

## Featured Stories



### All things InSight: Where to watch landing events, plus a space claw and a new podcast

The first Mars landing since Curiosity will happen just before noon on Monday, Nov. 26, and it will be anything but a typical workday. Hundreds of guests and journalists are expected for the landing.

#### How you can view the landing

NASA TV will carry a live broadcast of the landing from 11 a.m. to 12:30 p.m. on Monday, Nov. 26. The broadcast will also be carried on <https://www.nasa.gov/nasalive>, <https://www.youtube.com/NASAJPL/live>, and <http://www.ustream.tv/NASAJPL>. On-demand recordings will also be available after the live event has finished on the YouTube and Ustream pages.

Beckman Auditorium at Caltech will be open for JPLers who want to gather with colleagues to watch NASA TV's live broadcast. Parking on campus will be limited because classes are in session. You can RSVP for this free, public event here: <http://www.caltech.edu/content/mars-insight-landing-viewing-party-and-discussion>. Doors open at 10:30 a.m. and seating will be on a first come, first served basis. Please note an RSVP does not guarantee entry.

The event also will be shown at the Los Angeles Central Library and more than 30 other L.A. branch libraries, the Pasadena Central Library, and the La Crescenta, La Canada Flintridge, Altadena and San Gabriel libraries.

If you'd like to hear more about InSight, check out the newly launched JPL podcast, "On a Mission": Information and downloads at: <https://www.jpl.nasa.gov/news/news.php?feature=7270>

For more about InSight's space claw, watch this "Crazy Engineering" video: <https://www.jpl.nasa.gov/news/news.php?feature=7259>

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*Nagin Cox.*

## **Fight and flight: one woman's fearless journey to the stars**

The year was 1975.

"Jaws" was the biggest movie in theaters, "Love Will Keep Us Together" was the top song on the radio and 10-year-old Nagin Cox's home life was unraveling. It was a time when Cox thought only about making it to age 18 so she could be free.

"I remember looking up at the stars and thinking, 'I'm going to live and get through this,' Cox recalls. "I need to set a goal. I need something so meaningful it will help me get through the next eight years."

That goal revealed itself when she was 14, a curly-haired Indian girl fascinated by "Star Trek" and Carl Sagan's "Cosmos." She wanted to explore the universe. And no, she didn't want to be an astronaut.

"If you really want to go where someone has never been, you want to be with the robots. They truly explore first," she says. "There was one place that did that consistently and that was NASA's Jet Propulsion Laboratory."

She just needed to figure out how.

Cox, now 53, is celebrating 25 years since first walking through the gates of JPL. Since her first day in 1993, she has written the acronym IWWTWTF in the top right-hand corner of every notebook. It stands for I was willing to wash the floors—a reminder of just how badly she wanted to work at NASA.

For two-plus decades, she has taken part in such iconic NASA missions as Galileo, the Mars rovers Spirit, Opportunity and Curiosity, the exoplanet explorer Kepler, and InSight, a lander that will measure “quakes” to study the Martian interior.

Cox has boundless energy beneath a cherubic face with wide, inquisitive eyes and a melodic voice. With her warmth and good-natured sense of humor, it’s hard to imagine she’s the product of a tough childhood. But, in many ways, her upbringing helped deliver her to her calling.

“I use three words to describe myself,” she says. “I’m an explorer, an engineer and a fighter.”



*Cox as a high school student growing up in Kansas City, Kansas.*

## **The Fighter**

The fighter came first.

Cox was born in India and raised primarily in Kansas City, Kansas, the second eldest of four siblings. Her father was a political science professor at the University of Missouri at Kansas City. Her mother stayed at home to look after the family, but studied sociology in India and was one of the first women in her province to earn a master’s degree. Cox’s relationship with her mom was especially close. “She was a fountain of love and support and encouragement,” she says.

But from a young age, Cox had a different kind of relationship with her father. “Growing up, I just wanted my dad to love me,” she recalls. “I thought, ‘What is the problem?’ Then I realized: It has something to do with being a girl.”

As she got older, she began to notice different expectations in the household for boys and girls. Her two

brothers were sent to a middle school known for math and science, and she was sent to a different school specializing in art and humanities. At dinnertime, the women in the family were expected to cook and serve food.

For years, she remembers her father saying girls were “worthless.” During this time, Cox grew especially close to her mother.



*With her mother in the summer of 1983.*

“My mom was a gentle, caring, nurturing soul. Because of the battle that developed between my father and I—I am not a gentle, caring, nurturing soul. I just don’t go quietly,” Cox says, adding that her mother always understood her. “‘You were raised in a battleground and therefore you are always my fighting daughter,’ she would say. ‘I don’t have to worry about you because you will never be stepped on. If anyone tries, you will raise hell.’”

The turning point was in 1981. A high school junior, Cox spotted an Air Force trailer behind her school. Even though she didn’t want to be an astronaut, she knew many had a military background and it might be her ticket to NASA.

A deal was on: get into college and the Air Force would pay her way. And she knew exactly which college. “At the end of ‘Cosmos,’ it would say, ‘Carl Sagan: Cornell University.’ I saw that and thought, I’m going to Cornell.”

That spring, Cox’s advisers started asking which colleges she would choose from, but she hadn’t heard anything. Then it dawned on her: Her father was throwing away her letters. She eventually got the good news: She had been accepted into Cornell.

She took the Cornell letter and her Air Force scholarship award and walked up to her father. She had two words for him: “I win.”

## **The Engineer**

Cox started Cornell in the fall of 1982, double majoring in psychology and operations research and

industrial engineering.

“She was so serious about her studies,” recalls her college friend, Shae Renali. “Engineering at Cornell is a really rigorous program. To think that you would take on Cornell engineering and add another major on top of it—that was mind-boggling to me.”

In college, Cox also met her future husband, Earl. A tall, handsome engineer with a megawatt smile, they met through the Reserve Officers' Training Corps—she in the Air Force program and he in the Navy program—and dated for six weeks before she dumped him because she thought he was “an arrogant know-it-all.” Alas, he was a lovable, arrogant know-it-all—the two later eloped in 1992.



*At a Cornell University ball with her future husband, Earl.*

After four years at Cornell, Cox swapped her graduation gown for an Air Force uniform in 1986. With NASA as her endgame, she set her sights on systems engineering at Wright-Patterson Air Force Base in Dayton, Ohio, helping build F-16 aircrew training systems. She later earned her master's degree in space operations engineering at the Air Force Institute of Technology and worked as an orbital analyst for U.S. Space Command Operations at Cheyenne Mountain Air Force Base.

After six years of active duty, Cox mailed in her application for an engineering position at JPL. She waited—and was met with resounding silence. But a high school reunion helped her eventually connect with a former classmate working at JPL. She called him soon after and learned he was about to leave for graduate school.

“If I had not called then, or just a few months later, I would have missed him,” she recalls. “Instead, I got hired into his group just as he left.”

### **The Explorer**

“Every day, I am bone-deep fulfilled being here,” Cox says from her office on the fourth floor of JPL's Flight Projects building, which sits in the middle of 177 acres of the sprawling JPL campus. “It's about legacy—being part of something greater than yourself.”

And something greater requires sacrifice, including Thanksgivings spent in Mission Control and missing friends' weddings.

The work doesn't let up these days, either. On a recent Wednesday, she had a "three-rover day": She was on shift for Curiosity all day, went to dinner with the Mars Exploration Rovers team in the evening and then came home to work on Mars 2020 at night.

Cox is "solar-powered," she says, and works best from 6 a.m. to 10 a.m., a window she calls her "prime time." A typical day will start at 5:45 a.m., when she rolls out of bed, opens up her laptop on the treadmill and works out while checking off her to-do list. On especially busy weeks, she'll work through the weekend at home. Her husband, Earl, who knows not to interrupt during those precious hours, will slip her a plate of toast while whispering with a smile, "Prime time."

Even though there is a back entrance to a parking lot much closer to her office, Cox prefers to drive onto lab through the main entrance, where she can see the NASA logo and the Jet Propulsion Laboratory sign.

"I don't drink coffee and I don't drink tea, but I do like to see that sign in the morning to start the day off right," she says.

On the Mars 2020 mission, the next rover that will fly to Mars, she's both the deputy team lead for the engineering operations team and the operations test and training manager, helping develop operations processes and tools for operating the rover.

Rob Manning, JPL's chief engineer, has known Cox since her early days on Galileo and supervised her on the Mars Exploration Rovers after she knocked on his door and asked to work on Spirit and Opportunity as a systems engineer.

"She's got all three: She's got passion, she's got discipline, she has perseverance in the face of obstacles," he says. "She's one of the most tenacious individuals I've ever met."

Ask Cox how she has the strength to do all she does with such energy, enthusiasm and focus, and she has a simple answer. "Work doesn't feel like work," she replies. "It's where I want to be."

In Cox's free time—which must exist on some separate, invisible plane of time—she is often traveling the world speaking to audiences about exploring the universe. To date, she's given almost 700 lectures in 20 years of outreach, has nearly 2 million views on her "Mars Time" TED talk, and has visited dozens of countries on STEM diplomacy trips, many as a U.S. State Department speaker since 2004—all on personal vacation time.

In Jordan, children traveled for four hours by bus from rural areas to hear her speak. In Pakistan, she was escorted by 12 men carrying machine guns to a small town where, in addition to her career lectures, she taught self-defense classes for young girls. And in Morocco, one of the students asked her one day, "Do you know how lucky you are to live and work in the United States?"

"Yes, I do," she replied. "I think about that every day and that's why I'm here."

## Journeying On



*Cox proudly wearing her mission lanyards collected from more than two decades at JPL.*

Having come so far in her journey of space exploration, Cox has discovered a sense of peace and forgiveness that she never expected. The challenges of her childhood have given way to an adulthood full of satisfaction, wonder and happiness. Her parents eventually divorced and her mother learned to drive at 40 and got a job at a bank; her father, in later years, “tried to learn to love more.” While both passed away several years ago, she has come to an accepting, even good-humored, perspective of her upbringing now.

“Your parents are a product of their own childhood issues and their cultures. It seems like we all ought to be forgiving of each other, especially our parents.”

Cox leads an active social life that has included hobbies like dragon boating, sprint triathlons and improvisational comedy. On the philanthropic end, she has volunteered for suicide prevention programs, is the first engineer to sit on Human Rights Watch’s advisory committee for women’s rights, and served on the Griffith Observatory board for more than 10 years.

Jordan Evans, the deputy director of engineering and science at JPL, knows what makes her stand out. “She’s not self-centered or arrogant in any way,” he says. “She’s genuinely happy, genuinely positive and genuinely wants to make the world a better place.”

Cox became what that young girl in Kansas hoped to be so many years ago: an explorer of the universe. “I have never expected that anyone would remember my name,” she says. “But I’m hopeful they will remember my missions.”



## Caltech's Frances Arnold wins Nobel Prize, son is JPL Mars flight tech

"What the heck does Mom want? Oh, Mom probably doesn't understand the time difference, she's in Dallas right now and is probably still thinking it's California time...maybe she just wants me to go check on her cats..." A litany of mundane explanations ran through James Bailey's bleary mind at 3:23 a.m. on October 3 when he was awakened from a deep sleep by three phone calls from his mother's cell number. Bailey silenced his phone for the first two, getting grumpier with each ring. Call #3 did the trick. He picked up the phone and said groggily, "What do you want?" With great excitement and maybe a tinge of impatience, his mother said, "I wish you had picked up your phone, but I just won the Nobel Prize."

Bailey bolted upright, thrilled by the news and fueled by adrenaline. "I was overjoyed for her. It's fairly difficult to verbalize how I feel," he said. He never did manage to go back to sleep that night. In a few hours, he'd be able to share the news with his colleagues when he arrived at his job at NASA's Jet Propulsion Laboratory in Building 179, High Bay 1 -- the clean room where he is a flight technician working on Mars 2020.

Bailey's mother is Frances Arnold, the Linus Pauling Professor of Chemical Engineering at Caltech, which manages JPL for NASA. Her 2018 Nobel Prize in Chemistry honors her pioneering work in creating new, improved enzymes in the laboratory using the principles of evolution. Arnold shares the prize with two other scientists.



*Nobel Prize winner Frances Arnold of Caltech.*

Arnold's bio has an abundance of academic milestones and stellar awards. She was the first woman to receive the 2011 Charles Stark Draper Prize from the National Academy of Engineering. She is also the first woman and one of just a few individuals elected to all three branches of the National Academies: for Medicine, Sciences and Engineering.

Bailey traveled a different path than his mother to his job at JPL. Growing up in Pasadena, he didn't thrive in conventional schools, so he pursued vocational training in welding and machining. After high school, he worked on high-performance cars at a local shop. At 20, he joined the Army, where he was trained as a Blackhawk helicopter mechanic and became part of a flight crew. After wrapping up six years of military service, including crucial work on medical evacuation helicopter teams in Afghanistan, he learned JPL was looking for people with an aviation background to work as flight technicians. Bailey fit the bill, and he was hired.

"If you do something wrong in aviation, lives are at stake, and that same level of detail needs to be taken here, because we send spacecraft that we can't repair, so they have to be perfect the first time," Bailey said.

Eventually, Bailey hopes to continue his education in aerospace and mechanical engineering. After all, engineering and science are a family tradition. In addition to his mother's career, his biological father, James E. Bailey, was a chemistry professor at ETH Zurich, and his stepfather, Andrew Lange, was a Caltech professor of astrophysics. His mother's father was a nuclear engineer, one of her brothers worked on developing microprocessors, and her other brother is a professor who conducts cancer research at Rutgers University.



*Arnold's son, James Bailey.*

Bailey has vivid childhood memories of visiting Caltech labs with his parents, which he believes pushed him toward science and mechanics. But he added, "I really think it's genetic." And in his family, that affinity for STEM fields is shared by men and women.

Bailey met a lot of female students and professors through his parents. "When I first heard about the struggles of women and STEM, I was a little surprised, like, 'This is really a thing?' That's because I had a small, biased view of it, being surrounded by brilliant female engineers and professors."

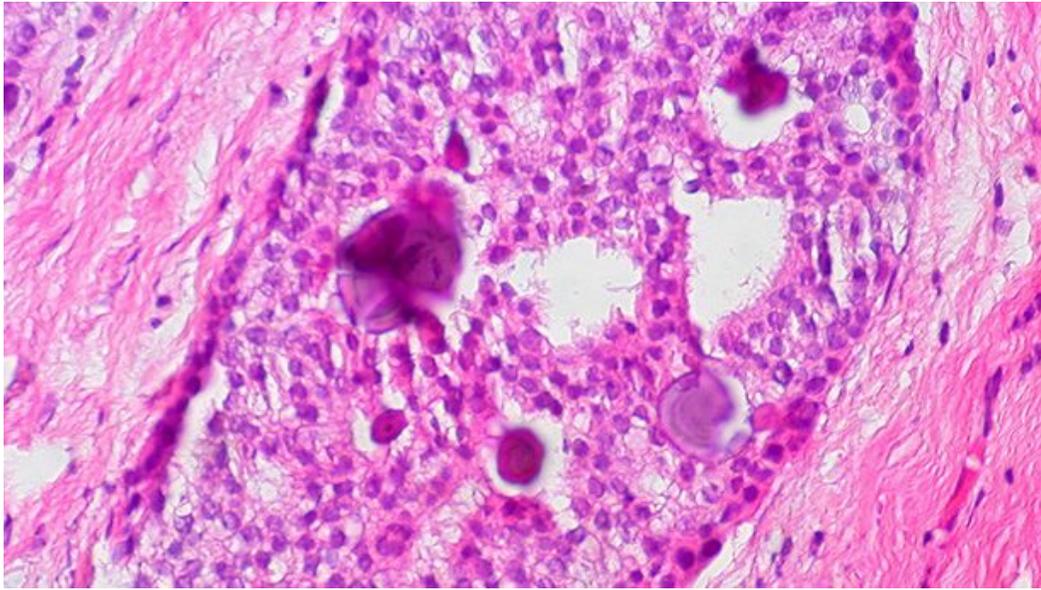
Bailey said that since the Nobel Prize announcement, his mother has received a massive influx of bottles of Champagne, flower deliveries and phone calls, plus group emails from every corner of the family. When Arnold goes to the official Nobel ceremony in Sweden in December, she will be accompanied by her family, and she will bring her graduate students to express gratitude for all they've done and to inspire them to pursue their dreams.

"My mom would want everybody to know that it's a collaboration of everyone to achieve these big goals," Bailey said. He has seen firsthand the value of collaborations in his mother's career and in his own. "The beautiful balance of working here at JPL is that you have some of the most brilliant minds from all backgrounds, whether technical or theoretical, you have the camaraderie of the sharpest technicians and others working with some of the smartest engineers, and they find the perfect balance of making it all work," he explained.

When Bailey is not at work sporting a bunny suit in a clean room, he is mentoring his younger brother who wants to be a machinist, remodeling a house, and restoring classic cars -- a '66 Chevelle and a '71 Blazer.

"I've always got to keep a wrench in my hands, so I work on the rover during the day, and I work on my projects at night, but I need to be mechanically involved," Bailey said.

## Upcoming Events



### **JPL's search for life helps breast cancer mapping**

**Dr. Susan Love, Chief Visionary Officer, Dr. Susan Love Research Foundation**  
**Wednesday, Nov. 14**  
**11:30 a.m. - 1 p.m.**  
**321 - Pickering Auditorium**

Also available via WebEx: <https://jpl.webex.com/join/benefits> 906 056 374  
Join by phone 1-510-210-8882 USA Toll  
Access code: 906 056 374

For the past 20 years, Dr. Susan Love—chief visionary officer of the Dr. Susan Love Research Foundation—has dedicated her career to the eradication of breast cancer and has pioneered some of the world’s most innovative research. From spearheading a collaboration with JPL’s Office of Planetary Protection to map the breast ductal system, to harnessing the power of artificial intelligence to develop a handheld, self-reading ultrasound for breast cancer screening in underserved populations, Dr. Love’s goal remains simple and clear: to achieve a future without breast cancer.

Read more about the work of the Planetary Protection Office that is related to this type of breast cancer research, in this 2016 JPL article:  
<https://www.jpl.nasa.gov/news/news.php?feature=6541>

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## Exoplanets from space and from the ground

David Ciardi: Chief Scientist, NASA Exoplanet Science Institute

Thursday, Nov. 29

1 to 2 p.m.

Pickering Auditorium

Since the discovery of the first planetary systems around Sun-like stars only three decades ago, we have discovered more than 3,000 planetary systems. Initially, all of the discoveries were made from the ground but in the early-2000s, spacecraft were starting to be used to characterize these planets and discover new exoplanetary systems. With the launch of Kepler in 2009, the majority of known exoplanets were, for the first time, discovered from a space platform, and now that TESS has launched in 2018, the number of exoplanet discoveries from space is expected to increase by almost an order of magnitude.

However, none of these discoveries could have been made without the coupling of ground-based observations with the space-based detections. Both Kepler and TESS have an extensive community wide ground program to confirm the planetary candidates as bona fide planetary systems. As we move from the era of planetary discovery to the era of planetary characterization, the coupling of space-based and ground-based observations will become even more important as march towards our ultimate goal of finding habitable (and perhaps inhabited) worlds beyond our Solar System.

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## Webcast: Lessons learned from large NASA projects

Thursday, Nov. 15  
10:30 a.m. to noon

Mark your calendars for the final Virtual Project Management Challenge (VPMC) of the year: "Lessons Learned from Large NASA Projects," featuring William H. Gerstenmaier, associate administrator for NASA's Human Exploration and Operations Directorate, and Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate.

The session will cover a wide range of topics including the importance of active management, challenges in a government-contractor work environment, benefits of "positive tension," built-in schedule margins, investing in people to prevent mistakes, and more.

Please [click here](#) to reserve your place and learn more about this informative and educational VPMC. APPEL Knowledge Services is hosting the event.

If you can't attend the live session or are interested in past sessions, you can view them on-demand on the [VPMC site](#).

# JPL Classifieds

Ads submitted Nov. 6-12

Submit an ad to: [universe@jpl.nasa.gov](mailto:universe@jpl.nasa.gov)

## For Sale

2003 Nissan 350Z Touring Edition, automatic transmission, RWD, 116k miles. Good condition, NEVER MODDED. Some scratches on the car and the driver's seat could use some TLC. Brand new front tires and rear brakes. \$7,775/OBO. Contact Kat with any questions or photos: [kat.cnls@gmail.com](mailto:kat.cnls@gmail.com)

2000 Jeep Cherokee 2-wheel drive, good condition runs and drives very well. Current smog and June registration; \$2,500. Contact: [kc6uzn@msn.com](mailto:kc6uzn@msn.com)

## Wanted

SPACE INFORMATION/memorabilia from U.S. & other countries, past & present, for personal use (see <http://www.youtube.com/watch?v=S7PvjGp7mCU>). [mrayman@alumni.princeton.edu](mailto:mrayman@alumni.princeton.edu), 818-790-8523, Marc Rayman.

## For Rent

MONROVIA: Rent \$850.00 per month. Studio-type room separate from house, Private Entrance & Bathroom, Close to Gold Line Station, Shopping & Downtown Monrovia, WiFi, Electric, & Water Included, Full Size Bed, Dresser, Portable AC & Heater, No Pets, No Smoking, No Parties, Limited Visitors, Perfect for Student or Busy Single Person, Minimum 6 Month Commitment. Call for more details: 626-864-2001.

LONG BEACH: Beautiful Condominium, 650 Sq. Ft. All Electric Unit. All appliances included. New Carpet and Tile Floors. Gated Community. One Assigned Covered Parking with plenty of off street parking. Conveniently located (Near Belmont Shores, Long Beach State). Utilities Include: Water, Trash and HOA fees. Contact Leslie for more details; [Leslie.M.Heard@jpl.nasa.gov](mailto:Leslie.M.Heard@jpl.nasa.gov).

## Vacation Rentals

COACHELLA RENTAL: Week 1, April 11-18, 2019, \$2,500. Luxury 1 Bedroom, 1 Bath Marriott Desert Villas II Condo. Full resort amenities and activities for the Coachella Festival week #1. Catch a shuttle to the concert venue (shuttle pass to the Fairgrounds is not included). Fabulous, comfortable beds. Amenities include yoga and fitness classes, gym, tennis, pool and spa, with pool bar and restaurant. Privileges at the nearby Marriott Resort Spa. The Villa sleeps 4 comfortably, with a full kitchen, microwave, coffee maker, dishwasher, pots, pans, dishes and utensils, large-screen TV in the living room, flat-screen TV in the bedroom, free WiFi, washer/dryer, full bathroom, linens, towels and balcony. Plenty of free parking. Contact Ann at 818-749-7754 or at [ann.b.drucker@jpl.nasa.gov](mailto:ann.b.drucker@jpl.nasa.gov)

MAMMOTH, Snowcreek, 2 bd., 2 ba. + loft, sleeps 6-8, fully equip'd kitchen incl. microwave, D/W, cable TV, VCR, phone, balcony w/mtn. vw., Jacz., sauna, streams, fishponds, close to Mammoth Creek, JPL discount, no pets. 626-798-9222, 626-840-3749 or [valeriee@caltech.edu](mailto:valeriee@caltech.edu).

MAMMOTH, Snowcreek, beautiful updated condo, 2 bd., 2 ba. + loft (sleeps 6-8), great location by pond/meadow, new appliances, TVs, DVD players, free wireless Internet and washer/dryer, no pets. 818-952-2696 or [BigMtnPrettySky@gmail.com](mailto:BigMtnPrettySky@gmail.com).

MAMMOTH, remodeled 2 bed/2 bath + loft, short walk to Canyon Lodge; Courchevel 6 features full kitchen, cable/Internet TV, DVD, Blu-Ray, wireless hi-speed Internet, 2-car garage, Jacuzzis, grill, pool; no pets. <http://Courchevel6.com>.

## JPL Family News

### Awards



*Benedikt Soja stands in front of one of the two newly inaugurated geodetic VLBI radio telescopes in Ny-Ålesund, Svalbard*

### JPLer earns EGU's Early Career Scientist Award

NASA Postdoctoral Fellow Benedikt Soja (335N) will receive the European Geosciences Union's 2019 Outstanding Early Career Scientist award in the Geodesy Division.

Soja's work and original research on very long baseline interferometry data (VLBI) and terrestrial reference frames (TRFs) with 335N group supervisor Richard Gross was instrumental in his being selected for the award.

"Of all the geodetic observation techniques, VLBI has always fascinated me the most," Soja said. "I think it's incredible that we are able to record the faint radiation from galaxies billions of light-years away—and use it to determine the positions of radio telescopes here on Earth with millimeter precision."

One of Soja's goals at JPL includes reducing errors in the terrestrial and celestial reference frames, which are fundamentally important for spacecraft tracking and navigation purposes. Reducing errors in the TRF,

CRF, and tracking station positions enables more accurate tracking and navigation of interplanetary spacecraft and hence more precise targeting of spacecraft for pinpoint landings on bodies like Mars.

Recipients of EGU medals and awards are selected from both European and non-European countries for their important contributions to the Earth, planetary and space sciences. Soja completed his Ph.D. in Geodesy and Geoinformation Science at the Technical University of Vienna, Austria before coming to JPL in 2016.

An awards ceremony will take place at the EGU 2019 General Assembly on April 7-12 in Vienna, Austria.

“Being named for this award has made my work feel valued and appreciated by the research community,” Soja said. “It’s a great honor for me, and I’m very grateful to everyone who has supported me throughout my career.”

## Retirees

David M. Hansen, 38 years, Section 337H; William Mateer, 27 years, Section 382B; Susan Deligiannis, 22 years, Section 1110; Jon Seddon, 14 years, Section 2313; David He, 16 years, Section 2210; Glenn Kubat, 15 years, Section 1191; Kevin Miller, 30 years, Section 335S; William Mogensen, 17 years, Section 393E; Kevin Rice, 16 years, Section 2001; Casper Sagoian, 41 years, Section 348E; John T. Schofield, 35 years, Section 3222; Jonathan Stabb, 18 years, Section 1650; Karen Boggs, 25 years, Section 398N; Diana Burrows, 23 years, Section 252F; Calvin Miyazono, 40 years, Section 3930; Elsa Waters, 32 years, Section 3020; Mark Whalen, 26 years, Section 1812.

## Passings

**Fernando S. Mina** died 5/30/18 at the age of 77. He worked at JPL for 15 years, most recently in Org. 6623, site services support, senior electrician. He is survived by his spouse, Marietta Q. Mina.

## Letters

Thank you to JPL colleagues for kindness shown on the recent death of my father. It's possible that a Universe reader knew Talmage Williams of RCA at Patrick AFB, or ITT-FEC at Vandenberg in the '70s and '80s. Tal taught his young daughter how to solder, read a weather map, and use an RPN calculator, and when to shout "second stage!" at a launch.

— **Angelyn Moore**