

## Featured Stories



*SpaceX Dragon cargo spacecraft launched with Orbiting Carbon Observatory 3 on board on Friday, May 3.*

### **Mirror, mirror out in space: a new angle on Earth's carbon**

By Jane Platt

**Updated May 3: The spacecraft launched successfully on Friday, May 3, at 11:48 p.m. PDT.**

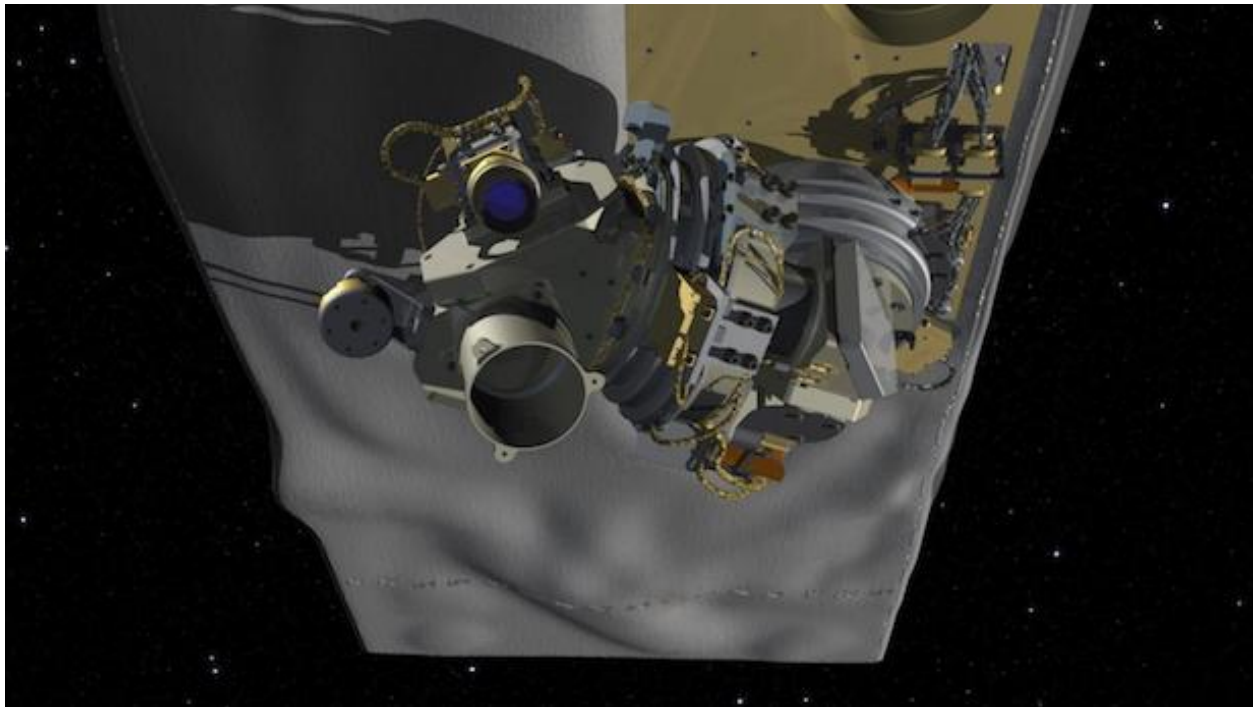
When the Orbiting Carbon Observatory 3 blasts off from Cape Canaveral in the wee hours and heads to the International Space Station, it will bring a new view--literally--to studies of Earth's carbon cycle.

From its perch on the space station, OCO-3, as it's called, will observe near-global measurements of carbon dioxide on land and sea, from just after sunrise to just before sunset. That makes it far more versatile and powerful than its predecessor, OCO-2.

"OCO-2 revisits areas on Earth at roughly the same time of day due to its sun-synchronous orbit," said Matt Bennett (Section 382A), OCO-3's project systems engineer. "OCO-3 will expand the time period of that coverage and observe the presence of carbon dioxide at varying times of day."

Since the space station orbits Earth every 90 minutes, OCO-3 will complete 16 passes a day.

"The point of the mission is to continue the legacy of OCO-2, but from the perspective of the International Space Station," Bennett said.



*Artist's concept of OCO-3 at the International Space Station.*

The OCO-3 space instrument is the third in a series. Its immediate predecessor, OCO-2, has been studying carbon dioxide distribution, and detecting emission hotspots and volcanoes since 2014. The OCO-1 spacecraft was lost in 2009 when the rocket fairing, with the spacecraft inside, failed to release during launch.

### **Mirrors, motors and mapping mode**

OCO-3's new capabilities depend heavily on an innovative swiveling mirror assembly, which Bennett describes as a "very agile pointing mechanism."

"When OCO-2 points toward an observation target, the entire spacecraft has to rotate," Bennett said.

"Since OCO-3 is a 'passenger' on the space station, we had to add the pointing mirror assembly to point independently of the station."

The pointing assembly uses two pairs of mirrors to rotate in two complementary directions—one parallel to Earth's surface, the other perpendicular. This setup allows OCO-3 to point to just about anywhere within view of the space station, but also allows it to capture "snapshot maps" – detailed mini-maps of carbon dioxide – over areas of interest.

This snapshot mapping mode can measure emissions from sources ranging from relatively small areas surrounding power plants, to large urban areas up 1,000 square miles, in just two minutes. That means OCO-3 can measure the entire Los Angeles basin in just a single pass – a task that would take OCO-2 several days.

Measuring large urban areas is particularly important to scientists since about 70 percent of total fossil-fuel emissions come from large cities.

"These targeted measurements will help us disentangle which sources of carbon dioxide are in nature, and which are anthropogenic, or human-caused," Bennett said.



*Matt Bennett supervises OCO-3 placement in test chamber.*

While measuring carbon dioxide, OCO-3 can simultaneously measure how well plants are performing photosynthesis by measuring how much their chlorophyll “fluoresces” -- or emits a specific wavelength of light – while illuminated by the Sun. This will help carbon-cycle scientists observe how well vegetation is absorbing carbon dioxide on the ground and how the surrounding atmosphere is responding.

"We will get to see how different sources of carbon dioxide, and sinks--areas that collect carbon, such as forests and oceans--vary by day, by season, and annually," Bennett said.

### **OCO-2 + 3 > 5**

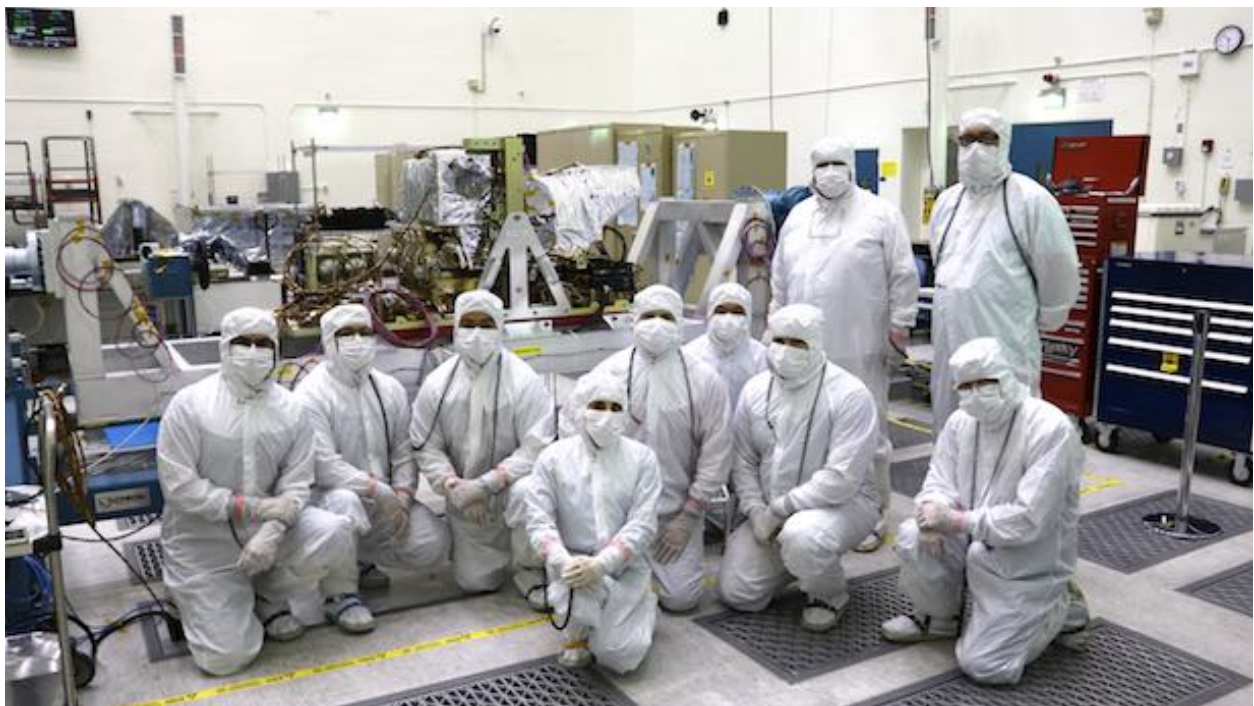
Since OCO-2 is still gathering data, the two missions will cross-calibrate by measuring carbon in some of the same areas on Earth, which improves verification of data.

The Lab’s Director for Earth Science and Technology, Diane Evans, said combined observations from both OCO missions will provide more comprehensive information about the state of carbon on our planet.

“They will add to the growing body of research from multiple Earth-observing missions,” Evans said. “And combining these data with data sets from other instruments on the space station like ECOSTRESS and GEDI will make it possible to answer key questions about the interactions of the carbon and water cycles.”



*OCO-3 team photo*



*OCO-3 team members in a JPL clean room.*

### **Launch, arrival and robotic choreography**

OCO-3 launch is scheduled for no earlier than May 3 at 11:48 p.m. PDT. Watch it live on NASA TV and at <https://nasa.gov/nasalive>. It's an instantaneous launch window, so if for any reason it doesn't launch at the precise scheduled moment, the launch needs to wait until the next day.

"I definitely have the pre-launch jitters," said Bennett, certainly not the first JPLer to have that experience mere days before launch.

OCO-3 is hitching a ride to the International Space Station on a SpaceX Dragon capsule, launched on a Falcon 9 rocket. Two robotic arms will welcome OCO-3 at the station: one to pull OCO-3 out of the

capsule's trunk, another to grab it and install it on the Japanese Experiment Module-Exposed Facility module. All this happens while OCO-3 is without power, so it has to be installed before it gets too cold. While this sounds like a nail-biter, the station operators have successfully performed this carefully-crafted, robotic choreography for several payloads over the last few years.

Like a courteous houseguest, OCO-3 and its team will follow certain "rules of the house" of the space station. For example, when resupply missions from Earth arrive to drop off essentials and science experiments to the astronauts, OCO-3 will "take a break" during the docking process and roll with it--literally, as the station rotates to different attitudes, including, Bennett notes, "belly-up, with no view for the instrument." The instrument also has to point around the station's solar arrays. And of course, sometimes the astronauts on the station have to perform an EVA--an Extra Vehicular Activity, aka a spacewalk. OCO-3 will power down for EVAs performed nearby to keep the astronauts safe from the moving pointing mechanism and high-voltage equipment.

Bennett says while these factors present new challenges for the OCO-3 team, he and his colleagues are excited about seeing how this "room with a view" and the instrument's swiveling mirrors offer up new insights into Earth's carbon cycle.

More articles about OCO-3 are at:

<https://www.jpl.nasa.gov/news/news.php?feature=7364>

<https://www.jpl.nasa.gov/news/news.php?feature=7370>

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## The Big Dig at JPL's birthplace

By Taylor Hill

On May 13 Los Angeles County Public Works will begin removing more than 1.7 million cubic yards of sediment from behind Devil's Gate Dam—an excavation effort expected to last nearly four years.

The project will involve close to 100 trucks taking four trips per weekday to deposit sites in Irwindale and Sun Valley.

Hauling will take place on weekdays from 7 a.m. to 3:30 pm, with trucks routed away from schools in La Cañada and JPL during morning rush hour. No sediment removal will occur on weekends, holidays or during major Rose Bowl events. The hauling will be seasonal from April through November, 2019 to 2022.

Walking and equestrian trails including the eastbound Arroyo Seco Trail along Hahamongna Watershed Park, and the southbound Arroyo Seco Trail will be closed on weekdays from 7 a.m. to 5 p.m.

### The dam that worked too well

In 1920, more than a decade before JPL's "rocket boys" tested engine parts in the dry riverbed of the Arroyo Seco, engineers completed construction on the first flood control dam in Los Angeles County, downstream from the Lab's future home.

Today, Devil's Gate Dam—named for the rock outcropping at its base which resembles a devil—still stands, protecting Pasadena residents from catastrophic floods like ones that laid waste to homes in 1914 and 1916.

The dam's past success threatens its future effectiveness. Years of sediment buildup has led to decreased water storage capacity behind the dam, leaving homes below vulnerable to flooding in the event of a 100-year storm, according to LA County.

"It's enough sediment to fill the Rose Bowl four times," said Steve Burger, LA County Public Works construction engineer.

The 2009 Station Fire exacerbated the issue, pushing an additional 1.3 million cubic yards of sediment into the reservoir.



Map of the areas to be affected by the project.

### Arroyo habitat to be restored

In addition to the sediment removal, the county will be restoring large swaths of the Arroyo Seco back to its natural setting. The plan includes removing invasive species such as Eucalyptus trees, perennial pepperweed, poison oak, Spanish broom, and black mustard, and replace them with native vegetation including California Sagebrush, California Buckwheat, mulefat, and Black willow trees.



The Arroyo area south of JPL.

The county will plant these new trees and native plants to create a 70-acre habitat restoration area surrounding a 42-acre part of the reservoir that will remain subject to periodic sediment removal.

“The main purpose of the project is to provide flood protection to the communities downstream by cleaning out the reservoir, but we’re going to essentially be making things better here for the environment. So, people can come out here and experience what it was like hundreds of years ago,” Burger said.

The sediment removal portion of the project is expected to be completed in the fall of 2022. To avoid the need for large-scale excavations in the future, county officials are planning to perform annual habitat and reservoir maintenance to preserve flood control capacity, and clear out sediment following each rainy season.

### **Community input**

Since 2011, Public Works has been involved in more than 80 community meetings with various stakeholders. The Los Angeles County Board of Supervisors determined in 2017 to limit the scope of the project from 2.4 million cubic yards scheduled for removal down to 1.7 million cubic yards of sediment. The County will be monitoring air quality around the project as well. A draft plan is available here.

For the latest updates and more information on the project, visit <https://dpw.lacounty.gov/swe/devilsgate/>.

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## Dawn mission snags a stellar honor from Space Foundation

Photo: Space Foundation CEO Tom Zelibor (left) presented Dawn Project Manager Marc Rayman (center) and JPL Associate Director for Strategic Integration Dave Gallagher (right) with the 2019 John L. "Jack" Swigert Award for Space Exploration. Credit: Space Foundation

The Dawn mission, which concluded its exploration of two planet-like worlds--Vesta and Ceres--in October of 2018, picked up a prestigious award from the Space Foundation.

Dawn Project Manager Marc Rayman of JPL, and the Lab's Associate Director for Strategic Integration, Dave Gallagher, accepted the foundation's 2019 John L. "Jack" Swigert, Jr., Award for Space Exploration on Monday, April 8, at the opening ceremony of the organization's 35th Space Symposium. The ceremony was held in Colorado Springs.

Dawn was the first spacecraft to orbit an object in the main asteroid belt, and the only spacecraft to orbit two extraterrestrial destinations. The Foundation honor recognizes Dawn for its work revealing important information about the formation of the solar system.

Rayman said, "We are very grateful to the Space Foundation for the Swigert Award recognizing the Dawn team for piloting this advanced spaceship. For two centuries, dwarf planet Ceres and Vesta were seen as little more than faint dots of light amid the stars, until this bold mission provided us with richly detailed, intimate portraits of these two complex, fascinating alien worlds."

Scientists will continue to flesh out those portraits for years to come, as they analyze the data from the mission.



## Bear barred from JPL

An unbadged, furry visitor was turned away at the East Gate—by a wall and a turnstile.

About 1 a.m. Sunday, security personnel and cameras caught a bear trying to climb a wall to get into JPL and then trying another tactic: walking through the turnstile. When that attempt failed, it walked away. Not easily deterred, the bear came back 15 to 30 minutes later and tried the turnstile again—and again failed to gain entry. It then left.

Here are some additional photos taken right after the turnstile view.





This sighting is another reminder that we share our neighborhood with various types of wildlife.

Read National Park Service information about staying safe around bears at:

<https://www.nps.gov/subjects/bears/safety.htm>.

Also read a recent JPL Space post about how to stay safe if you see a mountain lion:

<https://js.jpl.nasa.gov/Pages/story.aspx?StoryID=27065>

Contact JPL Protective Services, ext. 3-3333 to report a bear or mountain lion sighting.

For more information on wildlife safety, contact Cheryl Allworth at 4-8646 or Chuck Buriel at 4-0180.

# Events



## von Kármán Lecture Series: CubeSats & SmallSats

Thursday, May 9

7 p.m.

von Kármán Auditorium

Friday, May 10

7 p.m.

Caltech Ramo Auditorium

### About the lecture:

Some are the size of a toaster. Others a suitcase. They can ride into space as secondary payloads in a rocket's "trunk," or even be tossed out of an airlock, to start their missions. Small satellites, often collectively called "cubesats," are changing the way we explore space and monitor our home planet.

**Host:** Preston Dyches (JPL)

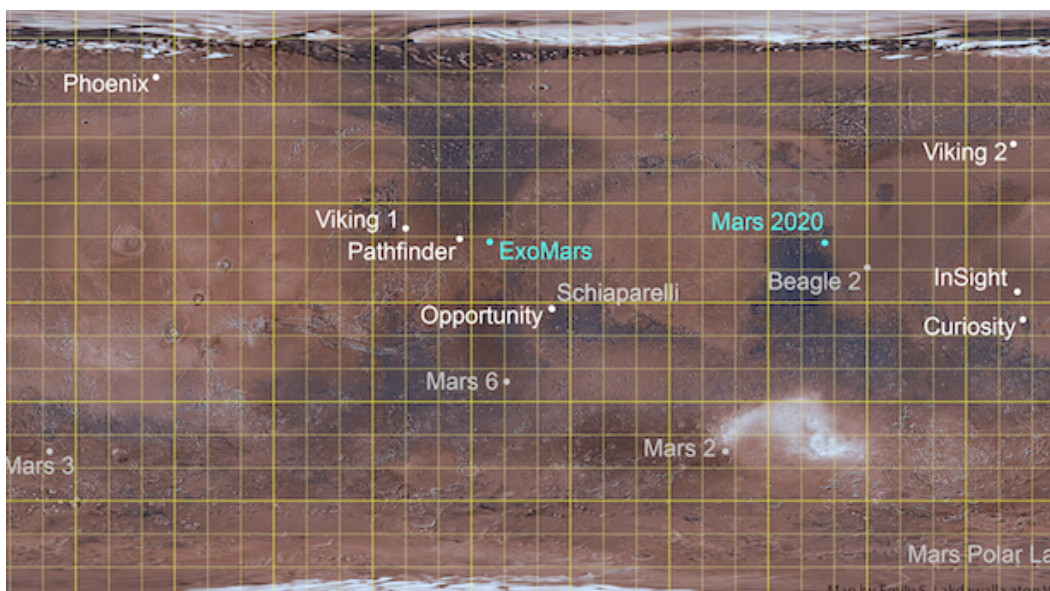
### Speakers:

Anne Marinan - (JPL) Systems Engineer, Near Earth Asteroid Scout & Mars Cube One;  
Team Xc Lead Engineer

Travis Imken - (JPL) Project Systems Engineer, RainCube

For more information, visit

[https://www.jpl.nasa.gov/events/lectures\\_archive.php?year=2019&month=5](https://www.jpl.nasa.gov/events/lectures_archive.php?year=2019&month=5)



## Selecting Mars landing sites: from Viking to Mars 2020

Thursday, May 16, Noon to 1 p.m.

321- Pickering

Presented by: Gentry Lee

**Mission Chronicles – Mars Missions Landing Site Selection: From Viking to Mars 2020**

The selection of a landing site (or sites) is one of the most important decisions made by any Mars mission going to the surface. Both engineering and scientific issues affect the selection of the landing site. In the beginning, for Viking, landing safely was the first and foremost criterion for landing site selection. As our knowledge of Mars has expanded, and the capabilities of our landing vehicles have increased, the scientific value of a site has become more and more important in landing site selection. This mission chronicle talk will look at the landing site selection process from Viking to InSight, including a forward look at Mars 2020, and discuss how the nature of the process has changed. This talk is one in the Mission Chronicles series. Video and presentation material will be available after the talk on JPL Tube by searching "Mission Chronicles."

The "Mission Chronicles" speaker series is sponsored by the 3X/5X Operations Working Group whose purpose is to communicate to a wide JPL audience the challenges experienced during mission development and operations. The event is restricted to US persons/JPLers-only.

The technical data in this document is controlled under the U.S. Export Regulations; release to foreign persons may require an export authorization.

# JPL Family News

## Retirees

The following JPL employees recently announced their retirements:

**Richard Denzin**, 28 years, Section 2507; **Donald E. Gibbs**, 36 years, Section 349E; **Ronald K. Kandt**, 18 years, Section 394F; **Patrick J. Martin**, 25 years, Section 357F; **Annie Murray**, 35 years, Section 3416; **Frank Y. Tsai**, 18 years, Section 2210

## Passings

**Jon DePew**, 74, died January 19, 2019. Jon's career at JPL began in 1986. He contributed to a number of flight projects including NASA United States Microgravity Lab-1 Space Shuttle program, Fundamental Physics, Herschel SPIRE, Planck Cryocooler and HFI, MSL, Chemin, MIRI Focal Plane, and MSL Terminal Descent Radar Testing. He was also involved in technology development projects including the Optical Communication Ground Station Receiver, Hydrogen storage materials technology program, sub-Kelvin cooler development for future astrophysics missions, study of cryogenic ices as applied to icy moons, advanced camera and spectrometer development, instrument for CO<sub>2</sub> collection on Mars, and advanced mirror technologies.

He is survived by his life partner of 34 years, Deborah Shepler, and his brother, Ren DePew. Contributions in his memory can be sent to Planned Parenthood.

**Jon Stinzel**, 49, died March 12, 2019. He joined JPL in March 2007, and was a member of the Section 333's Front End Controller Group (333G) since 2009. Prior to, as early as the late 90's, he was part of the MTC Support Contract that provided engineering services to the Section for many years. He was well known and respected for his contributions to a variety of DSN tasks and had collaborated with a number of divisions within ESD. In particular, he contributed to the software development for uplink controllers, transmitters, and supported the DSN antenna systems engineering. A celebration of Jon Stinzel's life was held Saturday, April 6 at 2 p.m. at Neighborhood Unitarian Universalist Church: 301 N. Orange Grove Blvd., Pasadena, CA, 91103.

## Awards



Louise Jandura working with her colleague Avi Okon at JPL's Mars Yard.

### **Louis Jandura named to Academic All-America Hall of Fame**

Louise Jandura, a mechatronics engineer at JPL, is one of a four-member class to be inducted into the College Sports Information Directors of America (CoSIDA) Google Cloud Academic All-America Hall of Fame Class of 2019.

The ceremony—which will be held on Monday, June 10 at the 2019 CoSIDA Convention in Orlando, Florida—“recognizes former Academic All-Americans who received a college degree at least 10 years ago, have achieved lifetime success in their professional careers, and are committed to philanthropic causes,” according to the organization's press release.

Jandura was a three-sport athlete in field hockey, basketball and softball for the Massachusetts Institute of Technology (MIT) class of 1984. She started her career at JPL in 1989.

Detailing her time on-Lab, the announcement described Jandura as “an engineering leader for the Mars 2020 mission. She serves as the Sampling and Caching Subsystem Chief Engineer for the Mars venture. Jandura joined JPL following graduate school, and has spent her entire professional career—nearly 30 years—working at JPL to deliver mechanisms, robotics and scientific hardware to many space flight projects including the Mars Exploration Rovers, Mars Science Laboratory Curiosity Rover, Shuttle Radar Topography Mission, and the Genesis and Aquarius missions. Currently, she leads a team of 120 engineers who are designing and building the sampling and caching system for the Mars 2020 rover.”



Jandura at bat during an MIT softball game in college.

“MIT provided me a tremendous opportunity to pursue my passion for both academics and athletics,” Jandura said in a statement. “My time there, both in the classroom and on the field, gave me a superb foundation for my work at JPL and expanded my perspective of the world and its possibilities a great deal.”

Read the full Academic All-America Hall of Fame announcement [here](#).





The JPL-managed Mars InSight social media efforts and Solar System Exploration site are People's Voice winners at the 2019 Webby Awards.

## **JPL web, social media efforts honored at the Webby Awards**

The Mars InSight mission (@NASAInSight) received a social media People's Voice Award for Education & Discovery. After landing on Mars in November 2018, the mission generated more than one million social media posts from members of the public. The hashtag #MarsLanding even trended higher than #cybermonday on the Monday after Thanksgiving, known as Cyber Monday.

The Solar System Exploration site won a People's Voice award in the Science category.

Other Lab nominees included the NASA's Climate Change website in the Green category, and the video "The Call of Science," in the 360-degree video category.

The Mars InSight Lander social media account, Climate Change, and Solar System Exploration websites are managed by JPL, which also produced "The Call of Science" video.

Webby honoree designations, named earlier this month, included JPL's social media efforts, JPL's Open Source Rover, and the "On a Mission" podcast.

NASA's social media presence, which has grown from a few accounts more than a decade ago to dozens of channels with millions of followers, was also honored Tuesday with a pair of Webbys and People's Voice awards. NASA.gov, the agency's primary website, won its 11th People's Voice award in Government & Civil Innovation.

The agency's use of social media really took off in 2008, when Veronica McGregor, news manager at JPL, began tweeting in the voice of the Mars Phoenix Lander. Since then, the agency has added channels across a variety of platforms. On Twitter, NASA has 66 million followers, with 60 million on Facebook and 51 million on Instagram.

This year's Webbys are the second and third for NASA's overall social media presence, having won both the Webby and People's Voice award in 2017.

Established in 1996, The Webby Awards are presented by the International Academy of Digital Arts and Sciences. This year there were more than 13,000 entries, and more than 3 million votes were cast for the People's Voice awards.

Full JPL news release about NASA and JPL honors at the Webby Awards:

<https://www.jpl.nasa.gov/news/news.php?feature=7384> .

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## **Sewanee: The University of the South honorary degree for Matt Golombek**

Read the full story from Sewanee: The University of the South:

<https://new.sewanee.edu/news/honorary-degrees-to-be-conferred-during-baccalaureate/>