universe

JPL

January 2021

Featured Stories

What's In Store For 2021?

By Carl Marziali

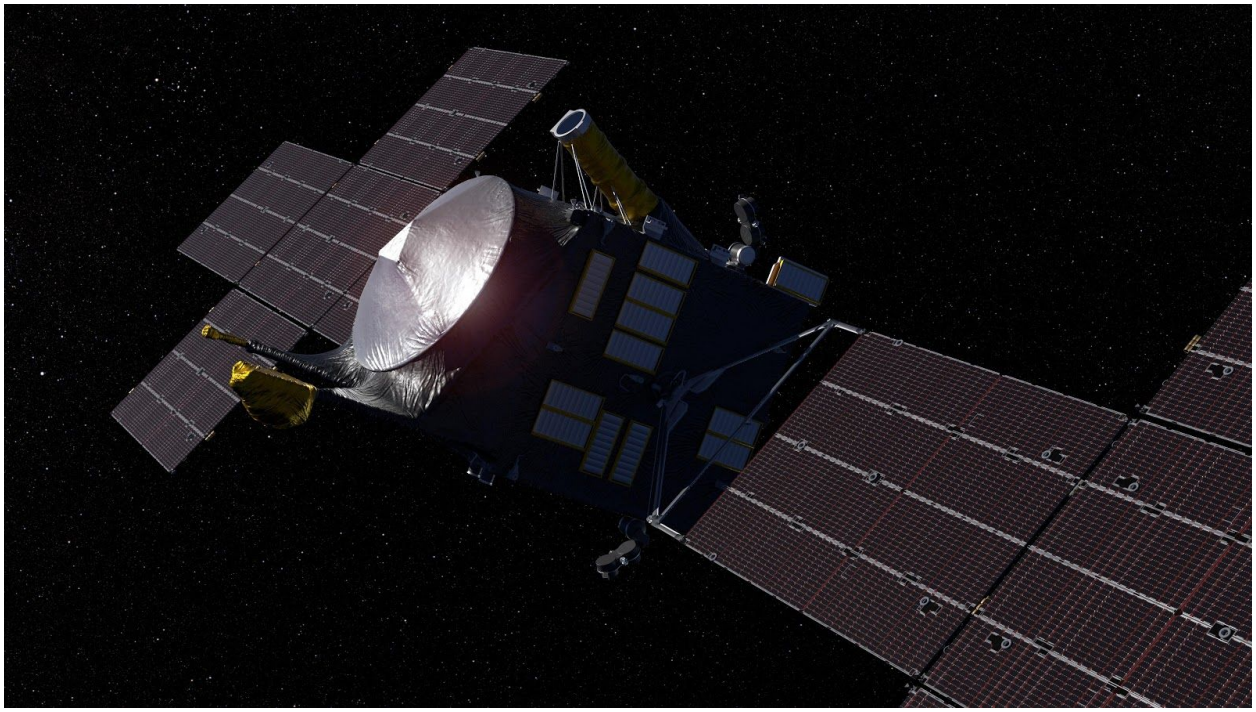
The JPL community rolls into 2021 like a wary driver in a thick fog.

Coronavirus infections are multiplying across the region. Hospitals are turning away ambulances. A vaccine waits around the corner, but how far is that corner? At the Lab, on-site work remains restricted to mission-critical tasks.

The outlook brightens in the skies and in space. The Perseverance rover and its marsupial helicopter Ingenuity are approaching Mars. Sentinel-6 Michael Freilich has glided safely into Earth orbit, and upgrades are almost complete on the largest Deep Space Network dish in the Southern Hemisphere.

The Astronomy & Physics directorate plans to deliver a Deep Space Optical Communications (DSOC) package to the Psyche mission in 2021. Designed to transmit data through photons in a laser beam, DSOC is expected to increase communications performance and efficiency by 10 to 100 times over conventional means, with no added burden of mass or energy on the spacecraft.

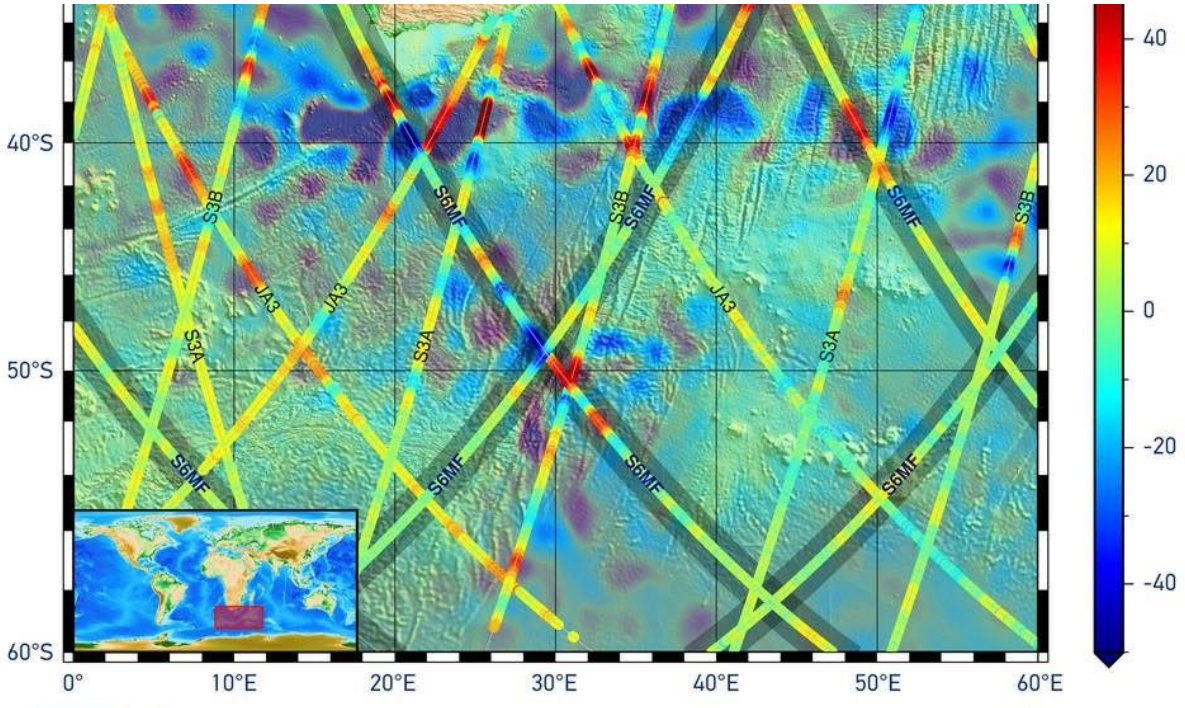
The James Webb Space Telescope is expected to launch in 2021, carrying the directorate's Mid-Infrared Instrument. The Coronagraph Instrument, which uses a system of masks, prisms, detectors, and self-flexing mirrors to directly image Jupiter-like exoplanets, will undergo its Critical Design Review in preparation for delivery to the Nancy Grace Roman Space Telescope mission. And the SPHEREx mission, chosen by NASA in 2019 to scour the near-infrared sky for clues to the origins of galaxies, will start to deliver hardware.



This artist's concept, updated as of June 2020, depicts NASA's Psyche spacecraft. Image Credit: NASA/JPL-Caltech/ASU

The Earth Science & Technology directorate looks forward to the first data from the Sentinel-6 Michael Freilich spacecraft, launched into orbit in November. Named after the storied NASA/JPL Earth science researcher and executive who passed away in 2020, the mission extends a 30-year record of ocean observations from space. Sentinel-6 Michael Freilich will collect the most accurate data yet on sea level changes. Combined with observations from a second satellite launching in 2025, the mission will measure sea level down to the centimeter for more than 90% of the world's oceans. The data will extend a historical record that dates from 1992 and the launch of the joint U.S.-French effort TOPEX/Poseidon.

Another satellite observing sea level, Jason-3, will move to a slightly different orbit in 2021 in order to provide complementary data to Sentinel-6 Michael Freilich. An additional instrument on the latter satellite, a GNSS radio occultation sensor, will measure physical properties of the atmosphere, such as temperature, pressure, and water vapor, over a wide range of altitudes. The new dataset has the potential to improve weather forecasting, provide information about the ionosphere, and support climate studies.

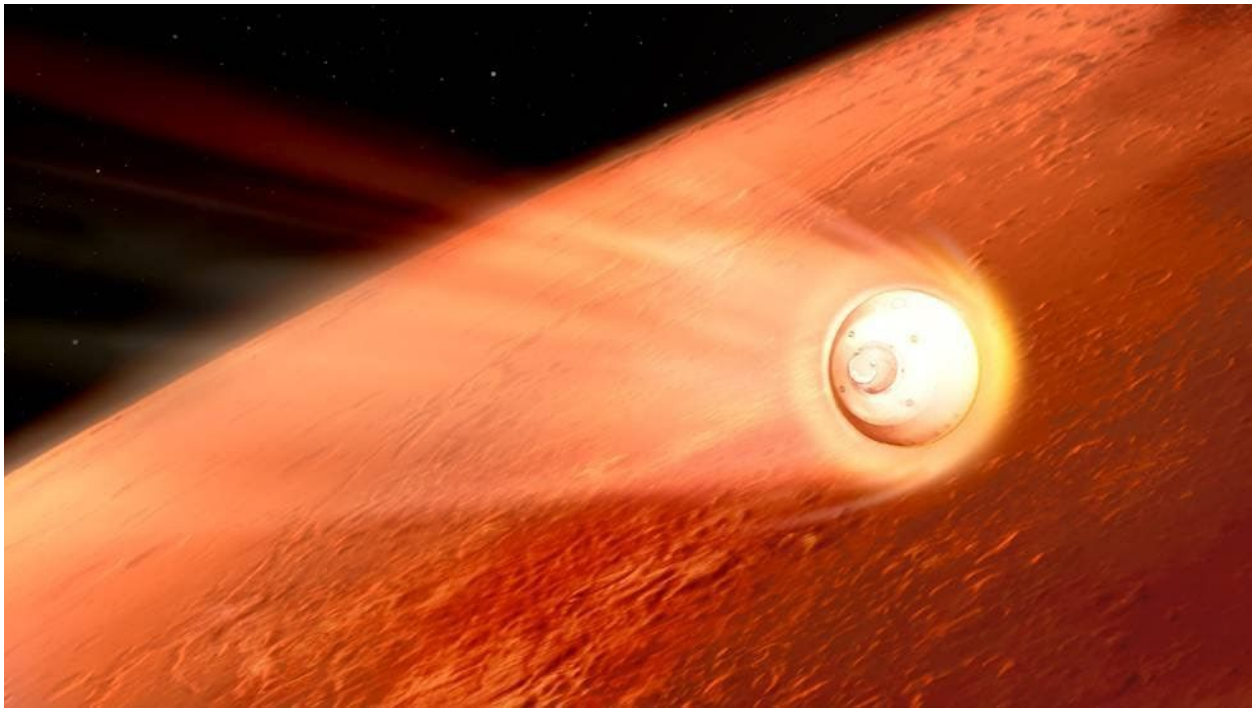


The data in this graphic are the first sea surface height measurements from the Sentinel-6 Michael Freilich satellite, which launched Nov. 21, 2020. They show the ocean off the southern tip of Africa. Image Credit: EUMETSAT

The Interplanetary Network Directorate will celebrate the new year a few weeks late with the return to full service on Feb. 12 of Deep Space Station-43, the 70m antenna at the Canberra Deep Space Communications Complex. The antenna, the Deep Space Network's largest in the Southern Hemisphere, has been undergoing repairs and upgrades for over 10 months. Other upgrades at the Canberra complex include the first delivery of a DSN Lunar Exploration Upgrade near-Earth k-band deployment to support NASA's Artemis program.

In a delicate operation, a 400-ton crane lifts the new X-band cone into the 70-meter (230-feet) Deep Space Station 43 dish located in Canberra, Australia. Image Credit: NASA/JPL-Caltech

At the DSN's American site, the newly restored Goldstone Solar System Radar is already tracking near-Earth asteroids, helping to make up for the recent collapse of Puerto Rico's Arecibo radio telescope. And at the third DSN site in Madrid, a new 34m Beam Wave Guide antenna will come online Jan. 15, in time to support the Mars 2020 landing.



In this illustration of its descent to Mars, the spacecraft containing NASA's Perseverance rover slows down using the drag generated by plunging through the Martian atmosphere. Image Credit: NASA/JPL-Caltech

The Planetary directorate also will celebrate a late new year, pending the safe landing of Mars 2020's payload on the Red Planet. The lander carries history's most advanced rover, Perseverance, and its experimental companion, the Ingenuity helicopter. If all goes well, rover and helicopter will sit safely on Martian soil Feb. 18.

"Perseverance sets a new bar for our ambitions at Mars," said Lori Glaze, planetary science director at NASA Headquarters in Washington. "We will get closer than ever before to answering some of science's longest-standing questions about the Red Planet, including whether life ever arose there."

Other anticipated Planetary highlights: the Critical Design Review for Europa Clipper; the selection of Discovery mission finalists (JPL has two out of four in the running, Trident and Veritas); and confirmation by NASA of Lunar Trailblazer, selected by the agency in 2019 to map water on the Moon as one of the first small satellite missions for planetary science.

Across all directorates, the new year brings hopes of a return to some semblance of normalcy. Mandatory telework brought some benefits: JPLers learned to work virtually and reclaimed their commuting time. But many miss our Lab, our deer, our friends and colleagues.

Whether we feel nostalgia for once-grumbled-about weekly team meetings, a hot tea on a cold day at the Mall, or sneak peeks from the Highbay's viewing gallery, here's hoping that once the fog lifts, we will see each other again.

Hope and Highlights from a Year of Loss

By Carl Marziali, Taylor Hill, Jane Platt

Isn't a perfect launch to Mars enough to make a year? Not in 2020, when besides getting Mars 2020 to its final countdown in the midst of a worldwide calamity, JPLers designed and built life-saving devices in weeks, adapted to a virtual workplace overnight, and closed the year with another flawless launch.

As coronavirus hit, JPL engineers teamed up to invent a simple ventilator that could be mass produced to fill a massive need – and they did it in 37 days.

On Apr. 30, the Food and Drug Administration approved VITAL (short for Ventilator Intervention Technology Accessible Locally) for an Emergency Use Authorization. Designed specifically for Covid-19 patients, the prototype is composed of far fewer parts than traditional ventilators and is intended to last three to four months.

More than 100 manufacturers from around the world quickly applied for a free license to build VITAL. Read the story of how a team of engineers, fueled by a desire to help during the crisis, brought VITAL into being.

As with JPL's ventilator project, eager JPLers came running to design and test 3D-printed respirator masks in less than a month, including instruction videos, manuals, and specs available through Open Source. And soon after, another team came up with a practical and simple scheme to stem infection: a pendant that reminds wearers not to touch their face.

Within days of the Lab moving to mandatory telework in March, JPLers were trading teleworking tips and comparing home office set-ups. Within three months, the Lab community and the nation faced a new challenge: the unrest and questioning that followed the homicide of George Floyd. Director Michael Watkins and the JPL Executive Council responded with a set of 10 actions to support and strengthen inclusivity in the Lab community.

The Astronomy & Physics directorate guided instruments on two of NASA's upcoming space telescopes past critical milestones this year. The Mid-Infrared Instrument (MIRI), nestled aboard the fully built,

assembled, and integrated James Webb Space Telescope (JWST), passed a comprehensive systems test, a ground segment test, and final environmental stress tests in the lead up to next year's planned launch. For the Nancy Grace Roman Space Telescope, JPL has been busy developing and manufacturing the Coronagraph Instrument (CGI) that will use a system of masks, prisms, detectors, and even self-flexing mirrors built to directly image Earth-like exoplanets.

Aboard the ISS, the Cold Atom Lab (CAL) upgraded its measurement capabilities, adding an atom interferometer, which is based on the wave-like properties of atoms. CAL demonstrated atom interference for the first time in space in May, and upcoming experiments will include a demonstration of inertial sensing required for applications in spacecraft navigation, tests of Einstein's theory of gravity, and searches for dark energy candidates.

In March, NASA selected for development JPL's CubeSat constellation mission, SunRISE, which aims to show how the Sun generates and releases giant space weather storms. The goal is to launch six solar-powered CubeSats in Earth orbit, operating as one single radio telescope more than 6 miles (roughly 10 kilometers) across that will create 3D maps to pinpoint where giant particle bursts originate on the Sun, and how they evolve as they expand outward into space. The project passed its Project Mission System Review (PMSR) in November 2020.

NASA also extended the Deep Space Atomic Clock (DSAC) mission into a second year for 2020. An early result of the extended mission was a measure of DSAC's long-term drift characteristics, estimated at ~3e-16/day. This level is nearly two orders of magnitude less than the rubidium atomic clocks that are used by GPS today, and will be an important factor for any mission that envisions the need for long term, autonomous operations.

The Earth Science & Technology directorate wrapped up the challenging year with a successful, picture-perfect launch from Vandenberg Air Force Base in November. As the Sentinel-6 Michael Freilich spacecraft soared upward, propelled by a SpaceX Falcon 9 launch vehicle, it was a joyous reminder of the capabilities of humankind—even in the face of adversity—and a poignant tribute to a key NASA/JPL Earth science executive. Michael Freilich had a 40-year career at NASA, including more than a dozen years as head of the agency's Earth science division, and as a JPL researcher from 1983 to 1991.

Freilich died of complications of pancreatic cancer in 2020, but Sentinel-6, the latest in 30 years of ocean-observing spacecraft, carries his name and legacy.

JPL Earth scientists were once again called into action when a natural disaster struck our planet—this time when massive wildfires raced through California and other western states. Using the Uninhabited Air Vehicle Synthetic Aperture Radar (UAVSAR) instrument, scientists created proxy maps to show emergency responders the locations of damaged structures and burn areas.

Despite pandemic-related delays, the airborne Oceans Melting Greenland (OMG) mission traveled to Greenland, where their observations revealed that, despite a previous cooling period when glacier melting slowed at Jakobshavn, the process was speeding up as warmer waters returned.

The Interplanetary Network Directorate looked past a bleak 2020 with the return to 450KW capability in November of the Goldstone Solar System Radar (GSSR), which had been offline for 18 months. The restored capability has already led to a number of successful tracks on near-Earth asteroids, and came just in time. Puerto Rico's Arecibo radio telescope collapsed a month later, leaving the scientific and planetary defense community more reliant on Goldstone than ever.

November also brought the installation of the Three Links per Operator (3LPO) efficiency project at all Deep Space Network sites in November, allowing each operator to communicate with more spacecraft.

Other accomplishments included a successful uplink test with Voyager 2 of the new S-Band transmitter at the DSS-43, 70m antenna in Canberra, the only dish that can communicate with the spacecraft, one of the

farthest from Earth. The directorate also demonstrated the high-power laser transmitters and completed the critical design review for the Deep Space Optical Communications system.

The newly formed Planetary directorate notched an inaugural year of triumph and relief with the successful launch of the Mars 2020 payload, carrying history's most advanced rover, Perseverance, and its experimental companion, the Ingenuity helicopter. Final assembly and testing took place under rigid deadlines imposed by planetary alignment, and pandemic conditions that required many personal sacrifices.

"With the launch of Perseverance, we begin another historic mission of exploration," said NASA Administrator Jim Bridenstine. "This amazing explorer's journey has already required the very best from all of us to get it to launch through these challenging times. Now we can look forward to its incredible science and to bringing samples of Mars home even as we advance human missions to the Red Planet. As a mission, as an agency, and as a country, we will persevere."

The directorate also delivered RIME, an ice-penetrating radar instrument, under equally harsh conditions. Extensive testing was supposed to start in mid-March, right when most of the Lab switched to mandatory telework. It took a month before the RIME team could reassemble safely on Lab with extensive precautions. Despite the delay, the team met their deadline for delivering the transmitter, receiver and other key components to the Italian Space Agency. The instrument will launch in 2022 on a European Space Agency mission to explore Jupiter and its icy moons.

Psyche, a NASA mission to explore the eponymous metal-rock asteroid, in July passed its critical design review in July, during which NASA examined the designs for all of the project systems, including the three science instruments and all of the spacecraft engineering subsystems, including telecommunications, propulsion, power, avionics, and flight computer. Now the mission is manufacturing and testing the spacecraft hardware in preparation for launch in 2022.

The Planetary Directorate resulted from the merger in early 2020 of the Mars Exploration Directorate (6x) and Solar System Exploration Directorate (4x), in order to better align JPL's organization with that of NASA HQ and the planetary science community, while continuing to ensure strong oversight and leadership of critical, ongoing projects.

The Ocean Worlds Life Surveyor (OWLS) project, part of the JPL Next investment program for jumpstarting key new JPL capabilities, completed its breadboard phase, demonstrating a set of prototype instruments that together could show conclusive evidence for the presence of life on another world. The project is now integrating this suite of instruments in preparation for a field test at Mono Lake, California in the summer of 2021.

JPL Smashes Its United Way Giving Record

By Jane Platt

It has been an unusual giving season for the United Way of Greater Los Angeles, to say the least. There was no in-person kickoff or fund-raising event, and most community events were cancelled. Despite that, during the Nov. 4 through Dec. 4 annual United Way giving campaign, JPLers displayed their generosity by donating a record amount to help those less fortunate.

The stats are in (virtual bell ring): Over 1,300 generous JPLers – 1,323 to be precise – donated $515,000. The amount collected sets a new record. Contributions were a mix of one-time, recurring, HomeWalk, and other external donations.

“I’m so proud and impressed that, despite having to handle their own challenges and uncertainties during the pandemic, our JPL community has reached out to help others in our area through the Lab’s United Way giving campaign,” said JPL Deputy Director Larry James.

This year's contributions go toward United Way’s mission to break the cycle of poverty in L.A. County through housing, education, and economic mobility. Donors also had the option of directing their contribution to a specific charity of their choice.

Missed out on this year's official giving campaign? You can still donate at JPL’s external site for credit/debit card donations, or by emailing uwgive@jpl.nasa.gov. And although many in-person volunteer opportunities are on hold during the pandemic, virtual opportunities are in the works for the first half of 2021. Watch for announcements on JPL Space and at https://unitedway.jpl.nasa.gov.

A rendering of the planned Building 350, Flight Electronic Integration Facility, from Mariner Road.

Making Way For JPL's Flight Electronics Integration Facility

By Taylor Hill

The footprint of JPL's newest building will soon be evident, as the demolition of trailers T1723 and T1722 gets underway Dec. 20 to make way for a new five-story, 86,000-square-foot Flight Electronic Integration Facility.

Building 350 will house much of the Electronic Manufacturing, Packaging & Tech Services Section (356), centralizing testing labs and outdated facilities scattered around Lab to a new state-of-the-art facility that will act as a showcase for JPL's technological innovations.

"The new facility updates a lot of the functionality of aging infrastructure around Lab." says Facilities Project Administrator Benjamin Tom. "For example, Building 103—the current Electronics Fabrication Shop—was originally a cafeteria back in the 60s and 70s. This new facility is laid out with the Lab's current needs and potential future requirements in mind."

Some of the testing capabilities expected to be incorporated into the Flight Electronics Integration Facility (FEIF) include environmental testing typically done in Building 144, electromagnetic compatibility and interference testing handled in Building 179, avionics functional testing currently done in Buildings 198 and 317, and functional power tests conducted in Building 303.

So instead of transporting delicate test equipment and hardware up and down the hills of JPL, engineers and scientists can test, build, and study their components in one central, climate-controlled, clean room-capable facility. Additionally, FEIF will have grounding infrastructure that will allow teams to conduct signal and power integrity tests that could catch design issues earlier in the development phase, minimizing costly and time-consuming redesigns.

"It takes a lot of manpower, time, and scheduling to move parts around Lab, and that can all mean added costs to projects," Tom said. "This building should help alleviate those issues."

The new building's central atrium will act as a gathering space and pathway from floor to floor and building to building.

Section 356 Manager Joseph Onstott said the team has invested a lot of time into the three floors they will be occupying in Building 350, ensuring efficient flow and organization of the labs and local engineering support.

"This will be a huge advancement to our current building and operations in Building 103 by providing the space to allow a single flow for cable, board and hybrid, as well as adding state-of-the-art equipment to improve production," Onstott said. "A newly defined R&D electronic fabrication area will add capability for prototyping helping out projects in early development."

The new structure will be located near the east gate entrance between Buildings 317 (In-Situ Instruments Laboratory) and Building 277. The building's design elements include a walking bridge linking it to Explorer Road on the third level and to Mariner Road on the first floor, acting as a pathway for pedestrians to make their way up or down the hill. Once completed, the building will be accessible for tours, giving the public a front row seat to the electronic manufacturing capabilities of JPL.

Construction is expected to run from March 2021 through December 2023, with a grand opening scheduled for January 2024.

Michael Mangano during Perseverance Rover's walkdown in April 2020. Image Credit: Christian Mangano

The Robot and Space Shuffle

By Celeste Hoang

Behind every great JPL mission is the great task of...getting time in the clean room. And JPL's high bay in Building 179 might be the most exclusive hot spot on Lab.

Always in demand with a months-long waiting list, it's a crucial and essential destination for any mission or instrument waiting to complete Assembly, Test, and Launch Operations (ATLO). No, the work can't be done in another type of environment, and yes, it's got to be in a clean room.

So, who is the lucky JPLer tasked with holding the keys and granting entry? That would be Michael Mangano, the Assistant Division 35 manager for Flight Projects, who oversees the Lab's cleanroom schedule with assistance from Division 35 Operations Engineer Mason Carney and Assistant Manager of Section 313 Rich Kinslow.

"I call myself the traffic cop of the Laboratory," Mangano says with a laugh. "When there are conflicting resources, I try to fill this vacuum because there's really no one around who can go negotiate from project to project. I try to get ahead of scheduling conflicts and make sure we resolve them before they become problems."

In a year like 2020, Mangano has become one of the most sought-after people at JPL. With the pandemic delaying missions such as SWOT and NISAR by about four to six months, and a pipeline of missions slated for ATLO in early 2021 and 2022, the Lab is seeing an unprecedented number of missions desperate for precious time in the clean rooms.

But the pandemic isn't entirely to blame. It's certainly a contributing factor, acknowledges Mangano, with limited staff creating delayed schedules and overlapping activities, but the Lab has been dealing with an influx of projects for some time now.

"Over the past five years, we've had an unprecedented amount of work that overwhelmed some of our resources," Mangano says. "It's been a tsunami that moved through the Lab starting with design,

fabrication, and mechanical inspection, and then we got to a point last year where all of the big projects were going through our environmental testing facilities at the same time. There was a bit of a juggling act trying to make sure we didn't impact the project schedules to a large extent. We had to coordinate very carefully with the projects."

"We were just very successful at winning proposals," Mangano says. "[Add in] assigned flagship projects like Mars 2020 and Europa Clipper, and we just ended up having a very large portfolio of spacecraft and instruments that we were trying to develop at the same time."

Planetary missions such as Mars 2020 and Psyche were not delayed by much, Mangano says. But as 2020 comes to a close, the real test for the Lab will come in early 2021, when NISAR, SWOT, and Psyche are all slated for ATLO in the Spacecraft Assembly Facility (SAF), with Europa Clipper right on their heels. Alongside each spacecraft also comes a long list of instruments and payloads competing for clean room time.

"The major conflict shows up in late February," Mangano says, as he rattles off a tight schedule he has memorized to a tee: "Right now, both NISAR and SWOT are occupying High Bays 1 and 2 in SAF. Psyche will be delivering their Solar Electric Propulsion Chassis in late February, and they're not planned to complete all of their activities until April 2022. SWOT will ship in July of 2021, but NISAR doesn't leave the SAF facility until March of 2022. Then we have Europa Clipper, planned to start build-up in January 2022 with several months of overlap with NISAR and Psyche, which are wrapping up their integration and testing (I&T) activities before shipment in March and April 2022, respectively."

Solving this puzzle means Mangano, Carney, and Kinslow work closely with a multi-project team of ATLO and I&T managers. Together, they spend their days gathering ATLO schedule updates from project managers. From there, the team works in Microsoft Project Schedule to line up schedule items and identify conflicts.

"The project managers have their thoughts on the scheduling and least impact, and we try to meet the plan that they've got in mind," says Mangano. "Where there are conflicts, we try to highlight what those are and try to find workaround solutions."

While most JPLers are familiar with the clean room in Building 179, there are a number of others on Lab—B306, B233, and two clean rooms in the environmental testing lab—where projects are being shuffled in and out as scheduling requires and allows.

"We've been trying to utilize every nook and cranny that we can," Mangano says. "Those facilities are all part of this entire plan to satisfy all of the project needs."

When the clean rooms hit capacity with no more wiggle room, however, JPL may consider contracting out some of the work to offsite locations.

The level of problem-solving a role like this demands requires years of expertise, something Mangano isn't short of. A JPLer for 40 years, Mangano cut his teeth as a mechanical engineer early in his career, building hardware such as the Shuttle Imaging Radar (SIR-C) in the early '90s, and leading the ATLO mechanical engineering team for Mars Pathfinder at Kennedy Space Center. He later went on to become a product delivery manager for Mars Exploration Rover (MER) and Mars Science Laboratory (MSL), before taking on his current position in 2011.

For Mangano, much of his success in the role—and the joy he finds in it—comes down to simply being deeply familiar with the Lab and its resources, facilities, and people.

"I use a lot of my knowledge from over the years to connect different projects and people. I think I've earned a certain amount of trust with the project managers where they understand that I'm working in

their best interest and in the best interest of the Laboratory as a whole," Mangano says. "I don't come with any biases to any project. It's whatever works best for JPL."

Events

Conversations on COVID-19: Vaccines in the News

Monday, Jan. 11
11 to 11:45 a.m.
Register below:
https://caltech.zoom.us/webinar/register/5616077299674/WN_Nnltc13WTZSF5L3vbytWJw

Join Caltech science writers as they interview scientists and engineers from across campus and at JPL about how they are tackling COVID-19, and ask your own questions.

In this webinar, Professor Pamela Bjorkman, an expert in immunology, speaks with science writer Lori Dajose about how vaccines work and the current state of the COVID-19 vaccine development and distribution.

About the Participants
Pamela J. Bjorkman is Caltech's David Baltimore Professor of Biology and Biological Engineering. She graduated from Harvard University, where she received her PhD in

Biochemistry and Molecular Biology. Professor Bjorkman's research focuses on immune responses to pathogenic viruses.

Lori Dajose is a content strategist and science writer in Caltech's Office of Strategic Communications covering biology, bioengineering, and neuroscience. Lori received her undergraduate degree from Caltech in 2015 and began working in OSC shortly afterward. As a planetary science major, she didn't have much exposure to the biological sciences but enjoys learning new things every day at work.

This series is presented by the Caltech Science Exchange, which brings expert insight to the scientific questions that define our time. The Science Exchange offers trustworthy answers, clear explanations, and fact-driven conversation on critical topics in science and technology, including COVID-19 and other viruses.

Learning Space With NASA Live Stream – Studying Climate Change

Wednesday, Jan. 13
9 to 9:30 a.m.
Watch Online and Explore Education Resources: https://go.nasa.gov/learningspace

As many state science standards now include concepts related to climate change, students may have questions about how scientists collect data on climate change and its impacts on our daily lives. In this webinar for K-8 students, JPL education specialists Lyle Tavernier and Brandon Rodriguez will discuss how NASA uses satellites to collect data on everything from Earth's global temperature to its rising seas.

This live broadcast is designed for K-8 classrooms and students.

Registrants must be at least 18 years old. If you are under 18, have a teacher or adult fill out the registration form on your behalf.

Educators and households who register below will receive information about how to submit questions during the live stream.

You do not need to register to attend – only to ask questions during the live stream.

Register your classroom, educational organization, or household for an opportunity to have your questions answered during the live Q&A session: https://bit.ly/37t9w8F

This event is presented by Learning Space with NASA at Home (go.nasa.gov/learningspace), which provides K-12 students, their families, and educators with standards-aligned STEM activities, tutorials, and resources for home learning.

Teaching Space With NASA: Monitoring Earth From Space

Wednesday, Jan. 13
3 to 4 p.m.
Watch online and explore related resources: https://go.nasa.gov/teachingspace
Register to join the Q&A: https://bit.ly/3nwXhxJ

NASA may be well known for exploring Mars and worlds beyond, but did you know that the agency has more than a dozen Earth-science satellites collecting important data

about our planet's changing climate and its impacts on our daily lives? This fleet of spacecraft provides crucial insight on everything from rising seas to carbon emissions to melting ice and even extreme weather.

In this educational live stream from, JPL Education Specialist Brandon Rodriguez will be joined by Public Outreach Specialist for Earth missions Annie Richardson to discuss how NASA monitors the health of our planet and how the newest addition to the Earth-science fleet, Sentinel-6 Michael Freilich, will take our understanding even further. The presentation will conclude with a short discussion for educators about how the content of the presentation can be aligned to Next Generation Science Standards (NGSS) and related educational resources from NASA.

All audiences are welcome to watch this live broadcast, which will also include a Q&A for registered participants.

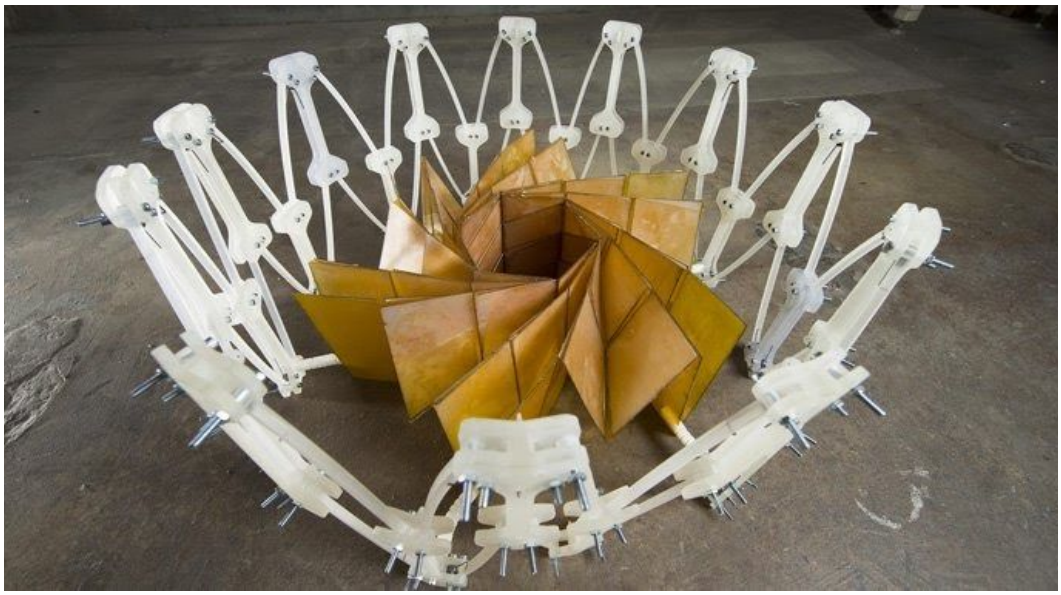
Register for a chance to have your questions answered by NASA.

You do not need to register to watch – only to participate in the Q&A.

This event is part of an ongoing series of education workshops from the JPL Education Office. For resources related to this workshop, recordings, and information about future workshops, visit Teaching Space with NASA (go.nasa.gov/teachingspace).

Teachers, take a deeper dive into Teaching Space presentations with our interactive virtual workshops lead by NASA-JPL education specialists. See what's coming up (go.nasa.gov/2KFUJ1O).

For educational resources related to the workshop, visit:
https://go.nasa.gov/teachingspace#resources



Von Karman Lecture Series: Spacecraft Origami

Thursday, Jan. 14
7 to 8 p.m.
Webcast:
› YouTube link coming soon:
https://www.jpl.nasa.gov/events/lectures_archive.php?year=2021&month=1
› Click here to watch the event live on Ustream: http://www.ustream.tv/nasajpl2

For years, engineers have had to deal with "the tyranny of the faring": anything you want to send into space has to fit into a rocket bearing. A field of advanced design has been looking for new ways to advance our engineering, using the centuries old art form to dream bigger.

Host: Brian White, Public Services Office, NASA/JPL
Co-host: Thalia Rivera, Public Outreach Specialist, NASA/JPL

Speakers:
Manan Arya, Technologist, NASA/JPL
Lizbeth B. De La Torre, Creative Technologist, NASA/JPL

JPL Family News

Retirees

The following JPL employees recently announced their retirements:

40+ Years:

Vahraz Jamnejad, Section 3330, 41 years

30+ Years:

Robert Shishko, Section 312C, 37 years

Monica Quinn, 36 years

Karen L'Heureux, Section 5160, 33 years

William M. Folkner, Section 392R, 32 years

P Peggy Li, Section 398L, 31 years

Marc Walch, Section 382E, 30 years

20+ Years:

James Shirley, Section 3226, 27 years

Steven M. Jones, Section 353E, 24 years

Barron Latham, Section 386G, 23 years

Gary Block, Section 398K, 20 years

Letters

I would like to thank my JPL colleagues for their support and understanding following the passing of my father. I also want to thank JPL Hospitality Group for the beautiful plant. -Feng Zhao

Passings

Randall Crow Acosta died on Nov. 27, 2020 at the age of 30. He started at JPL as a student and went on to become a full-time regular employee. Acosta, a systems engineer for 313C – System Verification & Validation Engineering, worked at JPL for 7 years. He is survived by his mother, Inocence Wilson; his father, Randall A. Acosta; and his younger sister, Isabella C. Acosta.

A memorial service will be held Saturday, Jan. 9, at 10 a.m. at One and All Church, San Dimas, CA.