Featured Stories

A closeup of the 8-inch by 8-inch stamps, or "glyphs" on display at the Earth Systematic Missions Program Office at B180-401.

Mission Stamps Bring Visual Language to Earth Sciences Office

By Christian Hill

Since NASA's designation of an Earth Systematic Missions Program Office (ESMPO-J) at JPL in 2019, the Earthshine display along the outer hallway windows of Building 180's 4th floor has served as an eye-catching reminder of the magic of light that JPL's Earth-observing missions encounter.

But Program Manager Steven Bard — who leads the ESMPO-J technical team, program management team, and business team that keep 8x projects on the path to mission success — also wanted an art installation that directly related to each of the individual projects.

“We have 14 flight projects in orbit and have another 11 in various phases of development – two of which are about to launch soon – NISAR and PREFIRE,” Bard said.

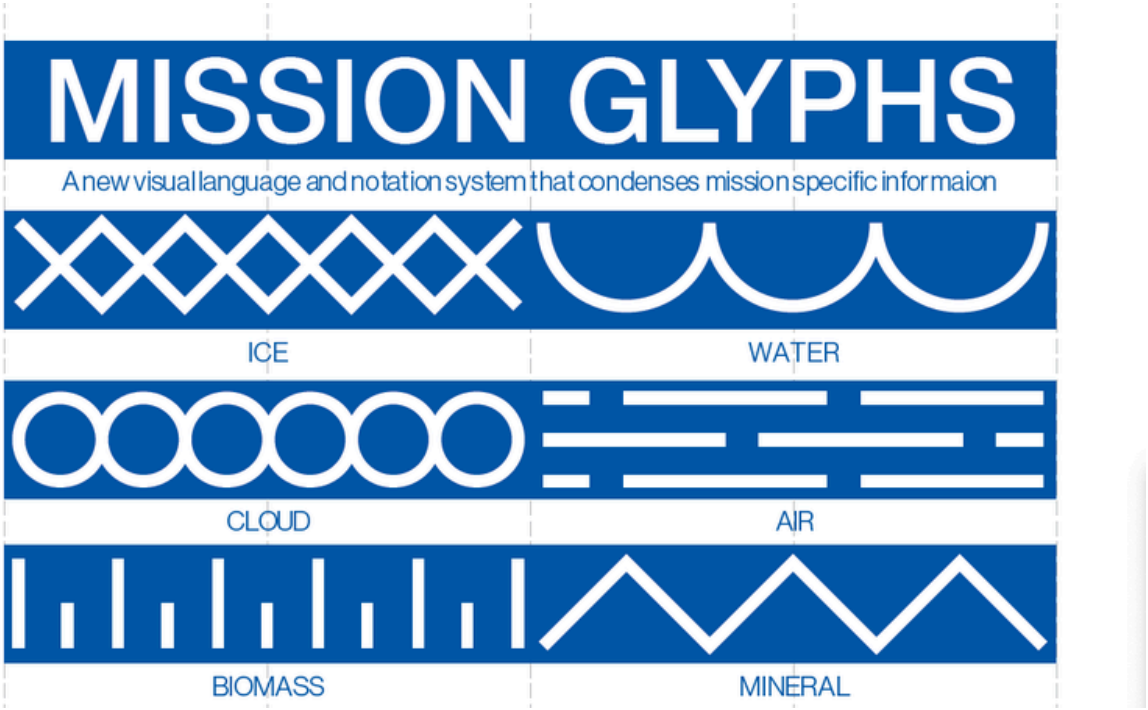
Project teams often utilize a silhouette of their spacecraft, rover, or helicopter that depict an iconic symbol. But unlike the Mars rovers or helicopter missions that have recognizable characteristics, the array of Earth-observing missions across various satellite platforms and instruments flying aboard the International Space Station can lead to a bit of similarity and mistaken identity when placed in silhouette.

“We needed to get creative,” Bard said.

Bard turned to DesignLab’s The Studio at JPL, where Visual Strategist David Levine began thinking of how to bring the suite of Earth missions and scientific instruments into a comprehensive artistic design — while giving each mission a distinct identity.

Levine and freelance artist Joseph Kennedy collaborated on a series of stamps designed to visually communicate what JPL’s Earth-observing missions are studying.

Each of the mission stamps uses “glyphs,” a visual notation system — sort of like a created language — to describe and evoke the core components of each Earth satellite mission. Just as the ancient Egyptians used shapes to depict objects, the glyphs along the walls of the ESMPO-J office utilize dotted lines, waves, semi-circles, dashes, and more to depict mission-specific criteria, including orbital altitude, imaging swath width, differing wavelengths, surface or stratospheric focal areas, and orbital inclinations.



Each circle, line, dash and wave within the stamps represent mission-specific criteria, including orbital altitude, imaging swath width, differing wavelengths, surface or stratospheric focal areas, and orbital inclinations.

One example: The NISAR stamp includes a silhouette of the satellite in the center, surrounded by a circle depicting Earth, a wavelength line signifying its L-band and S-band instruments, and an array of line formations along the bottom indicating the mission’s ability to examine land, water, ice, and biomass through its instruments.

“We talk about missions in terms of having a single capability or the one component of something it’s studying – whether that’s surface water, ice coverage, or temperature change,” Levine said. “But here, when you look at these missions lined up one next to the other, you see all of the different ways they view

the planet. It really highlights and individualizes each mission, while showing how much of, and how many different ways, we're covering the Earth."

DesignLab created 24 mission stamps in total, featuring in-orbit missions like GRACE-FO and SWOT, and soon-to-be-launched satellites including NISAR, and MAIA. The glyphs line the hallway in B180-401, stamped with blue ink on white paper, or with white ink on blue paper. The 8-inch by 8-inch rubber stamps are also on display on the office wall; the smaller, more traditional-sized stamps are near the front desk for everyday use.

"To me, the stamps are sort of this low-tech, traditional medium that we're using to depict these state-of–the-art, high-tech missions," Levine said, adding that the ink makes each copy one-of-a-kind.

"You can get a pin with the logo of the mission, or you can get a poster of the mission that we hand out, but if you get one of these stamps, each one is different, depending on how the ink comes off," Levine said. "It's a personalized touch for these missions that matter to each person on Earth."

Ingenuity team photo taken April 19, 2023, following the 50th successful flight on Mars. ***Image Credit: PhotoLab***

Ingenuity Team Members Share Triumphs, Memories as Helicopter Chapter Ends

By Vincent Robbins, Celeste Hoang, and Christian Hill

Ingenuity entered retirement with grace — although it has flown its last flight, the intrepid Mars Helicopter still stands upright, and still communicates with ground controllers here on Earth.

The history-making autonomous chopper ended its mission on the Red Planet after imagery of its Jan. 18 flight sent to Earth last week indicated one or more of its rotor blades sustained damage during landing and it is no longer capable of flight.

Originally designed as a technology demonstration to perform up to five experimental test flights over 30 days, the first aircraft on another world operated from the Martian surface for almost three years, performed 72 flights, and flew more than 14 times farther than planned while logging more than two hours of total flight time.

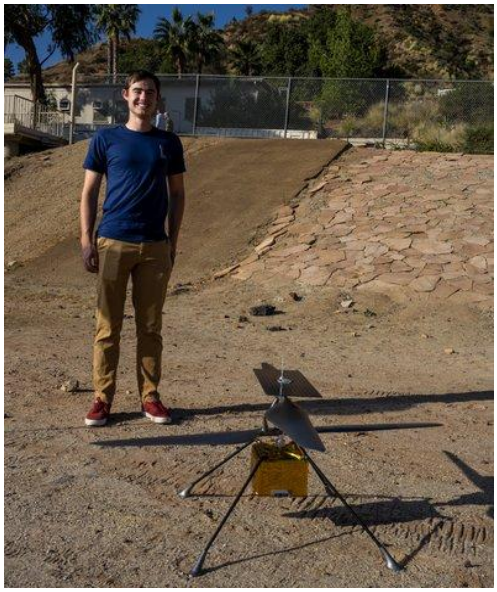
At JPL, team members have been preparing for Ingenuity's end of mission for a few weeks, but the damaged rotor blade accelerated the official announcement on Jan. 25. Below, we spoke with a few project members, past and present, as they reflected on their ties to this historic mission.

Joshua Anderson

Ingenuity Team Lead Joshua Anderson wouldn't call his start at JPL a crash course in interplanetary rotorcraft flying, but it was accelerated, to say the least.

“I joined JPL in 2020 as a flight software engineer, and within a few weeks of being at the Lab, I was asked if I wanted to fly a helicopter on Mars,” Anderson recalled. Turns out, he’d joined JPL’s Small Scale Flight Software (348C) team, which had made the flight software for Ingenuity.

Anderson quickly signed on and joined the Mars Helicopter Operations team while the Mars2020 mission was in the cruise stage toward the Red Planet.



He remembers the buildup to the first flight: The nerves, the excitement. “It was really just elation from the team from that very first flight,” Anderson said. “Almost everything after that was a bonus.”

Following the original 30-sol mission objective, that bonus time turned into opportunity time for Anderson, as Mars Helicopter operations team members rolled off the mission onto other work. Anderson ended up being one of a few spacecraft operators to stay on the team following the technology demonstration window. He quickly moved up to operations team lead, training new team members on how to fly on Mars for the extended mission.

“One extra month turned into two, two into three, and then we realized we may be flying for a while,” Anderson said. “It’s truly remarkable what that rotorcraft was able to do, what it was able to accomplish, how many times we pushed it toward new heights, new speeds, and new flight lengths. It’s a sad moment that Ingenuity’s flight days have come to an end, but what an incredible mission. Seventy-two flights.”

Looking back, Anderson thinks of Flight 34 on Nov. 22, 2022 as his favorite moment.

“It was just a pop-up flight, up and down,” Anderson said, nothing remarkable compared to Ingenuity’s other record-breaking feats, but it was the first flight Ingenuity undertook following an interplanetary software update — an integral development if the helicopter was going to continue in its role as a scout for the Mars Perseverance Rover.

Ingenuity was designed to land on flat ground in sandy areas, which worked for where it operated during the tech demo, but now the craft was approaching Jezero Crater, with steep inclines and hazardous terrain all around.

“We had to upload hazard-avoidance and detection for its navigation camera, so it could autonomously find safe spots to land amongst the rocky terrain, and it worked,” Anderson said. “To me, it’s such a huge moment, because it showed just how much more capable this craft was than any of us thought. Nobody, and I mean nobody, thought we’d make it through a Martian winter, but it just kept performing.”

On seeing the images of the damaged blade and Ingenuity’s final resting spot, Anderson has only gratitude.

“If you’re going to end a mission, that’s the way to do it,” Anderson said. “Even with that damage, it still unbelievably landed on all four legs, it’s still communicating with us, and its data is intact. She’s been through a lot and deserves a break. We’re fortunate to have flown her.”

Martin Cacan

While Martin Cacan didn't sit in the Space Flight Operations Facility with a joystick — the helicopter was, after all, autonomous — Ingenuity's chief pilot was tasked with carving out a safe and scientifically action-packed trajectory for that pioneering little four-legged flyer.

"I work as a liaison between our science team to understand where areas of interest are and where safe landing pads might be," Cacan says. "And work with the [operations] team to deliver new flight sequences and ultimately try to find safe paths for the helicopter to make its way through Mars."

And find its way it did — After Cacan came on board around flight 14, Ingenuity buzzed around the surface of Mars dozens more times for a total of 72 separate flights, completing 128.8 flying minutes, covering 10.5 miles (17.0 km), and reaching altitudes as high as 78.7 ft (24.0 m). Cacan was the chief pilot for approximately the second half of those flights.

"It's really shocking and just mind-blowing to look at the map and zoom in to where we were at Octavia Butler Field to start," Cacan says. "And then you just zoom out and you zoom out and you zoom out and you still don't even see where the end of the path is. You really have to move over [on the map] to see this massive journey that this tiny helicopter has gone on."

Cacan says that just one flight — proof that powered, controlled flight on another planet was possible — would have made the mission a success. But Ingenuity accomplished much more in the extremely thin Martian atmosphere.

"Proving at a basic level that you can fly on Mars is one thing," Cacan says. "But we proved how you can fly on Mars, how far you can fly on Mars, how high you can fly on Mars…I think that really is just opening so many doors for the next generation of vehicles."

For Cacan, one of the best parts about working on Ingenuity was getting to see through the eyes of the little chopper.

"I love astronomy, I love to go look at the stars," Cacan says. "And you see this little red dot out there at night and then you come into work in the morning and you literally just get a picture down from this vehicle that you're flying around and it's like — that's the desert of Mars. It's mind-boggling."

Although the end of the mission was not exactly a shock, it was a poignant moment for Cacan.

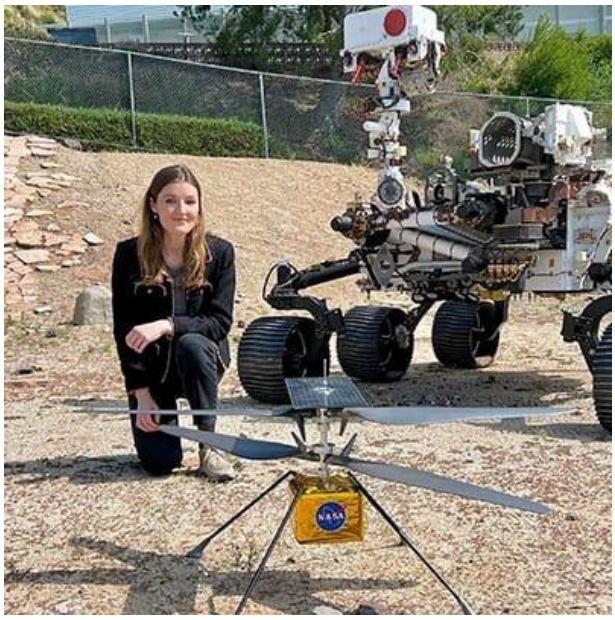
"People keep throwing around the word 'bittersweet,' so I think I need to find a thesaurus and get a new word," Cacan says. "We honestly knew all 72 flights that every single time it could be at the end. So you're always a little bit prepared…But it's always a little sad to see something like this come to a conclusion. And at the same time, I'm kind of blown away that we survived all of this."

Noah Rothenberger

Noah Rothenberger's JPL career took off from day one when she was assigned to Ingenuity as soon as she joined the Lab in April 2022. For nearly two years, she served as the Mars Helicopter operator, planning Ingenuity's sequencing activities and assessing the outcomes of operations to ensure the helicopter's health and successful performance on the Red Planet.

When the end came, it was tough for her to process. Seeing the image of the damaged blade for the first time was “quite startling,” Rothenberger recalled, even though she prepared herself for the possibility of the mission ending when Ingenuity lost communication or undertook high-risk flights in the past.

“Confronting the reality that Ingenuity had completed its final flight felt quite extraordinary,” she said. “The initial sadness was strong, but it quickly gave way to a deep sense of pride and thankfulness for our achievements, particularly because the mission surpassed all expectations for this technological demonstration.”



Rothenberger also has a wealth of memorable moments from her tenure to walk away with, including the first time she supported uplink for Flight 31.

“The thought of delivering sequences that would initiate a flight on Mars was nerve-racking,” she said. “[But the] sense of relief and satisfaction upon receiving confirmation of a successful flight was indescribable.”

And, of course, nothing quite compares to the excitement of seeing images from Perseverance of Ingenuity in flight.

“It brings a whole new dimension to the experience,” she said. “It is one thing to see flight logs and telemetry, but quite another to actually see Ingenuity navigate the Martian skies.”

As her time with Ingenuity came to a close, Rothenberger reflected on how the mission touched her on a personal level.

“It has been a significant chapter in my career,” she said. “My first project at JPL, which I have invested much time, thought, and emotional energy into, and it has certainly left its mark on me. The complexity of operating Ingenuity on another planet and the success we have achieved is a tribute to the incredible team I have been able to work with.”

Tim Canham

While Tim Canham left the Ingenuity team following the completion of its primary mission, the former Mars Helicopter operations lead still attends project meetings and keeps up with the mission. Seeing the image of the damaged rotor after its 72nd flight was sad, he acknowledged, but was also a testament to the hardiness of the robot.

“It’s just tough,” Canham said. “This helicopter, made with many of its parts bought off the shelf, wildly outperformed any of our expectations. It just kept freezing and thawing, running, and flying. It did everything we asked of it to do, and it’ll go down in the history books on the scale of Sojourner, Pathfinder and other historic missions that are the legacy of JPL.”

A Duo of Talks Celebrate 20 Years of JPL's Beloved Twin Rovers

By Vincent Robbins and Christian Hill

It takes two to rove the Red Planet, but it took a village of JPLers to pull off the iconic Mars Exploration Rover mission two decades ago. In celebration of MER's 20th, JPL hosted a duo of internal talks with key team members who reminisced about the challenges and triumphs of the twin rovers, Spirit and Opportunity.

On Jan. 24, Steve Squyres, Jennifer Trosper, Matt Wallace, Richard Cook, and Rob Manning told a crowd in Pickering Auditorium tales of the tireless hours spent troubleshooting, the near-insurmountable odds to overcome, and the incredible relief when the mid-sized rovers proved successful beyond expectations.

On Jan. 25, MER veterans Adam Steltzner, Miguel San Martin, Wayne Lee, and Tom Rivellini reunited to discuss some of the challenges, anomalies, and successes of this trailblazing mission through the lens of a guiding question: "How do you know when what you're doing is wrong?"

In case you missed the events, or just want to re-live some of the memorable discussions, we captured highlights from both panels below.

"The Edge of Possibility" - Jan. 24

Director Laurie Leshin kicked off the first event before handing it over to Preston Dyches from JPL's StoryLab, who moderated the discussion.

The story of Spirit and Opportunity has become an important part of JPL's identity, both for their accomplishments and for the challenges that the team overcame to make them successful, but before the rovers could begin exploring Mars, there's a backstory to the backstory. Below are excerpts from the panelists' responses during the talk:

Steve Squyres, Mars Exploration Rover Payload Principal Investigator:

"The backstory is the part I've tried to erase from my memory, but it's still in there. What eventually became MER arose out of frustration. Frustration with Mars itself, and the data we had. It was 1987, and what we had mostly was Viking—two wonderful landings on two incredibly boring spots on the planet. And we had two fantastic orbiters that took a lot of pictures.

I was originally a trained field biologist, but I got interested in Mars and I would look at these pictures from orbit and I would look at these things on the surface of Mars…and I just knew that if you gave me an hour on the surface with my boots and my hammer and my basic geologic tools, I could figure out the answer. It was just screaming for field geology, but we didn't know how to do that with robots. And so began a period of 10 years of proposals."

After 10 years, four proposal attempts, and a few cancellations, JPL needed some "clever people to come up with a new idea to pull this off," — according to Squyres — bringing the team to the year 2000.

Rob Manning, Chief Engineer, Flight System and EDL Lead:

"In fact, it wasn't my idea. We had previously built with Richard, Matt, Jennifer and others, we built Mars Pathfinder, and we had an entry, descent, and landing Rube Goldberg architecture for getting to Mars, and we thought, wouldn't it be great if we could change it? But there wasn't enough room in the tetrahedral-shaped lander to make a full rover that could do science.

So with the failures of the two Mars missions [Mars Climate Orbiter and Mars Polar Lander] in 1999, there was a lot of depression, but NASA had to figure out what to do next in the Mars sequence. So, they said there's a meeting coming up in a few weeks in Pasadena, where NASA's going to make some decisions. And I get a knock on my door two weeks before these meetings, and it's my friend Mark Adler. He says, 'Rob, we should make a rover out of the lander. Steve's got the instruments, we could fly it on that. We know how big they are.'

So, people think that MER is based on the Sojourner rover, but we actually ditched Sojourner. We thought it would be much easier to put wheels on the white box that was Pathfinder. What if we did that, and made it stand up and drive off? How tough could that be?"

The team worked to create a 26-page PowerPoint slide and presented it to NASA leaders at the Pasadena meeting, who were evaluating six other Mars mission proposals as well. The pitch for MER scored a

D-minus on its risk assessment — faring better than any of the other teams. "Winning a massive game of poker with a pair of twos," as Manning described it.

From there, the mission was accepted, and the team had three years to get the project to launch in the 2003 window.

Richard Cook, MER Flight System Manager Project Manager:

"One thing is that shortly after we got approved, NASA Administrator Dan Golden asked us to do two rovers. I was at that meeting and he asked us how much it would cost, and we gave him a cost estimate in 36 hours.

That's probably when Steve said, 'Wait, I only have one set of instruments!' So that was a surprise. But it was just a go from there. And in a way, actually doing two made it possible. It allowed us to do two in parallel and switch back and forth and make use of that in ATLO in particular, but it meant that much more hardware to build.

We went from basically a dead stop with nothing happening in May 2000, to a PDR [Preliminary Design Review] in October, and the PDR was the place in which we're gonna try to get this thing from a concept to turn into some version that will work, and it basically fell apart. Getting the rover to fit inside the lander just didn't leave us with enough elbow room in the design and the mass and the volume — everything was a problem. And it was really the first of a series of resets that the project had, which is one of the themes of MER. One challenge after the other getting thrown up and knocked down.

We had to go back to the showers on the whole idea of the EDL design and probably one of Rob's greatest choices there was to not change the rover. Even though the rover was the new thing — we were putting wheels on the electronics module for Pathfinder, we kept the electronics the same, that whole configuration as close as we could, and we actually broke the EDL heritage. So the lander got bigger, all of the parachutes got bigger, the airbags got bigger… by just this much. It was a huge challenge."

With the compressed schedule, hardware delivery was pushed back, and the challenges fell to Matt Wallace, MER ATLO manager.

Matt Wallace, MER ATLO Manager:

"I think one of the things that made an enormous difference for ATLO was having two vehicles, which is counterintuitive. I think most of the team at first felt that it was going to be twice the work, twice the trouble, twice the staff.

But I had been digging through these old sort of musty project archives in building 301 to look at how we had processed the Voyager and Viking, which were the last times we had done a dual concurrent spacecraft ATLO activity. I was trying to understand how they had done it, and what it

would mean, and what the challenges would be. As I was looking, it occurred to me that maybe having two vehicles instead of one could in fact, be an advantage. If we diversify the test program, we don't have to do every test on both vehicles. We could do some of the design-oriented tests on one vehicle and other tests on the other vehicle and we could accelerate the ATLO program.

I think we probably saved about three to four months on the first vehicle, and about eight months on the second vehicle, because of the changes we made in ATLO operations."

Following the successful launch of the rovers in June and July of 2003, the challenges of MER were transferred to Project Systems Engineer and MER Mission Manager Jennifer Trosper, who ended up dealing with surface and EDL software, and operations preparations.

Jennifer Trosper, Project Systems Engineer and MER Mission Manager:

"The team was very busy and not just in those six months, but in the whole three years, in order to get the software for a really autonomous rover that we wanted to have able to do the full mission success criteria expected in 90 sols.

We had to put a lot of autonomy and high-level behaviors in the software. We had to change paradigms about what we were designing into the software, this rover. That meant the development time needed to increase instead of decrease, and so we had to change the way we did business. So instead of software being delivered every three months or six months, we were delivering it weekly, and it wasn't good.

With the software team, they got it together and they put something out there and the systems team tested it, and they tested it every week. Back then, there weren't a lot of extra checks, or a lot of extra reviews; we really relied on the people to do their jobs.

In the end, the thing I learned from the people around me, throughout all the development and the challenges, is to just work the problem. You can sit there and say, 'Oh, the Vice President [of the United States] is coming next week, what should we do?' Work the problem. 'Oh, I wonder if it was the sequencing I did?' Work the problem. And that's part of the secret sauce of JPL. We focus and we work the problems and that's what makes us able to sit here 20 years later and celebrate the success of two amazing vehicles on the surface of Mars."

"Stories About EDL" - Jan. 25

Adam Steltzner, now the chief engineer of Mars Sample Return who was the lead mechanical engineer for MER's entry, descent, and landing, kicked off the second talk with a theoretical framework that would guide the conversation.

Steltzner: "I like to think that all knowledge is breakable into three things: that which you know, that which you might be able to know, and that which you'll never know. And then — if you're at all smart — you should not design

anything that relies on that third thing, and you should really endeavor to rely very little on that which you don't currently know but you might know, and lean hard on the things that you have solid knowledge of."

But there is always uncertainty, and to accomplish things that have never been done before, you can't rely only on things you know. And so Steltzner posed the question that his fellow MER veterans would reflect on together: How do you know when what you're doing is wrong?

Tom Rivellini, the deputy chief mechanical engineer on MER, picked this thematic thread up by recounting the redesign of the mission's landing airbag system. In a grueling process that would require redesigns, extensive testing, and several failures, Rivellini identified three criteria that guided the team in identifying when they might be wrong.

The first two criteria were concrete: 1.) measures like mission requirements and testing protocols and 2.) more subjective, yet scientific, criteria such as margin for error.

The third criterion, however, was more nebulous.

Rivellini: "The third criteria that we went through in all of this is…the emotional criteria. This is where it's all a personal responsibility. How do you feel about this? Do you sleep well at night? Do you see in your mind this process, this design, this system converging?...and that's probably the hardest [criteria] because that's all personal responsibility — how you feel about it. It's something that we don't usually talk about because we're engineers — we engineer things, right or wrong, there's math, there's physics."

Focusing on these criteria, and a commitment to being wrong until they got it right, drove the MER team to succeed:

Rivellini: "We all contributed to making the decision that the airbags as designed on Pathfinder were not going to work for MER and we had to make a major change. To the outside, they look the same — but internally it was a complete redesign of the airbags…And to be honest with you, we kind of hated [the redesign]. We really did not like it and we tried pretty hard to rationalize our way out of it. But we were faithful to physics and faithful to what was in front of us. And at some point, I think we all had that emotional sense that we're just going to do another test and we're just going to fail again."

Wayne Lee, —the entry, descent, and landing chief engineer on MER — explained that the team's structure and culture allowed them to lean into the uncertainty.

Lee: "One of the big things we learned about 'how do you know what you're doing is wrong?' from MER is…every concept you're going to start with is wrong and you're going to learn as you go. 'Well, that didn't work, that didn't work, that didn't work.' And what saves you, I think, is having a good team structure that allows everybody to challenge the ideas and to have the right interaction to be able to tease out that these ideas that are put forth are not going to work and we have to fix them.

And so one of the things that we were blessed with on MER is Richard Cook allowed us to operate as a close-knit team [and] we broke down the silos between the divisions…We expected each person, each cognizant engineer, not only to understand their system but to also contribute to understanding how a whole thing was going to come together. Every person — whether it was a parachute person, the airbag person, or the flight dynamics people — they took responsibility for the fact that this whole thing has to come together and work.

("A lot of credit for that actually goes to Wayne," Steltzner chimed in.)

Miguel San Martin, who was the chief engineer, guidance, and control system of MER, recalled the uncertainty in predicting Martian winds, and his philosophy for unearthing solutions to challenging problems.

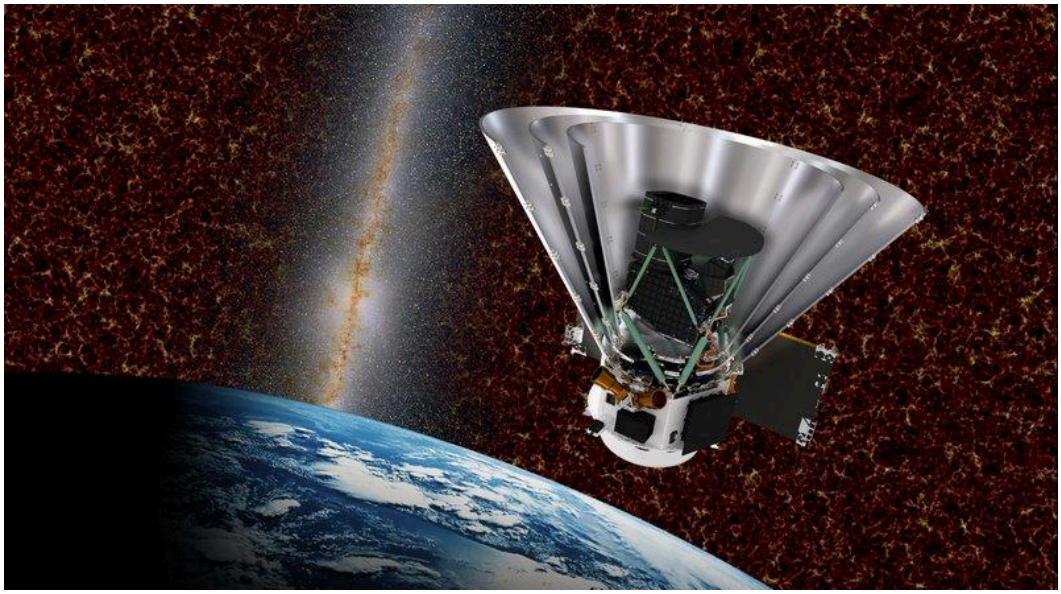
San Martin: What I try to do, I think that we all do in one way or the other, is if you focus on the root of the problem…some people get confused by the symptoms of the problem as opposed to the root of the problem. I think Einstein used to say — or at least they say he said it — but given the problem, [you should] spend 95% of the time understanding it and 5% solving it. Because I think that if you get to the root, the solution comes out by itself. It's almost like you don't invent the solution, you discover the solution — it's already there, right? So under all these challenges, that's what I decide myself. The solution is there. I need to go unearth it.

Steltzner concluded the discussion by proposing that plumbing the depths of scientific uncertainty is a very personal, very introspective process.

Steltzner: "I think you have to appreciate what you bring in terms of your confidence, overconfidence, your understanding of what you know, you don't know, your attraction to want to believe the thing that you were believing.

It's very personal. These stories are personal stories and the actual job that we have is very personal. I think the institution naturally, all institutions, strive to make a process — something that stands on its own — and you can plug different human beings into processes and turn the crank and something happens. But I think that that's rarely the case…You are always going to have to know and find out when you're not doing the right thing. And the only way you're going to do that is by being personally invested and having an authentic understanding of what you're doing."

Events



Von Karman Lecture Series — SPHEREx: Zooming Out to See the Big Picture

Thursday, Feb. 22
5 to 6 p.m.

Watch live on YouTube

The Spectro-Photometer for the History of the Universe, Epoch of Reionization and Ices Explorer (SPHEREx) is a planned two-year NASA space mission that will survey the sky in near-infrared light. SPHEREx's unique all-sky spectral survey enables science ranging from our solar system to the very beginnings of the universe.

Speakers:
Jamie Bock, SPHEREx Principal Investigator, Caltech/NASA JPL

Host:
Marc Razze, Office of Communications and Education, NASA JPL

Co-host:
Kaitlyn Soares, Universe Public Engagement Lead, NASA JPL

JPL Family News

Retirees

The following JPL employees recently announced their retirements:

40+ Years:
Rose Ackerley, Section 319G, 41 years
Douglas E. Bernard, Section 1010, 40 years

30+ Years:
Carol R. Lewis, Section 1420, 36 years

Awards & Honors

JPLers often Dare Mighty Things, and nearly as often earn awards or professional designations. JPL Space periodically features a roundup of recent honorees. Please join us in congratulating your accomplished colleagues.

Bonnie J. Buratti
American Astronomical Society Fellow
"For fundamental insights into the origin and nature of small-body surfaces using both space- and ground-based facilities, tireless devotion to the planetary science community, and wise and supportive mentorship of young scientists." Award citation

Glenn Orton
American Astronomical Society Fellow
"For pioneering work and continuous dedication to the observation and interpretation of images and spectra of the giant planets obtained using ground-based and space-based telescopes, and for mentoring over 270 students at NASA's Jet Propulsion Laboratory in the art of observation." Award citation

Paul Goldsmith
Joseph Weber Award for Astronomical Instrumentation
"For his pioneering advancements in millimeter-wave astronomy and astronomical receivers, especially his notable development of quasioptics." Award citation

Douglas C. Hofmann
Fellow of the National Academy of Inventors
The NAI Fellows Program was established to highlight academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development and the welfare of society. Election to NAI Fellow status is the highest professional distinction accorded solely to academic inventors. Award citation

Angelyn Moore
The Association for Women Geoscientists (AWG) 2023 Professional Excellence Award Winner for Government/Regulatory
"In recognition of your distinguished contributions throughout your career in government. The breadth and depth of your professional accomplishments, your commitment to mentoring, and the continued emphasis you have placed on outreach and service activities makes you a true role model for women in geoscience." Award citation

Maksym Figat
2023 Poland Prime Minister Award
"For significant scientific contribution to the development of Polish science and an outstanding doctoral dissertation recognized by the Prime Minister of Poland." Award citation

2023 Asea Brown Boveri (ABB) Prize Competition (First Place)
"For technical innovation in industrial applications of automation and IT/autonomous technologies and systems in the Warsaw University of Technology." Award citation

2023 Young Innovators Award (First Place)
"For technical innovation in control, automation, and process automation, and robotics, recognized by the Warsaw University of Technology." Award citation

Ceth Parker
American Society for Gravitational and Space Research (ASGSR) 2023 Art Competition
Award for best technical merit for submission entitled Per Aspera Ad Astra Biologiā Latere. Award citation

Personnel Appointments

Star Tracks is a monthly series highlighting recent personnel appointments on Lab.

Asad M. Aboobaker: Group Supervisor of 312I Project Systems Engineering for Mars, Astro & Planetary on Dec. 4.

Kerry J. Klein: Deputy Section Manager of 3550 Payload & Small Spacecraft Mechanical Engineering on Dec. 4.

Margaret M. Nice: Manager of 1020 Director Office Support Group on Dec. 4.

Sharmila Padmanabhan: Group Supervisor of 386A Instrument Architecture and Systems Engineering on Dec. 4.

Russell T. Wilson: Manager of 1790 IT Special Programs Office on Dec. 4.

Max Coleman: Group Supervisor of 353N Biotechnology and Planetary Protection on Dec. 18.