The Institute
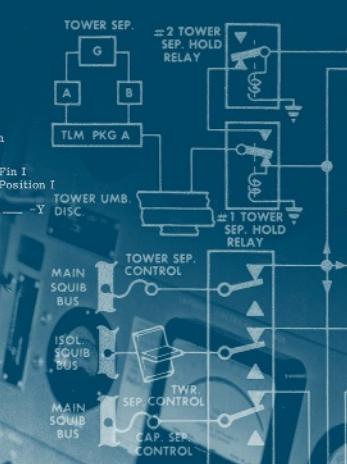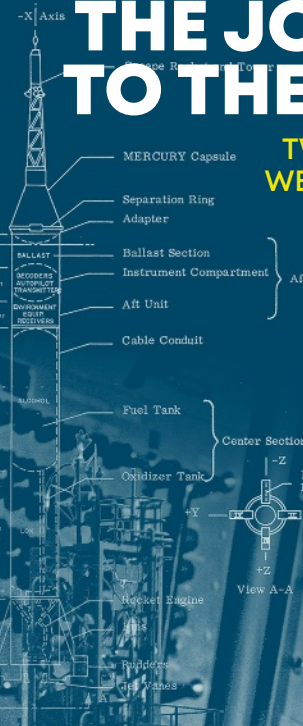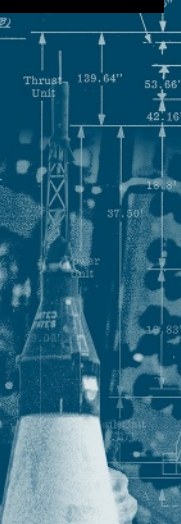
News of the **IEEE**

FIRSTHAND STORIES OF THE JOURNEY TO THE MOON

TWO IEEE MEMBERS WERE EYEWITNESSES TO HISTORY P. TI-6
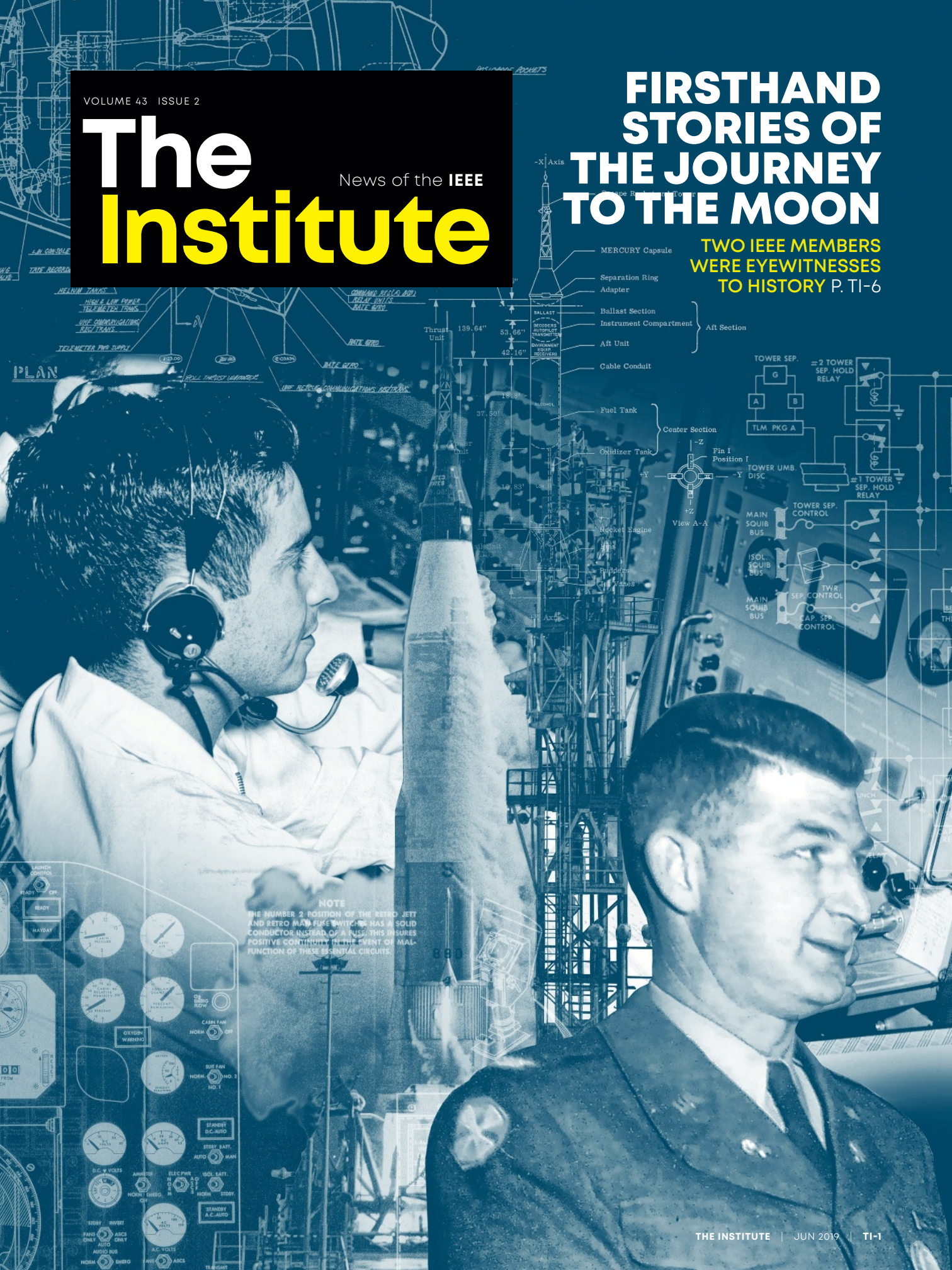
The Importance Of Transparency

Timely, meaningful, and reliable financial data

IEEE IS A distributed management association with many organizational units. Conduct that is transparent and accountable is critical to building trust among members, volunteers, and professional staff. Wise conduct requires consistent understanding, particularly of financial determinations, at all levels to make decisions that benefit all of IEEE and its members.

IEEE is financially sound. But, as I stated in 2017 in my president-elect platform, my goal was to overcome the then persistent operational deficits. To run IEEE with a balanced budget, healthy reserves, and the ability to invest wisely in our future requires understanding, in sufficient detail, our revenue and cost structures. To do so, we need transparency with preparation and distribution of timely operational financial data at the level of detail needed to consistently manage our distributed organization.

For historical reasons, much of IEEE's cost of doing business has been bundled together and allocated to its products and services indirectly–sometimes unevenly. We need to modernize this process so we can create more transparency in our financial structure. Better financial transparency is essential to run our businesses efficiently so we can determine exactly what it costs IEEE to deliver each product and service.

Transparent financial reporting should maximize the availability of fiscal information to decision makers at all levels of IEEE. I believe that financial transparency should objectively support the reporting of gross revenues to the units that generate them, and costs should be resolved at a sufficient level of detail to individual products and services and assigned to the unit that incurred them to pay for services the unit requested and agreed to.

Our volunteers and professional staff need the processes and tools that allow effective, efficient, and timely collection, reporting, and assignment of revenue and costs at an appropriate level of resolution. These processes and tools should enable the ability to trace and track revenue and costs in a bottom-up manner from organizational units that then roll up to IEEE corporate financial reporting. Our financial system should be able to record revenues and expenses at the transactional level, coded by projects and/or activities, and assisted by an information retrieval system that supports queries and analytics from different units.

During my tenure as an IEEE volunteer, I and others have helped promote financial transparency and have promoted developing a transparent financial system that explains where each dollar is spent, roots out waste, encourages efficiency, and reduces costs without affecting the quality of the products and services provided to our members.

AD HOC COMMITTEES

As a follow-up to the January IEEE Board retreat, I commissioned several ad hoc committees, chaired by dedicated volunteers and supported by members and professional staff, to address the underlying issues and challenges IEEE faces on its path to becoming a more transparent organization.

The financial transparency ad hoc committee's charter is to develop a plan for detailed financial reporting at a sufficient level of resolution and to initiate its immediate execution, which includes specific actions, timelines, and funding. The committee will provide a blueprint for operating units to present their budget early in the year, every year, with the costs to be charged for each service provided to another unit. The goal is for costs to be charged directly rather than being indirectly allocated. This will allow operating units to decide which services they need and are willing to purchase. It is vital that Board members, as well as all IEEE sections, regions, societies, councils, and major boards, have access to complete financial information in order to fulfill their fiduciary duty to the organization.

The ad hoc committee on contracting is charged with addressing issues that have been raised with our contracting workflows. Every year IEEE organizes nearly 2,000 conferences, half of which are in partnership with other organizations. Issues related to contracting with

> **Better financial transparency is essential to run our business efficiently.**

conference service providers frustrate volunteers and staff and could degrade the value of the events for attendees.

The committee is to propose practical suggestions that consider risk, timing, and available resources.

The ad hoc committee on conference finance management is developing and implementing policies and systems to provide IEEE with a financial management ecosystem for its conference business. It will provide best-in-class support for conference organizers and their organizational units while minimizing the vulnerabilities related to a distributed, global conference business.

And for a more open organization, the ad hoc committee on transparency in meetings, document classification, and elections is drafting bylaws and policies on executive sessions and election-related governing documents to provide maximum but reasonable transparency while still protecting corporate information.

I will continue to champion transparency at all levels, striving for increased communication and an open and accountable IEEE. Share your thoughts with me at president@ieee.org. ◼

—JOSÉ M.F. MOURA,
IEEE president and CEO

Celebrating Members Who Made Spaceflight Possible

AFTER THE 20 JULY 1969 MOON LANDING, U.S. astronauts Neil Armstrong, Michael Collins, and Buzz Aldrin became household names. The three were the Apollo 11 crew. But that mission would not have been possible without the hundreds of engineers who worked behind the scenes developing all sorts of technologies. Throughout this year, IEEE is marking the 50th anniversary of the event and spaceflight in general, as well as those involved, through the Footsteps: IEEE's Commemoration of Human Space Travel effort.

Two IEEE senior members are highlighted in our main feature on pages TI-6 and 7. Rufus Chavez and Carol Crom are just two of the dozens of IEEE members who posted their space-program experience on the Engineering and Technology History Wiki (https://ethw.org/Human_Space_Travel_Primary_Sources).
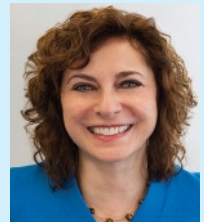
We welcome others to share their stories on the wiki so we can feature them on our new website, at https://spectrum.ieee.org/the-institute.

IEEE has made tackling diversity, inclusion, and professional ethics a priority this year and formed an ad hoc committee to address the issues. Read the committee's charter on page TI-4. Also on that page is information about a related project: the first edition of "Ethically Aligned Design: A Vision for Prioritizing Human Well-being With Autonomous and Intelligent Systems." The recently released report, also detailed on page TI-4, sets forth scientific analysis and resources, high-level principles, and actionable recommendations for the ethical implementation of autonomous and intelligent systems.

Take note of two upcoming dates listed on page TI-5. On 15 August eligible voting members may access their IEEE annual election ballot electronically. It's also when the paper ballot packages are due to be mailed. And IEEE Day is 1 October, when a record number of celebrations are expected to be held to celebrate the 10th anniversary. It's not too early to start planning yours.

Among our most recent popular online articles is "Forget Smart Watches–Here Come Smart Clothes" [p. TI-8]. E-textile expert Jesse Jur talks about the state of smart garments, including some of the challenges still to be overcome and the need for more textile engineers and designers.

"Why Companies Need Engineers With an Artistic Bent" [p. TI-11] is another highly read article. Training people how to use the analytical and creative parts of their brain is behind the STEAM movement, which encourages education that combines art with science, technology, engineering, and math. In the article, IEEE Fellow S.K. Ramesh says STEAM education increases diversity of thought and inclusiveness in the workplace. ◼

—KATHY PRETZ, editor in chief of *The Institute*

FOR UPDATES ABOUT IEEE AND ITS MEMBERS, VISIT US AT
HTTPS://SPECTRUM.IEEE.ORG/THE-INSTITUTE

briefings

Ethically Aligned Design Report Offers Guidelines for AI
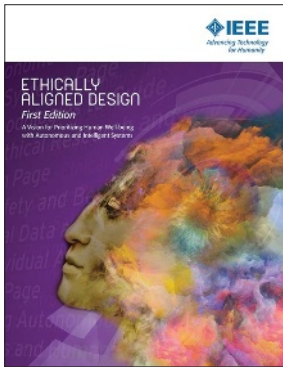
The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems, an IEEE Standards Association Industry Connections Program, recently released "Ethically Aligned Design: A Vision for Prioritizing Human Well-Being With Autonomous and Intelligent Systems, First Edition." The EAD1e report sets forth scientific analysis and resources, high-level principles, and actionable recommendations for the ethical implementation of autonomous and intelligent systems (A/IS). It is expected to serve as a key reference for educators, business-people, policymakers, and technologists.

Thousands of experts around the world provided feedback during the three-year iterative process that led to the edition. During that time, two draft documents (Ethically Aligned Design, Versions 1 and 2) were reviewed by academia, industry, governments, intergovernmental bodies and nongovernmental organizations. Those versions informed collaborations on autonomous and intelligent systems governance with the European Commission and Parliament, the Organization for Economic Cooperation and Development, and the United Nations as well as UNESCO and UNICEF.

"EAD1e is urgently needed to help policymakers, engineers, designers, developers, and corporations ensure that A/IS align with explicitly formulated human values," IEEE Fellow Raja Chatila said in a news release about the document. He chairs the IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems, which produced the document.

You may download the report at no cost from https://ethicsinaction.ieee.org.
—**KATHY PRETZ**

New Ad Hoc Committee Takes On Diversity, Inclusion, and Ethics

The IEEE Board of Directors in February approved the ad hoc committee on diversity, inclusion, and professional ethics. The committee has been organized into three subcommittees.

The first subcommittee has been tasked with developing and implementing mechanisms to improve diversity and inclusion across all of IEEE. That diversity encompasses age, gender, geography, race, ethnicity, and work sector.

The professional ethics subcommittee is looking to streamline and merge all of IEEE organizational units' various ethics codes into one. Plans call for the subcommittee to develop training and outreach programs to raise awareness among members and volunteers about IEEE's existing Code of Ethics and their responsibility to uphold it, report violations, and prevent retaliation. In addition, the subcommittee is developing professional ethics advice and support policies.

The subcommittee on IEEE ethics processes is designing a method for expanding IEEE's existing ethics processes around reporting, mediation, adjudication, appeal, and sanctions. The processes are to incorporate best practices for timeliness, tracking, transparency, and confidential reporting of violations. The subcommittee also will consider implementing an IEEE ombudsperson and creating a whistleblower program for member support around ethics and conduct.

IEEE Fellow Andrea Goldsmith has been appointed chair of the ad hoc committee, which reports to the Board.
—**K.P.**

IEEE Foundation Reaches 60 Percent of Its Fundraising Goal

In a little more than a year, the IEEE Foundation has received more than half of its goal of US $30 million since the launch of the organization's first fundraising campaign, Realize the Full Potential of IEEE, in February 2018.

Funds generated by the campaign will help increase technological access, innovation, and engagement through a variety of far-reaching global initiatives designed to transform lives through the power of technology and education.

The campaign is seeking donations from members and nonmembers as well as academic institutions, companies, foundations, and other organizations that support IEEE's mission of advancing technology for humanity through IEEE Day in 2020, which is 6 October.
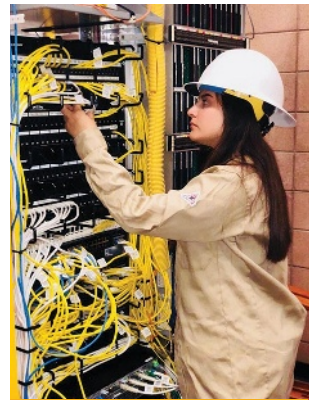
Student Member Stephanie Avendano benefited from the IEEE Power & Energy Society Scholarship Plus Initiative.

Some programs that benefit from the donations are EPICS in IEEE, the IEEE History Center REACH program, IEEE Smart Village, and the IEEE Power & Energy Society Scholarship Plus Initiative.

You can donate online and designate a specific program or let the Foundation determine where the need is greatest. You also can donate by mail, over the phone, or through your company's matching-gift program. Or you can contact the Foundation directly. If you'd like, you can choose to remain anonymous.

—JOANNA GOODRICH

IEEE Day Is 1 October

Help celebrate the 10th anniversary of IEEE Day. For some sections, one day is not enough, so celebrations now are held throughout the first two weeks of October.

A record number of events are expected to be held this year to mark the anniversary. Last year more than 1,050 events took place. There were a little less than 1,000 in 2017 and fewer than 600 in 2016.

Last year's celebrations included humanitarian projects, education programs, and social gatherings.

It's not too early to start planning. Check the IEEE Day website (https:// ieeeday.org) for updates.

Contests will be held for the best photos and videos taken at IEEE Day celebrations. To learn more about contest rules and prizes, visit the website.

As part of the celebration, IEEE is offering a US $30 discount on dues for new members who join between 29 September and 5 October. (The offer does not apply to student or graduate student memberships.) New members should visit https://www.ieee.org/ membership/join and enter the promo code IEEEDAY19.

—K.P.

Annual Election Begins in August

Look for your annual election ballot package to arrive in August via first-class mail with a postage-paid reply envelope. You'll also receive instructions by email explaining how you may access and return your ballot electronically.

Those eligible to vote include new members as of 30 June and students elevated to member or graduate student member grades on or before that date. Associate members are not eligible to vote.

To be eligible, student members graduating this year between 1 January and 30 June must update their education information online to be elevated to member or graduate student member grade.

Log in to your IEEE account by 30 June and confirm or update your contact information, your election communication preferences, and education information. That will help guarantee that a

ballot is created for you and provided to you in accordance with your communication preferences. Visit the IEEE Annual Election website (https:// www.ieee.org/elections) for more information.

Election deadlines
15 August
Eligible voting members may access their IEEE annual election ballot electronically and ballot packages will be mailed.

1 October
Last day that members' marked ballots will be accepted by IEEE, by noon EDT USA/16:00 UTC.

15 October
Election results are announced by the IEEE Tellers Committee.

24-25 November
IEEE Board of Directors acts to accept the report of the Tellers Committee. Election results are made official.

Behind the Scenes Of the SPACE RACE

Two IEEE members share their firsthand accounts

T O MARK THE ANNIVERSARY of U.S. human space flight, the IEEE History Center invited members to post their space-program experiences on the Engineering and Technology History Wiki. Dozens have done so already. Two were life members Rufus Chavez and Carol Crom.

Chavez began working at McDonnell Aircraft, in St. Louis, in 1959. The company was NASA's primary contractor for the manufacture of 20 Project Mercury satellite spacecrafts. Mercury was the first human spaceflight program for the United States. McDonnell also produced the launch vehicles for the spacecraft–which carried supplies and were modified from Redstone and Atlas D missiles. Chavez was a member of the engineering design group.

Crom worked from 1956 to 1958 as an antenna engineer at the Tulsa, Okla., division of Douglas Aircraft, now part of Boeing. He was responsible for the telemetry range safety and the C-band FPS-16 radar transponder antennae, which provided data and range safety for missile launches.

PROJECT MERCURY

In the mid-1960s, Chavez was transferred to the Cape Kennedy Air Force Station, in Florida. There he designed modifications to the Mercury-Atlas spacecraft. The Mercury-Atlas 3 test flight took place on 25 April 1961. Seconds after take-off, the spacecraft went off course, Chavez says, and the range safety officer ordered its self-destruction. Each space-craft has an escape system to keep the crew safe. The system can quickly separate the capsule from the rocket in case of an emergency.

According to Chavez, the blast propelled the capsule to a safe distance away from the rocket as it exploded. As the capsule jettisoned, its parachutes opened, and it safely landed in the Atlantic Ocean. A helicopter later recovered it.

Following the explosion, astronaut Alan Shepard, who was in the blockhouse, the concrete building used to observe the proceedings during the launch, quickly walked to the periscope and described the rescue operations to Chavez and other engineers who were monitoring the test. Shepard was the first American to travel into space.

After firefighters made sure the area was safe, the team held a debriefing session. Blockhouse personnel presented what they had observed, and it was suggested that a gyroscope in the rocket might have failed, Chavez says. A gyroscope guides the rocket–which explains why the rocket went off course.

The moderator wrapped up the session, and then Shepard addressed the group. According to Chavez, Shepard said he noticed the team was upset by the failure, but he said he was satisfied with the safety measures in place and was glad the engineers were able to assess the escape system, since it had never been used before. Shepard ended his speech by pounding his fist on the podium and saying, "I'm ready to go on the next flight."

MEMORABLE MEETINGS

Chavez had the opportunity to interact with Shepard again when they shared an office in the blockhouse. One day, an
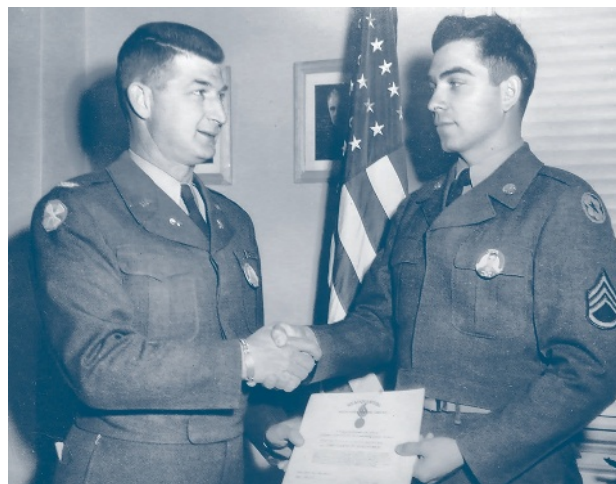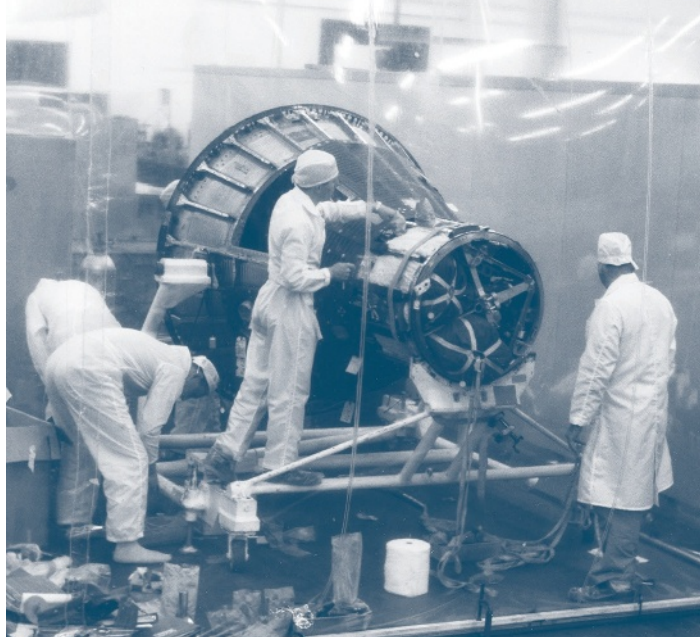
employee from McDonnell's publishing department came by to give Shepard the updated version of the capsule flight-operations manual. The astronaut threw away his old copy. Chavez retrieved the discarded manual [right] and asked Shepard if he would sign the first page. Chavez considers it a cherished memento from his time working on Project Mercury.

When Werhner von Braun, an aerospace engineer who helped shape space science in the United States, and his team of scientists and engineers working on the Mercury-Redstone asked to see the re-flight checkout trailer, Chavez got the chance to meet him.

The trailer housed instruments that NASA engineers used to assure that the machinery in a particular spacecraft was working properly. Chavez said he was told that no one except the facility's three engineers, which didn't include him, could give a tour of the trailer and explain what the instruments were used for. Von Braun and his team arrived an hour early, and Chavez was instructed to go to the trailer to warn those three engineers. As he was leaving, von Braun entered the trailer with his team. Von Braun introduced himself to Chavez, and when Chavez tried to exit the facility, the group blocked him, so he stayed.
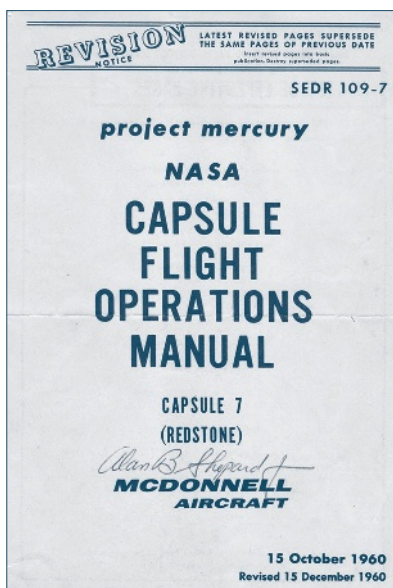
"It's an experience I won't forget," Chavez says.

CROM MAKES ANTENNAE SAFE

Crom detailed his project in the wiki and wrote about the struggles he faced when designing "hats," which connect coaxial cable to antennae.

He and his colleagues worked at the Cape Canaveral Air Force Station with the Douglas missiles and space division. They were assigned the job of building antennae for the spacecraft.

Once the antennae were built, the Cape Canaveral engineers planned to test the closed-loop system. A week before testing started, the engineers asked the Tulsa division engineering representative where the hats were for the closed-loop tests. Crom said no one in his division had any idea what the engineers were talking about. Crom was put in charge of designing them.

"The engineers at the Cape were not too pleased with my hats, because they wanted to be able to check the antenna impedances through them," he wrote. "I told them that was impossible, and they would have to be satisfied with the coupling coefficients that I gave them. Time was too short for them to complain, so they accepted the hats that we gave them. The hats worked fine for their purposes."

This article was written with assistance from the IEEE History Center, which is funded by donations to the IEEE Foundation's Realize the Full Potential of IEEE campaign.

—JOANNA GOODRICH

These articles originally appeared online as *"IEEE Commemorates Anniversary of Human Space Travel"* and *"Rufus Chavez Shares His Experiences Working on Project Mercury."*

From far left: Rufus Chavez at the electrical monitoring console on 8 September 1961. Blockhouse personnel during the flight test of Mercury-Atlas 2 (MA-2) in February 1961. Launch of the unmanned MA-2 suborbital test flight took place on 21 February 1961. Technicians working on the Mercury spacecraft in 1960. Carol Crom [left] receiving an award shortly before leaving the military and joining Douglas Aircraft.

BOTTOM: RUFUS CHAVEZ

E-textile expert Jesse Jur [left] and designer Allison Bowles discuss a garment being designed to monitor infant's biometrics.

Forget Smart Watches— Here Come Smart Clothes

Major retailers are getting in on garments with built-in electronics

WEARABLE technology, once the domain of rigid fitness wristbands and health monitors, is showing more of its softer side. High-tech companies and designers are increasingly moving to incorporate sensors to create smart clothing. By simply touching the cuff of a shirt, for example, a wearer might activate smartphone apps.

Google has teamed up with the Levi Strauss Co. to offer a clothing line, Jacquard by Google, that has conductive thread woven in. Its new Commuter X jacket, which sells for US $350, includes a battery-operated snap tag that lights up when the wearer's smartphone receives a text message and vibrates when a ride-hailing car arrives.

At last year's Winter Olympics, held in PyeongChang, South Korea, members of the U.S. Olympic team wore Ralph Lauren-branded parkas and bomber jackets that featured heat-conducting ink made with carbon and silver that was bonded to the garment's lining. The strands of ink were connected to a battery pack,

which kept the athletes warm for up to 11 hours. The coats' wearers could adjust the temperature with a mobile app.

More items are on the way. The smart clothing market share is expected to exceed $4 billion by 2024, according to Global Market Insights.

E-textile expert Jesse Jur talked to *The Institute* about the state of smart garments, including some of the challenges still to be overcome. Jur is an associate professor of textile engineering, chemistry, and science at North Carolina State University's Wilson College of Textiles, in Raleigh. He has published several research articles on e-textiles that are available in the IEEE Xplore Digital Library.

BRANCHING OUT

The Internet of Things is starting to make its way into the textile business, Jur says. There also have been improvements in health-monitoring applications that can sense the wearer's body temperature and make automatic adjustments in the clothing.

"Traditionally smart garments were

made for sports and fitness purposes as well as for biomedical monitoring, to take various measurements," he says. "What has evolved is a better understanding of that data, new ways of gathering information about the user other than from a smartphone app, and improvements in integrating technologies more seamlessly into garments."

Thanks to work by standards organizations, the washability of the garments is improving, according to Jur. The Levi's jacket, for example, can withstand up to 10 washes, although the snap tag must be removed before laundering.

Jur says his Nano-EXtended Textiles (NEXT) research group has historically worked on devising materials that could be used to help bind electronics to textiles or to have conductive yarns sewn into knitted structures. Now the NEXT group is working on automating the process of integrating electronics into the textiles in an affordable way, to speed up production and lower costs–two major concerns for smart-garment manufacturers.

SPEEDING UP THE PROCESS

Producing textiles is an automated process, but incorporating electronics into clothing is not. Adding individual components to the garments and handling variations of the electronics in the design requires the dexterity of human hands. Because the process is so labor-intensive, the garments are

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produced on a limited scale, Jur says.

Workers at small job shops piece together the garment sections containing the electronics from small batches. Until the garments can be mass-produced, they'll remain pricey.

"We've been using things like direct-write printing, which is a form of 3D printing on textiles," Jur says. "We have also been exploring ink-jet printing of conductive materials, as well as incorporating dielectric and polymer semiconducting materials onto textiles."

TALENT SHORTAGE

Another challenge facing the makers of smart garments is the shortage of textile engineers and designers, according to Jur, who says he is being bombarded by companies looking to hire.

"This particular field requires a unique skill set," he says. "Engineers and designers need to know early-stage development to be able to translate the company's idea for how to fabricate a smart garment, or explain how to apply new electronic textile techniques to improve a garment's durability."

But he urges caution for those who are interested in entering the industry: Because the smart-garment field is so hot right now, a lot of companies that contact Jur for help are not being methodical about product development–starting, for example, with developing an understanding of customer needs and whether there's a market for a particular garment.

"They think that if they create the product, the customer base will automatically appear," he says. "A lot of times, that's just not the case."

It's not until the company has a specification document that includes pricing information that textile engineers can try to determine what materials or processes can meet those requirements.

"Product development is nothing new," Jur notes, "but it just seems there are a lot of companies that are not following the general practices and are failing before they start."

—KATHY PRETZ

This article originally appeared online as *"Smart Clothing Could Soon Be Part of Your Wardrobe."*

career guidance

ISTOCKPHOTO

Why Companies Need Engineers With an Artistic Bent

PEOPLE WITH the ability to combine their engineering and scientific skills with their understanding of art, literature, music, and other creative works have introduced popular products and spawned billion-dollar industries. They've also made our lives a bit more enjoyable.

Take, for example, IEEE Member Alvy Ray Smith, the digital graphics pioneer who helped found Pixar. The company produced the first computer-animated feature film, *Toy Story*, and has since been winning over audiences of all ages with such blockbusters as *Monsters Inc., The Incredibles*, and *Cars*. Pixar received the 2018 IEEE Corporate Innovation Award.

The H910 Harmonizer, invented by IEEE Life Member Anthony Agnello, is a digital audio effects processor that gives musicians and producers flexibility by letting them, for example, change the pitch of an instrument, delay a sound, or have it repeat. Agnello's work was recognized with a 2018 Technical Grammy Award.

Life Fellow Amar G. Bose founded Bose Corp., the audio

equipment company. The visionary sound engineer, who died in 2013, invented the 901 Direct/Reflecting speaker system, one of the first stereo loudspeakers to use the space around a room instead of aiming all the sound directly at the listener. The 901 remained an industry standard for 25 years.

Those are "examples of technology and art blending together to create experiences that neither could do on its own," says IEEE Fellow S.K. Ramesh. He's director of the AIMS2 program at California State University, Northridge. The program is working to improve the academic achievement of Hispanic and low-income students in engineering and computer science and helping them pursue a career in a STEM field. "This coming together makes the whole much greater than the sum of its parts.

"There is this holistic approach of looking at the arts as a vehicle to inspire and motivate workers to create something new and different," says Ramesh, a former IEEE Educational Activities vice president.

Training more people how to use both the analytical and the artistic sides of their brain is behind the STEAM movement, which encourages education that combines art with science, technology, engineering, and math.

STEAM can give greater context to an engineer's work. The key to good design is a combination of empathy and knowledge of the arts and humanities, according to Vivek Wadhwa, an adjunct professor at Carnegie Mellon University Silicon Valley.

As Steve Jobs said when he unveiled the iPad2, "It's in Apple's DNA that technology alone is not enough; it's technology married with liberal arts, married with the humanities, that yields us the result that makes our heart sing."

Ramesh says having a STEAM background also increases diversity of thought and inclusiveness in the workplace–beyond the traditional categories of diversity, like gender, sexual orientation, socioeconomic status, and race.

"Those who have an artistic, musical, or another creative background see things from a different perspective," he says. "Other employees begin to appreciate them–which leads coworkers to value each other more. STEAM brings together people and communities–which can be transformative."

EARLY START

Studies show that STEAM education improves creativity and innovation. When students encounter a problem or challenge, they are encouraged to work through the solution not only using science and technology but also leveraging their knowledge of the arts, according to an *eSchool News* article.

They use creativity along with technical skills as well as out-of-the-box thinking and persistence–all traits companies are looking for in new hires, according to a *Fast Company* article.

Because STEAM hands-on projects incorporate a variety of materials and tools, students learn by practice, rather than from a lecture. They also learn at their own pace, using solutions they've devised. This method establishes an equal playing field for all students, regardless of their gender, socioeconomic status, or race, according to the *eSchool News* article.

IEEE PROGRAMS

IEEE is doing its part to help educators train the next generation of STEAM workers. Its TryEngineering program offers free lesson plans to educators working with preuniversity students. IEEE also runs the TryEngineering Summer Institute, a two-week program that gives students ages 12 to 17 hands-on projects in a variety of engineering fields while they learn what it's like to live on a college campus. Projects include designing a rocket, a 3D-printed car, and a trebuchet.

Ramesh, who visited one of the camps last year at the University of California, Riverside, shared how one student made a small, origami-type table out of napkins and toothpicks.

"He asked me, 'Do you think this would be part of engineering?'" Ramesh says. "I was simply blown away because this creative young man looked at the materials in front of him and realized they could be turned into something functional. It was inspiring.

"It may sound cliché," Ramesh adds, "but I truly believe engineering is the renaissance discipline of our century. With STEAM, we have the ability to educate in such a way that we can bring out more creativity and curiosity in students as well as build a more diverse and inclusive society of workers. Anything that we can do to make engineering more meaningful is the direction we need to go in."

—KATHY PRETZ

This article originally appeared online as *"Why Companies Need Engineers With a Creative Bent."*

IEEE Member Eric Becker Protects Rhinos From Poachers

THE ILLEGAL POACHING of black rhinoceroses in Africa has helped to decimate their population, from about 65,000 in the 1970s to just 5,400 today. Black rhinos are one of the world's most endangered species, according to the World Wildlife Fund (WWF). The animals are being killed for their horns, which can fetch thousands of U.S. dollars per kilogram on the black market. The African Wildlife Foundation estimates that the global wildlife poaching trade generates up to $23 billion annually in illicit revenue.

Most of Africa's remaining rhinos are found in four countries: Kenya, Namibia, South Africa, and Zimbabwe. Housed in wildlife preserves and national parks, they are protected by armed rangers. There were 769 rhino poaching incidents in South Africa last year, the National Department of Environmental Affairs says.

To help combat poaching and improve ranger safety, the WWF and sensor maker FLIR Systems teamed up in January to launch the Kifaru Rising project. In Swahili, the word for *rhino* is *kifaru*. WWF conservation engineer Eric Becker, an IEEE member, is the project's lead engineer. Kifaru Rising aims to eliminate rhino poaching in Kenya by 2021 with the help of thermal-imaging security cameras.

IMPROVED DETECTION
The project calls for installing FLIR cameras at 10 parks and game reserves in Kenya to secure the park's perimeters and help rangers identify illegal intrusions.

"We can't save rhinos if we don't stop poaching," Carter Roberts, president and CEO of the WWF, said in a news

IEEE Member Eric Becker, conservation engineer at the World Wildlife Fund, holds his thermal imaging FLIR camera, which helps wildlife preserves protect black rhinos in Africa from poachers.

release about the collaboration. "New technologies help change the game. They give rangers a leg up in deterring criminals and protecting themselves on the front lines of this war."

Thermal imaging can detect radiation in the electromagnetic spectrum and produce images of that radiation. Using handheld thermal-imaging cameras and ones mounted on patrol vehicles, and checking ones on poles located around the parks' perimeters, rangers can scan an area up to 3 kilometers away and see the heat generated by a human or other animal, Becker says.

"What most people don't realize is that everything glows around you and the frequency of that glow is the spectrum emission," he says. "We can deploy a sensor that can look out into the environment and really pick up on the living things that emit heat that the ranger can't see.

"The reason that thermal imaging is good for monitoring the parks is that it provides that contrast. Those infrared-detector elements create a detailed temperature pattern, called a thermogram, which is displayed on the camera."

The fixed-mounted thermal cameras that workers plan to place around the 10 parks' borders are capable of generating real-time video that can be streamed to control rooms so armed rangers can be deployed when an intruder is detected.

FLIR infrared cameras that the WWF installed in other parks are reducing poaching, Becker reports. One is a reserve that borders Nakuru, Kenya. It has a road that provided poachers with

quick access to congregating rhinos, making the animals easier targets. After poachers saw that cameras had been installed along the park's fence and learned of arrests being made, they stopped going there, Becker says.

"Rangers used to dread being deployed to that park, because they were almost always guaranteed to get into shootouts with the poachers," Becker says. "Now they have peace of mind because they no longer have that stress. It's psychological but, by installing the cameras, we have taken that area away from poachers."

ENGINEERS NEEDED
When Becker joined the WWF in 2016, he was the first conservation engineer the organization had ever hired. He previously worked as an engineering contractor for a variety of organizations including the U.S. Defense Advanced Research Projects Agency, a U.S. Air Force research lab, and the Army's Special Forces. His background in military projects gave him a familiarity with security systems.

IEEE got him into the conservation field, he said, after a chance meeting he had in 2014 with a WWF representative who gave a presentation at an IEEE event in Washington, D.C., about how drones and robots could be used to benefit society.

"WWF realized the value of having that type of engineer in-house–someone who had a really deep understanding of the technology, who knew what was out there and what would work, but also could bring that technical background to a team that was knowledgeable about the issues but who were not necessarily technologists," he says.

Part of Becker's job is to visit game reserves and work with the experts on the ground–including rangers, other researchers, park managers, and community leaders–to understand their challenges.

"I need to articulate those challenges into engineering requirements," he says, "because engineers speak requirements. Then I either develop my own solutions or use off-the-shelf

technology that will work in these environments. This is a better use of my skill set and a lot more in line with what I love to do."

He says he's one of the few engineers working on technologies to protect wildlife. "It's really a shame there are not more engineers going into this field," he says. "There should be a million more like me working to save animals."

To that end, Becker and others have created the conservation technology website Wildlabs.net, where conservationists on the ground can post their challenge and engineers can offer solutions.

"There are plenty of areas where engineers who are interested in this type of work can get involved and actually make a meaningful impact," he says. "We need plenty of creative engineers and computer scientists, because we are just scratching the surface of ways technology can help."

—KATHY PRETZ

This article originally appeared online as *"Thermal-Imaging Cameras Help Protect Endangered Rhinos in Africa."*

sparking conversations

U.S. Judge Decides Järlström's Constitutional Rights Were Infringed

A JUDGE IN FEDERAL DISTRICT COURT recently ruled that the state of Oregon illegally infringed on Mats Järlström's First Amendment rights when it fined him US $500 because he wrote "I am an engineer" in correspondence critiquing the state's traffic-light timing.

Järlström [pictured above] has an engineering degree, and his chosen field of interest is audio engineering and product design. He is not, however, a registered civil engineer practicing in the field of traffic engineering. Nor does he claim to be.

The Oregon State Board of Examiners for Engineering and Land Surveying fined him in January 2017 for violating a state law that governs who may call themselves an engineer, finding he wasn't an Oregon-registered professional engineer. Järlström sued the board, which last June admitted that its interpretation of the law had violated his rights guaranteed under the U.S. Constitution's First Amendment. Järlström and his attorney from the Institute for Justice countered that the state's proposed settlement didn't go far enough. They asked a U.S. district court to take a broad look at the state law and its administrative rules and declare them unconstitutional.

In a written ruling issued 28 December, Judge Stacie F. Beckerman found the board has a "history of overzealous enforcement actions" and called its restrictions on the use of the word *engineer* "substantially overbroad" and in violation of the First Amendment.

Beckerman declared that Järlström may study and communicate publicly or privately about his theories relating to traffic lights, as long as his remarks occur outside the context of any employment or contractual relationship with a governmental or other group that changes or implements or has final approval to change or implement traffic-light timing without the review and acceptance of responsibility by an Oregon-licensed professional engineer.

The judge also wrote, "The term *engineer*, standing alone, is neither actually nor inherently misleading.

"Courts have long recognized that the term *engineer* has a generic meaning separate from *professional engineer* and that the term has enjoyed widespread usage in job titles in our society to describe positions which require no professional training."

Järlström told *The Institute*, "This case has always been about more than just me, and I'm thrilled that the court has put a stop to some of the engineering board's worst abuses. Being an engineer is a big part of my identity, as it is for many people. Thousands of Oregonians are engineers—even though we have no reason to be licensed as professional engineers—and we are now free to use the word *engineer* to describe ourselves."

The judge is correct. The term *engineer* is a generic one and applies to anyone who has received an engineering education. For the positions that require licensing from the state, a proper and unambiguous designation should be "licensed engineer."
—*Nicholas*

I agree with the ruling, but I also feel like too many times people have been attaching the word *engineer* to their title to market themselves beyond their capabilities. Many consultants call themselves and their employees "project engineers" which, conveniently, is abbreviated as P.E., the same abbreviation that professional engineers use. It does seem like there was a bit of deception on the individual's part. If you graduated with a degree in audio engineering, why not use that title instead of the broader title of engineer when presenting at a conference where the vast majority will be licensed civil engineers.
—*Joseph Taft*

This is a very interesting discussion. In my country and in Spanish, the term *engineer* describes only a person with the proper university diploma and professional accreditation from the country's Ministry of Justice and Education. However, sometimes you

find people who call themselves engineers and they don't have the national accreditation nor the superior studies. They do it thinking it will help them gain a better social position. This is a deception and a crime, in my opinion.
—*Victor Fermín Gómez*

Anyone who applies existing science to solve a problem is engaged in the act of engineering and can be described as an "engineer." A person who gets paid to do so is, in fact, a "professional engineer." If a governing body imposes limitations on who may engage in certain types of engineering, then one of those authorized persons becomes a "(insert governing body name here) licensed engineer." Any person or body who says otherwise should complain to lexicographers. I get tetchy when anybody tries to restrict my use of a word or phrase to accurately communicate.
—*Sallie McRae*

This blog post originally appeared online as *"U.S. Judge Rules Mats Järlström's First Amendment Rights Were Infringed."*

products +services

IEEE Makes It Easier to Submit Articles For Conferences

The Author Center's new guide helps researchers through the process

THE IEEE Author Center recently added a conference section for people who want to publish their work at an IEEE conference. The new section provides best practices and guidance as well as tips and tools.

Submitting a paper for a conference differs from submitting one for a journal. To help submitters, the Become an IEEE Conference Author section shares some considerations, including the requirement that authors must present and defend their work at a conference.

To help authors select the most appropriate IEEE conference suited for their scholarly article, this section provides a link that lets people search across 1,800 IEEE conferences for matches to their research topic.

There's also a description of the various types of conference papers that an author might be asked to submit.

To ensure you get credit for your work, there are instructions for obtaining an open researcher and contributor ID. The unique, persistent ORCID identifier distinguishes you from other researchers and is required for authors who publish with IEEE.

Under the Author Ethics section, there's a guide to ensure writers properly cite their sources, accurately report their data, and properly credit all those who contributed.

For people writing a conference paper for the first time, and those who need a refresher, the Write Your Paper section goes over the basics, such as the organizational structure the paper should follow. There are templates available in Word and LaTeX that format an article, and tips for improving any graphics. A checklist is provided to ensure the paper meets the requirements for publishing it in the IEEE Xplore Digital Library.

The Understand Peer Review section explains what the experts evaluating the article are looking for to ensure it meets standards for acceptance and publication. There's also an explanation of what their decisions mean.

Once your paper is accepted, the Get Published section walks you through the next steps. That includes how to transfer the copyright to IEEE, ways to increase the impact of your data, and suggestions for improving the visibility of your work.
—KATHY PRETZ

This article originally appeared online as *"New Resource Makes Submitting Research Articles to IEEE Conferences Easier."*

# of note

Nominations Needed For 2021 IEEE Technical Field Awards

The IEEE Technical Field Awards are awarded for contributions or leadership in specific fields of interest of the IEEE. Submit your nominations by 15 January 2020.

IEEE Biomedical Engineering Award
For outstanding contributions to the field of biomedical engineering.
SPONSORS: IEEE Circuits and Systems and IEEE Engineering in Medicine and Biology societies

IEEE Cledo Brunetti Award
For outstanding contributions to nanotechnology and technologies for microsystem miniaturization.
SPONSOR: Brunetti Bequest

IEEE Control Systems Award
For outstanding contributions to control systems engineering, science, or technology.
SPONSOR: IEEE Control Systems Society

IEEE Electromagnetics Award
For outstanding contributions to the theory and/or application of electromagnetics.
SPONSORS: IEEE Antennas and Propagation, IEEE Electromagnetic Compatibility, IEEE Microwave Theory and Techniques, and IEEE Geoscience and Remote Sensing societies

IEEE Electronics Packaging Award
For outstanding contributions to advancing components, electronic packaging, or manufacturing technologies.
SPONSOR: IEEE Electronics Packaging Society

IEEE James L. Flanagan Speech and Audio Processing Award
For an outstanding contribution to the advancement of speech and/or audio signal processing.
SPONSOR: IEEE Signal Processing Society

IEEE Fourier Award for Signal Processing
For an outstanding contribution to the advancement of signal processing, other than in the areas of speech and audio processing.
SPONSORS: IEEE Signal Processing and IEEE Circuits and Systems societies

IEEE Andrew S. Grove Award
For outstanding contributions to solid-state devices and technology.
SPONSOR: IEEE Electron Devices Society

IEEE Herman Halperin Electric Transmission and Distribution Award
For outstanding contributions to electric transmission and distribution.
SPONSORS: Robert and Ruth Halperin Foundation, in memory of the late Herman and Edna Halperin, and the IEEE Power & Energy Society

IEEE Richard Harold Kaufmann Award
For outstanding contributions in industrial systems engineering.
SPONSOR: IEEE Industry Applications Society

IEEE Joseph F. Keithley Award in Instrumentation and Measurement
For outstanding contributions in electrical measurements.
SPONSORS: Keithley Instruments, a Tektronix company, and the IEEE Instrumentation and Measurement Society

IEEE Gustav Robert Kirchhoff Award
For an outstanding contribution to the fundamentals of any aspect of electronic circuits and systems that has a long-term significance or impact.
SPONSOR: IEEE Circuits and Systems Society

IEEE Koji Kobayashi Computers and Communications Award
For outstanding contributions to the integration of computers and communications.
SPONSOR: NEC Corp.

IEEE William E. Newell Power Electronics Award
For outstanding contributions to power electronics.
SPONSOR: IEEE Power Electronics Society

IEEE Donald O. Pederson Award in Solid-State Circuits
For outstanding contributions to solid-state circuits.
SPONSOR: IEEE Solid-State Circuits Society

IEEE Photonics Award
For outstanding achievements in photonics.
SPONSOR: IEEE Photonics Society

IEEE Robotics and Automation Award
For contributions in the field of robotics and automation.
SPONSOR: IEEE Robotics and Automation Society

IEEE Frank Rosenblatt Award
For outstanding contributions to biologically and linguistically motivated computational paradigms and systems.
SPONSOR: IEEE Computational Intelligence Society

IEEE Marie Sklodowska-Curie Award
For outstanding contributions to the field of nuclear and plasma sciences and engineering.
SPONSOR: IEEE Nuclear and Plasma Sciences Society

IEEE Innovation in Societal Infrastructure Award
For significant technological achievements and contributions to the establishment, development, and proliferation of innovative societal infrastructure systems through the application of information technology with an emphasis on distributed computing systems.
SPONSORS: Hitachi Ltd. and the IEEE Computer Society

IEEE Charles Proteus Steinmetz Award
For exceptional contributions to the development and/or advancement of standards in electrical and electronics engineering.
SPONSOR: IEEE Standards Association

IEEE Eric E. Sumner Award
For outstanding contributions to communications technology.
SPONSOR: Nokia Bell Labs

IEEE Nikola Tesla Award
For outstanding contributions to the generation and utilization of electric power.
SPONSORS: Wolong Electric Group Co., Ltd. and the IEEE Industry Applications and IEEE Power & Energy societies

IEEE Kiyo Tomiyasu Award
For outstanding early to mid-career contributions to technologies holding the promise of innovative applications.
SPONSORS: Dr. Kiyo Tomiyasu and the IEEE Geoscience and Remote Sensing and IEEE Microwave Theory and Techniques societies

IEEE Transportation Technologies Award
For advances in technologies within the fields of interest to the IEEE as applied in transportation systems.
SPONSORS: IEEE Industry Applications, IEEE Industrial Electronics, IEEE Intelligent Transportation Systems, IEEE Microwave Theory and Techniques, IEEE Power Electronics, IEEE Power & Energy, and IEEE Vehicular Technology societies

TEACHING AWARDS

IEEE Leon K. Kirchmayer Graduate Teaching Award
For inspirational teaching of graduate students in the IEEE fields of interest.
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IEEE Undergraduate Teaching Award
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