into the contributions of women in many areas of science and technology. *Headstrong* is divided into seven sections focusing on the areas of medicine, biology and the environment, genetics and development, physics, earth and stars, math and technology, and invention.

In addition to Brill, a number of the names will be familiar as prominent women of science: Grace Murray Hopper, Ph.D.; Rachel Carson; and Sally Ride, Ph.D. Others are familiar as a result of other parts of their lives,

Florence Nightingale and Hedy Lamarr, for example. Only scientists whose lives have been completed are included. This was to ensure that their lasting influence is clear. Unfortunately, because the entry of women of color into STEM was delayed there is little diversity.

Some of the women included here have vaguely familiar names. Virginia Apgar, M.D., developed the Apgar score used to assess a newborn's health. Maria Mitchell was one of the first Americans to discover a comet and chart its orbit. Inge Lehmann discovered the Earth's inner core through her work in seismology. Mary Cartwright, D.Phil., a mathematician, is credited with early work in chaos theory.

Some of the women in *Headstrong* have been showcased in SWE's ongoing series “Women Engineers You Should Know,” which appears in this issue of



the magazine. For example, Yvonne Brill, F.SWE; Hedy Lamarr; Ada Byron Lovelace; and Rear Admiral Grace Murray Hopper, Ph.D., have been identified as “Women Engineers You Should Know.” And, some women we have showcased in our series may very well find themselves among the women in this book someday.

Swaby presents the profiles in this book in an engaging way. Each can be read in a short time. The write-ups include some history and insight on why the women chose their particular fields. The challenges that some faced can seem almost insurmountable, but they persevered. These women are an inspiration as we move through our own careers. It is gratifying to know that

many of them provided significant input to the STEM fields as early as the 1700s.

There are 52 women showcased in this book, and there are 52 weeks in a year. If you don’t have time to read this book at one time, set a copy on your desk, and each week when you are facing a difficult challenge or a trying day, read just one of these profiles. It will give you a fresh perspective. ✨

Marilyn Reeder, F.SWE, is a project manager for Westinghouse Electric Co. in Cranberry Township, Pennsylvania, where she works on new nuclear power plant digital control systems. She is past chair of the SWE Magazine editorial board and a member of the Pittsburgh Section. Reeder was named a SWE Fellow in 2013.

LGBTQ+ Role Models

Most of us would agree that role models are important, and I would add that they are especially important to people who are lesbian, gay, bisexual, transgender, questioning, queer, and gender nonconforming.

By Marcie Mathis, SWE Editorial Board

Role models are key to getting more young people interested in science, technology, engineering, and math (STEM). SWE understands the importance of this in terms of reaching and encouraging girls and young women. For LGBTQ+ young people, this is not just about getting them interested in STEM, role models and mentors can be essential to their thriving, and in some cases, even life saving. This is part of what the campaign called “It Gets Better” was about. From www.itgetsbetter.org: “Growing up isn’t easy. Many young people face daily tormenting and bullying, leading them to feel like they have nowhere to turn. This is especially true for LGBT kids and teens, who often hide their sexuality for fear of bullying. Without other openly gay adults and mentors in their lives, they can’t imagine what their future may hold.”

According to the Center for Disease Control and Prevention, the rate of suicide attempts is four times greater for lesbian, gay, and bisexual youth and two times greater for questioning youth than that of straight youth. In the 2015 U.S. National Transgender Survey (National Center for Transgender Equality) 40 percent of transgender adults reported having made a suicide attempt. 92 percent of these individuals reported having attempted suicide before the age of 25.

In a practice brief called “Helping Families to Support Their Lesbian, Gay, Bisexual, and Transgender (LGBT) Children” (by Caitlin Ryan, Ph.D., director, Family Acceptance Project™ – San Francisco State University), there is a list of “Family Behaviors that Reduce Your LGBT Child’s Risk for Health and Mental

Health Problems and Help Promote Their Well-Being.” The list includes: “Connect your child with an LGBT adult role model to show them options for the future.”

Role models and mentors are important in college and workplaces, too. More than once, students have stopped by the National Organization of Gay and Lesbian Scientists and Technical Professionals (NOGLSTP) table at the SWE annual conference career fair and asked me: “Do I need to go back in the closet to get a job?” and “How can I tell which companies would accept me the way I am?” There are many companies that are LGBTQ+ friendly, but may not have any-

neering, and math fields. These are not the stereotypical jobs for LGBTQ folks, and it is important for people to know the breadth of opportunities out there and that if you are LGBTQ+ you aren’t limited to certain jobs or places to work.

A challenge for an LGBTQ role model is that you have to work a little harder to be obvious than say, a person of color, because being LGBTQ is not something you can necessarily tell by a person’s appearance. That means that to be a role model, you have to be out yourself, and obvious enough about it that other folks can recognize you as an out LGBTQ role model.

BEING OUT IS A BRAVE, PERSONAL CHOICE. IF YOU ARE STRUGGLING WITH THAT CHOICE, REMEMBER WHAT THE WORLD IS LOSING BY NOT HAVING MORE PEOPLE WITH THE COURAGE TO CHOOSE BEING ROLE MODELS.

thing obvious at their career fair booth that indicates so. Companies need to be obvious if they are serious about diverse hiring that includes LGBTQ+ employees. Even better, the companies can have an LGBTQ person at their career fair booth. It is also important for people already working to have role models and mentors — happy and successful out leaders and mentors.

Yes, things have progressed as far as LGBTQ rights and acceptance in the workplace, but people are still being rejected by their families, and youth are being kicked out of their homes, for who they are and whom they love. This makes role models and mentors for LGBTQ people essential in general, and even more important for science, engi-

Being out is a brave, personal choice, but if you are struggling with that choice, remember what the world is losing by not having more people with the courage to choose being role models. ✨

Marcie Mathis graduated from the University of Washington with a bachelor’s degree in electrical engineering. She has spent most of her engineering career as a civilian U.S. Navy employee and currently works at the Puget Sound Naval Shipyard and Intermediate Maintenance Facility in Bremerton, Washington. Mathis joined SWE in 1988 as a student and currently serves on the multicultural committee and as a member of the SWE Magazine editorial board.

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Mildred Spiewak Dresselhaus, Ph.D.

Inspirational “queen of carbon science,” recipient of numerous awards, including the Presidential Medal of Freedom

1930 – 2017



Mildred Spiewak Dresselhaus, Ph.D., member of the SWE Boston Section and faculty member at MIT for more than 55 years, died Feb. 20, 2017. A pioneer in the field of carbon science and nanoscience, she held five U.S. patents and was the author/co-author of more than 1,400 publications. Her groundbreaking work was recognized relatively early in her career with the SWE Achievement Award in 1977, followed by many others. These included the National Medal of Science in Engineering (the first female recipient), the Enrico Fermi Award, the Vannevar Bush Award, the Kavli Prize, the IEEE Medal of Honor (also the first female recipient), and the Presidential Medal of Freedom. Dr. Dresselhaus was the first female Institute Professor at MIT, an honor awarded by the faculty and administration for distinguished ac-

complishments across several platforms.

Dr. Dresselhaus overcame gender barriers throughout her long and productive career, promoted opportunities for women in science and engineering, and mentored many.

It was the mentorship and influence of other women — particularly Nobel laureate Rosalyn S. Yalow, Ph.D., and Abby Rockefeller Mauzé — whom Dr. Dresselhaus attributed as being so important at pivotal

moments in her own career. In an interview with *SWE Magazine* (Spring 2015), following her receipt of the Presidential Medal of Freedom and the IEEE Medal of Honor, Dr. Dresselhaus reflected on this.

“What helped me is that historically, from my very early years, my inspiration almost always came from women in some form,” she said. First and foremost, her mother encouraged her to be a good student. Later, Dr. Yalow was her teacher at Hunter College High School on Manhattan’s Upper East Side, and the two stayed in touch. Dr. Dresselhaus recalled that “she had similar kinds of problems as I would face ... she encouraged me to go seriously into science.” The funding that Abby Rockefeller Mauzé provided for female professors at MIT also provided important encouragement. Dr. Dresselhaus explained: “She funded a sitting professorship for

women in science and engineering. I was an early beneficiary. These fields are important for society, and women weren’t there.” It was because of that professorship, Dr. Dresselhaus said, that “the faucet was opened.”

Another mentor was Nobel laureate Enrico Fermi, Ph.D., under whom she studied at The University of Chicago, where she received her Ph.D. in 1958.

Discussing the importance of advocacy in the same interview, Dr. Dresselhaus noted, “I’ve been involved with SWE since the 1960s.” As an Achievement Award recipient, she became a lifetime member, and her presence was felt at SWE Boston and SWE MIT Collegiate Section activities in particular. Longtime members fondly recalled their memories of “Millie.” Beth Silverman noted that at one MIT section activity, “in the early to mid-1990s, she came in. Other than her hair — gray and in her traditional pinned-up braids — she looked just like the students, in jeans and a sweater!”

On news of Dr. Dresselhaus’ death, the SWE Boston newsletter reprinted an article from 2013, which recapped a professional development meeting in which she was the featured speaker. Quoting the advice dispensed by Dr. Dresselhaus that evening, “when disaster strikes, don’t despair but patiently try to find your new path.”

Dr. Dresselhaus is survived by her husband, Gene, and their four children and their families. ✨

—Anne Perusek
Sources: SWE Archives
SWE Boston Newsletter
MIT News, news.mit.edu

Elizabeth Iva “Pete” Plunkett

Aviation pioneer, member of SWE’s first class of Fellows

1925 – 2016



A member of the Society’s first class of Fellows, Elizabeth I. “Pete” Plunkett was one of eight women selected for the honor, based on “outstanding service to the advancement of public awareness of engineering as a profession for women.”

Plunkett spent her entire career with The Boeing Company, based in Seattle. She started out as a “draftsman” in the summer of 1944 while still attending the University of Washington, where she studied mechanical engineering. In 1946, she became a research engineer, and over the years had increasing responsibility for test programs.

She spent several years as a research analyst and test director of aeroelastic models of hypersonic orbital and space flight systems in the early days of the U.S. space program. Plunkett advanced to become engineering technical laboratory manager — responsible for two laboratories that provided experimental test facilities for all commercial airplanes.

In an oral history, Plunkett recalled how much it meant when, relatively early in her career, supervisors showed their support by sending her to the 1956 SWE convention in Detroit. It was her first airplane ride and her first exposure to the supportive atmosphere of SWE.

Plunkett’s service to the Pacific Northwest Section and on the Society level continued through her retirement — beginning as Pacific Northwest Section chairman in 1957 to serving on the nominating committee from 1982-85. In between, she held such positions as membership committee chair, member of the executive committee (now the board of directors), section representative many times over, and was the 1971 national convention co-chair. At the First International Conference of

Women Engineers and Scientists, held in 1964, Plunkett participated in the “Parade of States.”

In addition to SWE, Plunkett was an officer in the American Institute of Aeronautics and Astronautics. She was the first woman president of the Puget Sound Engineering Council, which was composed of 22 engineering societies, at the time representing 6,000 engineers, a position she held for two terms. Plunkett was a member of the Women’s Education Equality Project at Everett Community College, as well as other local and national organizations.

Together with her friend, SWE member Shirley Holmgreen, she built what would become a retirement home at Cape San Juan, on San Juan Island. In retirement, she was president of the homeowners association from 1986-1999, chaired the citizens water advisory committee for San Juan County for six years, and was a volunteer firefighter for 17 years.

Additional civic engagement included serving on the Cape San Juan District Board for nine years; being an active member of the U.S. Power Squadrons®; and teaching engine maintenance for the Friday Harbor squadron.

Plunkett enjoyed power boating and traveling through the U.S. and Canada. She died Sept. 22, 2016, and is survived by a niece, a nephew, and many friends. ✨

—Anne Perusek
Sources: SWE Archives; *The Seattle Times*, Oct. 17-18, 2016



Maxine Rogers

SWE senior member, participated in Parade of States at first ICWES in 1964

1926–2016



A copy of the letter from Governor George Wallace of Alabama, designating Rogers (then Rose) the official delegate from the state. Wallace became a controversial figure in the emerging civil rights movement, and later was a candidate for the U.S. presidency in 1968.

By appointment of the governor of Alabama, Maxine Rogers was the official representative of the state, participating as a delegate at the first meeting of the International Conference of Women Engineers and Scientists (ICWES), which was established by SWE. Held in New York City in conjunction with the 1964 World's Fair, ICWES brought together women engineers and scientists from across the globe for their first organized international meeting. On the opening day of the conference, attendees visited the Fair, which culminated in the "Parade of States," shown above, at the Federal Pavilion. As part of this parade of delegates from 35 countries and 47 U.S. states, Rogers helped make an impressive statement.

SWE recently received word that early member, and senior grade member, Maxine Rogers (Pieri) died in August 2016. Born May 19, 1926, Rogers joined SWE in 1963 and was the official representative of the state of Alabama in the "Parade of States" that took place during the first meeting of the International Conference of Women Engineers and Scientists in 1964.

Rogers spent most of her career in aerospace, primarily with The Boeing Company. She also was an independent consultant, working both in the United States and France, where she resided for a time with her second husband, Jean-Claude Pieri. Later in life, she reclaimed her birth name of Rogers, though contemporaries may remember her by her married names (Rose and Pieri) as well.

She attended Seattle University and The University of Alabama, Huntsville, where she majored in physical sciences and mathematics. Rogers received

additional training through technical and professional management courses offered by The Boeing Company to aerospace research staff.

From 1955 until 1970, she was a systems engineer with Boeing, working from Seattle, as well as at the Kennedy Space Center in Florida; NASA's Marshall Space Flight Center in Huntsville, Alabama; and at the Eglin Air Force Base in Florida.

Rogers participated in all major engineering aspects from design and development through flight test, check out, and launch for the BOMARC missile weapons systems and the Apollo/Saturn V lunar research program, and the Apollo missions, from Apollo 1 through Apollo 13.

A member of the North Alabama Section and, through much of her career a member-at-large, Rogers supported national conferences and maintained contact with her network of SWE friends and associates.

From a historical perspective, Rogers came of age during the post World War II period — a time when university course work, combined with company training and apprentice learning, still allowed one to perform as an engineer. While the nature of her work and the technical problems she solved clearly placed her in the realm of engineer, the lack of a university degree put her at a disadvantage when her credentials were reviewed, and on her initial membership application to SWE. It required letters from her employer as well as the word of a SWE president familiar with her work to allow her membership application to proceed. Such was the membership standard at a time when women were attempting to gain a foothold in the profession and be taken seriously.

Rogers retired in 1992. ✨

— Anne Perusek
Source: SWE Archives

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The 50K Coalition



professional members collectively), have formed the 50K Coalition focused on a bold national goal of producing 50,000 diverse engineering graduates annually by 2025. The 50K Coalition will achieve this goal by focusing the collective action of its members on the following agenda:

- **Undergraduate support and retention** — increasing college and universities' ability to recruit, enroll, retain, and graduate more women and underrepresented minority students (URM).
- **K-12 support** — raising awareness and interest in engineering and proficiency with math and science early in the K-12 education pipeline.
- **Public awareness/marketing** — promote the promise and awareness of engineering in creative ways that make it more appealing to URM students across genders.
- **Community college linkages** — building intentional linkages between community colleges and

Imagine a world in which everyone had access to clean water, life-saving medical equipment and technology, and affordable and sustainable housing and transportation. All this takes engineering. In very real and concrete ways, engineers save lives, prevent disease, reduce poverty, and protect our planet.

And, as the number of jobs requiring engineering education grows within the United States, the number of students preparing for those careers remains level, with women and minorities severely underrepresented. This imbalance threatens our future economic competitiveness, our quality of life, and our national security.

Currently, the U.S. produces about 30,000 engineers per year at the bachelor's level from diverse populations. Together, the American Indian Science and Engineering Society (AISES), the National Society of Black Engineers (NSBE), the Society of Hispanic Professional Engineers (SHPE), and the Society of Women Engineers (SWE), the preeminent diversity engineering organizations (currently serving some 75,000 precollegiate, collegiate, and

colleges of engineering as an important component of the engineering graduate pipeline.

COMMUNITY-LEVEL CHANGE REQUIRES THE CONCERTED EFFORTS OF THE MANY PLAYERS WHO CAN CONTRIBUTE TO BETTER SYSTEM PERFORMANCE TO BAND TOGETHER AROUND A COMMON AGENDA.

- **Culture and climate** — efforts that give attention to improving the climates and cultures of higher education institutions and workplaces; norms that are conducive and aligned to URM students across

genders and ethnic cultures.

- **Funding/financial support** — lowering the financial barriers to entry and completion in engineering and also strategies to obtain funding to sustain and scale activities by academic institutions that work.

Our more than 146 years of collective expertise perfectly positions us to tackle this goal. And through our partnership with the members of the 50K Coalition, we will broaden our reach across the entire engineering community.

With a focus on producing original research, sharing of best practices and thought-leader resources, collaborative K-12 outreach and university campus activities, and effective messaging and advocacy, we will have a transformative impact on the engineering community.

The 50K Coalition will use a Collective Impact^[1] framework to develop an evidence-based approach that will inform management decision-making, coalition members' program improvements, sharing of information, and coalition-member-driven collective action toward achieving the bold national

goal of 50,000 diverse engineering graduates annually by 2025.

The idea of collective action is pretty simple. No single program, organization, or academic institution acting in isolation can bring about large-scale social change on its own. Community-level change requires the concerted efforts of the many players who can contribute to better system performance to band

together around a common agenda. Collective action is a new way of working that allows individual efforts to add up to big change^[1].

Collective impact brings people together, in a structured way, to achieve social change. The five criteria for collective impact success are:

- Agreeing to a common agenda; coming together to collectively define the problem and creating a shared vision to solve it.
- Establishing a shared measurement; agreeing to track progress in the same way, which allows for continuous improvement.
- Fostering mutually reinforcing activities; coordinating collective efforts as needed to maximize the end result.
- Encouraging continuous communication; building trust and relationships among all participants.
- Having a strong backbone organization; having a team dedicated to orchestrating and supporting the work of the 50K Coalition.

The 50K Coalition is not another program, but a sustained and structured collaboration of associations, colleges and universities, agencies, corporations, and foundations that will work toward common goals by leveraging their distinctive missions, relationships, and institutional memory.

By acting together in this powerful way, we will have a tremendous collective impact on the future landscape of the underrepresented minority engineering community. We are confident that our comprehensive strategy and business plan will move us collectively toward fulfilling the 50K Coalition goal of "50,000 diverse engineering graduates annually by 2025!"

Karen Horting

Karen Horting, CAE
Executive Director & CEO

1. Collective Impact, John Kania and Mark Kramer, *Stanford Social Innovation Review*, Winter 2011.

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Challenging Assignments, Day Care Hours

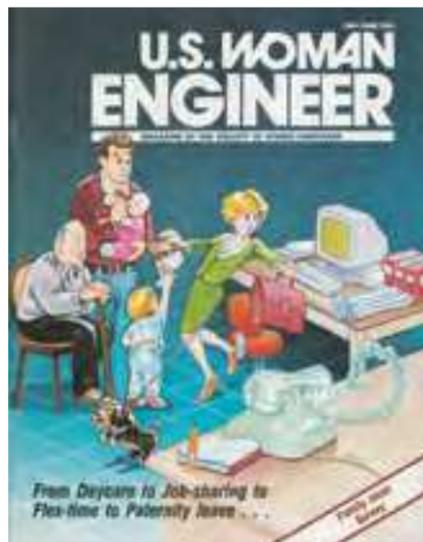
“Women aged 30 to 39 feel the family-work conflict strongly,” according to SWE’s 1993 “A National Survey of Women and Men Engineers: A Study of the Members of 22 Engineering Societies.” One survey respondent succinctly summarized the problem many professional women face: “I want challenging assignments but need to fit them to day care hours.”

While achieving work/life integration has always been an implicit challenge for SWE members — whether “life” encompassed partners and children, aging parents, volunteerism, hobbies, or travel — it had not always been an explicit programming concern of the Society.

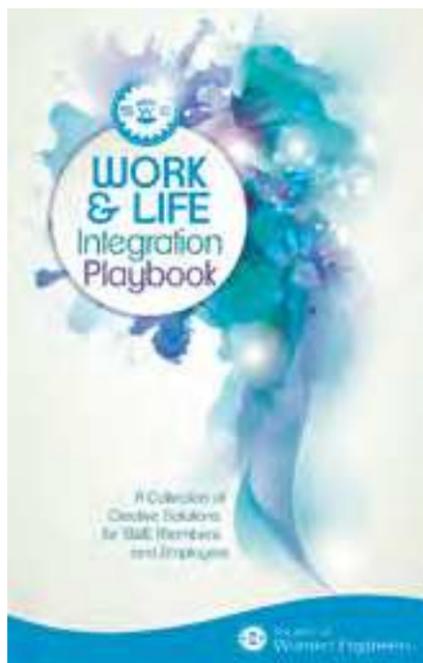
Although occasionally addressed at the section level, work/life integration issues did not enter SWE’s official national programming until a career/life planning workshop was featured at the 1977 national convention. Work/life issues soon became embedded in SWE programming, helping SWE members advocate their personal and professional needs in an industry not accustomed to heeding them. “If I just pretend I am not married, not a potential mother, not a woman, maybe the problems will go away,” Catalyst founder Felice N. Schwartz theorized in “Riddle of the Ring,” published in the March/April 1992 issue of *SWE Magazine*. “But they won’t.” ✨

– Troy Eller English, SWE Archivist

SWE’s e-book *Work & Life Integration Playbook*, published in 2014, explores methods for employees and employers alike to pursue, including flexible work environments and schedules, parental programs and dependent care, health and wellness initiatives, and financial programs. Download the Playbook at: <http://societyofwomenengineers.swe.org/e-book-download>



The cover illustration of SWE’s May/June 1992 issue of *U.S. Woman Engineer* (SWE’s predecessor) portrays a woman engineer attempting to navigate her many personal and professional responsibilities. The issue included articles on the business case for family benefits, dual-career families, elder care, federal legislation, and company policies on maternity leave, negotiating part-time positions, and an exploration of the backlash against working mothers.



In her article “Riddle of the Ring,” Catalyst founder Felice N. Schwartz contemplated a recent trend of young professional women choosing not to wear wedding rings during job interviews, fearing that hiring managers would assume “some variation on the same old formula: ‘Woman=Baby=No commitment.’”



Work and life memorably collided when James — the 3-year-old son of SWE member Maryly Van Leer Peck, Ph.D. — asked for help putting his swimsuit on during an interview for the Sept. 14, 1962, issue of *Life* magazine.

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