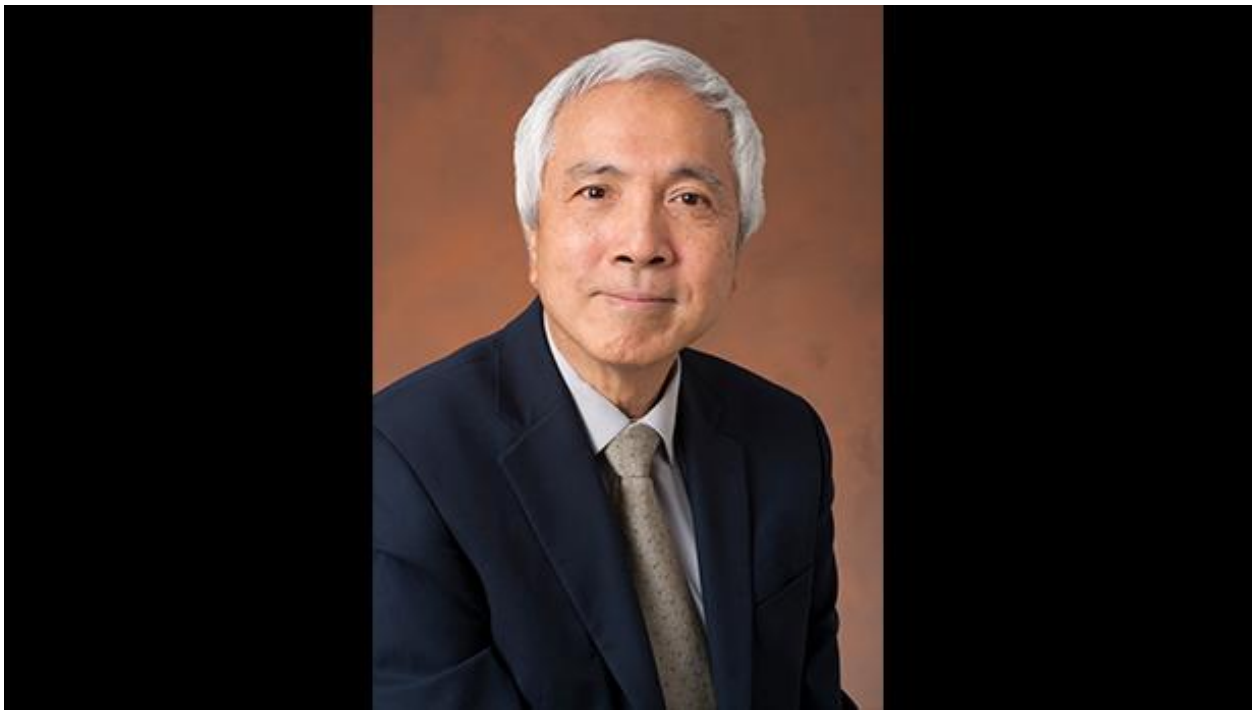
Featured Stories



Fuk Li Reflects on 40+ Years at JPL

By: Jane Platt

More than four decades after he started at JPL (with almost half of that time as manager of the Mars Exploration Program), Fuk Li retired on April 8.

In his time managing the Mars Program, five missions to the planet were launched—Mars Reconnaissance Orbiter, Phoenix, Mars Science Laboratory/Curiosity, a PI-led MAVEN project managed by the Goddard Space Flight Center, and Mars 2020/Perseverance. The long-living Odyssey, and the Mars Exploration rovers Spirit and Opportunity, were active during all or most of his time at the helm.

“It has been an unbelievable 16 years,” Li says of the accomplishments of the various Mars teams. During that time, he has seen three broad areas of capabilities for exploring Mars:

- **Strong community of scientists** working together to conduct scientific analysis and obtain discoveries from these missions. With these discoveries, the scientific strategy for future steps of the program also comes into better focus. Li now sees “professors who have trained students, and the students are now themselves becoming professors and researchers.”

- **Amazing engineering** is how Li describes it. Mars missions have changed dramatically since the first rover, the Pathfinder mission's Sojourner, landed on Mars in 1997. “Sojourner is just longer than the wheel on Perseverance,” he said, adding “there has been a substantial increase in engineering capabilities across the board.”
- **Learning to live with Mars.** Li describes the planet as “sometimes hostile, with a lot of unknowns” and points out how the teams have “learned how to operate on and around Mars and make sure we don’t get into traps or into harm’s way.”

Li is leaving JPL less than two months after the successful landing of Mars 2020/Perseverance. He has extremely high praise for the team and the technologies developed to support the landing. He says without the improved landing capability, “we would not have been brave enough to land in Jezero Crater” because of its rugged terrain. “The fact that it worked so well, it’s just an amazing accomplishment by the Mars 2020 team.”

Earth and Technology

Li began his JPL career in 1979 working in radar science and engineering. He has been involved with Synthetic Aperture Radars, scatterometers, and other radar systems. After leaving the radar section, he worked with Diane Evans, who retired in 2019 as Director for the Earth Science Directorate, on Earth science formulation activities. During that time, the Lab submitted proposals to the first Earth System Science Pathfinder Announcement of Opportunity that led to the selection of the GRACE mission.

He then managed the New Millennium Program office, his first time at JPL interacting with broader space science communities beyond Earth sciences. He describes New Millennium as a “challenge for me to learn the various science disciplines and the different technologies applicable to them.”

Fuk Li inside Mission Control during Mars Science Laboratory/Curiosity's Entry, Descent and Landing activities in 2012. Image Credit: PhotoLab

The Early Years

When Li left Hong Kong to study physics and X-ray astronomy at MIT in Cambridge, Massachusetts, at the age of 18, in 1971, "I did not really know what I was getting myself into. But fortunately, I lived in a dorm and made friends," which is where he began to learn about all things Americana.

"I never really knew what baseball was," he says. But he decided to learn when the Boston Red Sox made it to the 1975 World Series, and support for them was a given in the area. Li also learned about American football—and has been a fan of the local sports teams since.

Different times, different accomplishments, but Li is still keenly aware of the importance of teams.

In fact, as he prepares for retirement, Li is reluctant to take any spotlight away from others on the teams he has worked with. He notes that the longer he has been at JPL, the more strongly he believes that "every member of each team counts, everybody's contribution counts." He says this is because a mission often involves hundreds to thousands of people developing many thousands of hardware and software components. When the mission works properly, it's because everyone did their part to do the work correctly while collaborating with others.

Lots of Highs, and a Few Lows

Li says he savors the moments when a Mars mission lands safely, or a spacecraft arrives safely in orbit around the planet. "Seeing the data come back is mind-boggling," he says.

Fuk Li and Richard Cook with MSL flight hardware. Image Credit: PhotoLab

After guiding and enduring so many high-profile missions, you might think Li has nerves of steel. But you'd be wrong.

"I do not have nerves of steel at all…I really am a nervous wreck," Li says of his experiences during major mission events. But he deals with his worries by holding multiple team meetings before key events and even earlier, during mission development.

"I began hosting about a dozen lunches [pre-Covid] seeking viewpoints on how ready we are for key events. I would also call two to three dozens project members directly seeking their assessments. Based on the answers and assurances, instead of being nerve-wracking times three, it's only nerve-wracking times one for me," Li says. He emphasizes that during those meetings, and even outside of the meetings, he encourages people to speak up about any issues they see. He considers that "a responsibility of everyone."

When something goes awry with a mission, he believes that we need to convert the situation into an opportunity for the whole team to learn. For example, Li was program manager of the New Millennium Program in 1999 when its Deep Space 2 microprobes – attached to the Mars Polar Lander – were lost with the rest of the mission. "We did not hear from them, so it was difficult to understand what actually went wrong," he says, "but the Lab took actions to learn from such situations to make us a bit stronger."

On Daring Mighty Things Through the Years

Li considers himself fortunate that "I've lived my adult life through two institutes of technology—MIT and Caltech."

He attributes much of JPL's success to the combo of two environments—an industry-like project-delivery environment but with an academic-like work atmosphere – because of the NASA/Caltech mix. "Like industry, we need to deliver our projects and tasks with a set of schedule milestones and costs. But at the same time, with the rich heritage from Caltech, I feel that our work setup and our interactions have a strong university lab flavor."

That mix, he believes, spurs many animated and productive conversations, or as he has heard people describe it, "We debate issues until the truth comes out."

Since 1979, when the Voyagers were underway, Li has seen many changes in how we explore space and how we live on Earth. He describes how "the flavor and diversity of our projects have changed. JPL was known largely for its planetary exploration missions, and now its missions also include Earth science and astrophysics."

As for more general change, he says, "When I started there was no email, no PowerPoint. The way we communicate and share knowledge has changed dramatically."

A Mars-oriented example of that: The Send Your Name to Mars Public Engagement campaign. About 11-million people signed up to have their names etched onto chips aboard Perseverance, and as of early April, more than 18 million people around the globe have signed up to send their name on the next Mars mission. "It's clearly an absolute joy to know that so many people follow us, cheer us, share in our excitement," Li says. "It speaks to the human spirit of exploration."

Li leaves JPL with decades of memories, and a lot of thankfulness for having been part of teams and programs that are respected and honored. "When I sit next to someone on a plane and occasionally they ask where I work, many times they'd know about JPL, and they're almost always interested in the work that we do."

Does Li have any lessons learned to share with other JPLers, including those just starting out? Yes.

- "Be engaged and be dedicated. Put yourself into a task with your best effort to have an outcome you can be proud of."

- "Most of our work is conducted in teams. Be involved and be a team member. Contribute your part and give friendly support to help others on the team."

What's Ahead?

What will Li miss most about JPL? "Above all else, I'll miss the people at JPL. I'll miss the interactions immensely, where we work together but also chat about families and life in general," he says. "We have some of the best people—so smart, innovative, and dedicated."

Of course, Li will have more time to spend with one of his favorite teams: "Team Family"—which includes his wife, two daughters, a son-in-law, a baby granddaughter, his mother and sister.

Ingenuity Gives Wings to Big Dreamers of Small Spacecraft

By: Taylor Hill

As the Mars Helicopter team works on getting the four-pound Ingenuity Helicopter off the surface of Mars, JPL's Small Scale Flight Software (348C) team prepares to watch its code guide the first interplanetary drone on its maiden voyage.

It's a seminal moment in aviation, akin to the Wright Brothers' first flights at Kitty Hawk, and one that Mars Helicopter Operations Lead Tim Canham hopes will highlight JPL's prominence in flight software, and further the Lab's efforts to share that technology with partners, universities, and the general public.

F Prime (also written as F') is a reusable, multi-mission flight software framework designed for CubeSats, small spacecraft, and instruments. The program was initially developed in 2013 as part of a technology exploration task in Canham's section aimed at creating a low-cost, portable, pliable software architecture option that would allow components written for one application to be reused easily in other applications

and run on a range of processors. In 2017, the team pushed for F Prime to be released as an open-source software allowing external collaborators, universities, and the general public to use the framework on their own projects.

“F Prime has enabled a lot of goals we’ve had at JPL to design a truly reusable multi-mission flight architecture with the added bonus of the open-source collaboration and visibility afforded by the Mars Helicopter project,” Canham said. “It's kind of an open-source victory because we're flying an open-source operating system and an open-source flight software framework, and flying commercial parts that you can buy off the shelf, if you wanted to do this yourself someday.”

Before Ingenuity, F Prime had already been through its spacecraft paces, operating successfully aboard the ISS Rapid Scatterometer instrument launched in 2014 and JPL’s Asteria CubeSat in 2017. Looking forward, F Prime is scheduled to run on projects including the Lunar Flashlight CubeSat—looking for surface ice in the Moon’s craters; Near Earth Asteroid Scout—a CubeSat that will map an asteroid; and potentially aboard the JPL Next project’s Ocean Worlds Life Surveyor instrument.

Aadil Rizvi, flight software lead for the Lunar Flashlight and NEAScout CubeSats, says F Prime provides an out-of-the-box solution for several flight software services such as commanding, telemetry, parameters, and sequencing for the spacecraft. There’s also a sort of “auto-coding” tool that makes the reusable component-based architecture of F Prime highly portable for use across missions.

“This makes it quite easy to drop in a software component from something like Mars Helicopter into another mission’s flight software such as Lunar Flashlight or make the component available for open-source use by anyone else using F Prime,” Rizvi said. “And it’s pretty cool that a significant portion of software used on the Mars Helicopter is identical to another spacecraft going to the Moon, or an asteroid, or sitting on a student’s desk.”

Universities See the Benefits of F Prime

Outside of the Lab, JPL has been pushing to raise awareness of F Prime as a useful flight software option for university and student projects.

At Georgia Tech, a team has chosen to incorporate F Prime in its GT1 CubeSat, aimed to serve as an education exercise that will carry an interactive and automatic amateur radio payload.

“We chose F Prime after evaluating a handful of flight software frameworks, including the option of writing our own from scratch,” said Sterling Peet, Georgia Tech research faculty member and software lead for GT1. “We don’t have the resources to build all this code from scratch, use, and test it to ensure the necessary levels of reliability in-house. But by using F Prime, we can leverage the legacy it has and also contribute our testing and related benefits back to the F Prime community and project.”

A Carnegie Mellon University student-led team chose F Prime to run its Iris Lunar Rover—a tiny robot designed to prove the viability of nano-rovers in planetary exploration. Iris Deputy Program Manager Raewyn Duvall said the team was looking into various flight architectures when JPL happened to come to the university and present on F Prime. “It was a viable option with a direct link to the creators, so we decided to use it ourselves,” Duvall said.

F Prime will perform all control, health monitoring, and data recording onboard the rover.

“The fact that it is open source gave us a wide range of examples to base our own modules and let us use the forum to get quick answers without having to worry about potential support service charges just to get answers to questions we may have had,” Duvall said.

Besides dropping in at schools to present F Prime, The Small Scale Flight Software team has been hosting workshops, too.

Tim Canham (top right) working with students during the June 2019 CubeSat and F Prime workshop at the Courtyard Marriott in Pasadena. Image Credit: Courtesy of Jeff Levison

One three-day workshop held in 2019 included 15 students from five universities, plus seven JPL interns, who learned how to utilize and write code within the F Prime framework. In February 2020, the team hosted an internal workshop specifically for JPL organizations including 347, 39x, 35x, and 5x that will be supporting projects slated to utilize the F Prime software framework.

“There’s a community we’re forming here,” Small Scale Flight Software Group Supervisor Jeff Levison said. “We want to reach university students, faculty, other groups within JPL, and the greater aerospace community, and help them realize the benefit of having a common framework to build from for their missions.”

Levison sees the university partnerships as a two-way street, with JPL providing world-leading flight systems expertise to budding engineers, and then down the line, those future engineers could end up bringing their talents and a working understanding of F Prime to start a career at JPL.

At Carnegie Mellon University, the pathway to JPL may already be forming. “F Prime is not an easy architecture to pick up, so a student who manages to master it and create a solid working project clearly has amazing potential for an organization like JPL,” said Duvall. “Many of our students working on Iris that learned F Prime have expressed interest in applying to JPL, which I believe proves F Prime’s worth as a recruitment tool.”

What’s in a Name?

In the short form, it’s F'; the symbol following the F is not an apostrophe, but the prime symbol. In the long form, it is spelled out as F Prime. The long and short forms are interchangeable and equally appropriate, according to Small Scale Flight Software Group Supervisor Jeff Levison. “While we have fun associating the name with flight software, frameworks, math, and formal logic, we never designated a specific meaning,” Levison said. “Ultimately the team just wanted to get away from choosing another three-letter acronym.”

Why Use F Prime?

1. Faster and lower cost than building a one-off product: The software architecture is modular, which allows a lot of reuse between projects. And projects can share the newly developed components back to the core software, so future users can benefit.

2. It's flexible: F Prime can be used in many different projects, from small to large, and can be easily ported to new platforms.

3. Open-source = fewer restrictions: Because F Prime is open-source, it allows JPL to more freely collaborate with outside organizations, allowing university projects and students to utilize the software.

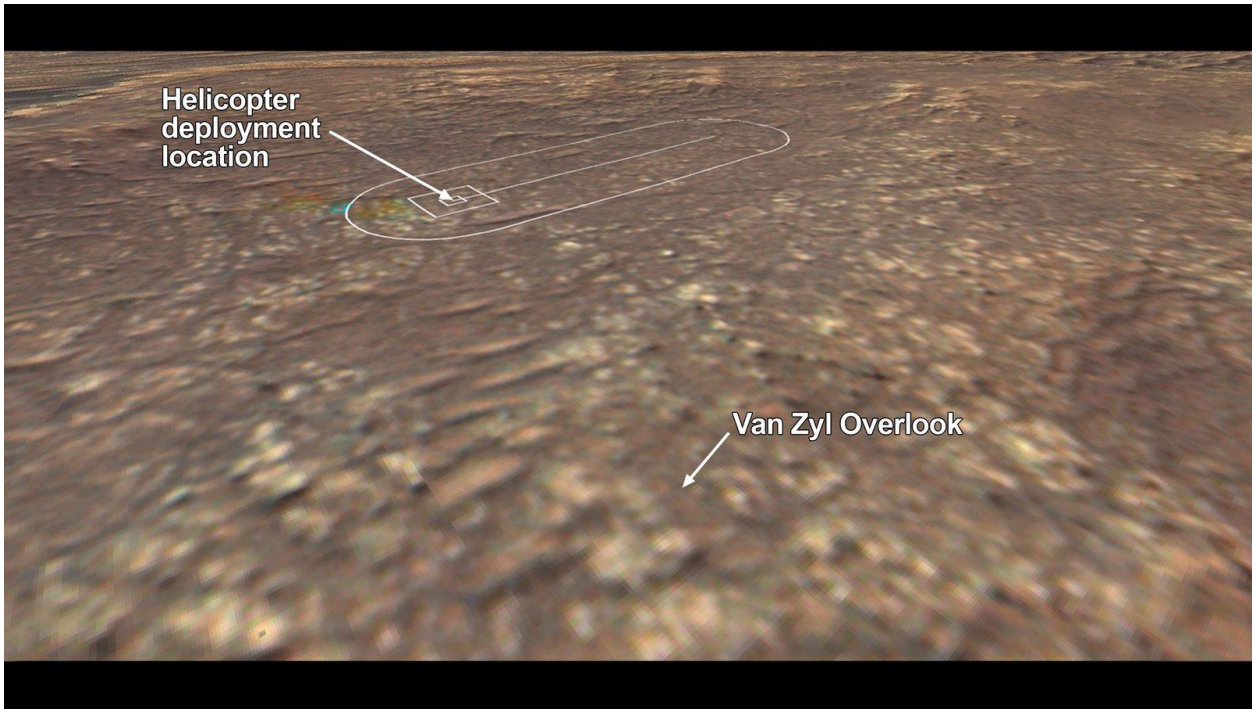


Image Credit: NASA/JPL-Caltech

Mars Overlook Named for Jakob van Zyl

While the Mars Helicopter team prepares Ingenuity for its historic flight, the Perseverance rover will be watching over the craft from a location to be named in honor of JPL's former Director for Solar System Exploration, Jakob van Zyl. After a distinguished 33-year career at JPL, van Zyl retired in March 2019, and passed away unexpectedly in August of 2020, about a month after the Perseverance launch.

On March 23, during a media briefing on the Mars Helicopter's planned first flight, Director for Planetary Science Bobby Braun announced the location's name: Van Zyl Overlook.

"May he continue to watch over this team, and may his memory continue to guide us, and encourage us to be bolder, and dare mighty things," Braun said.

Van Zyl joined JPL in 1986 and served in crucial roles at the Lab including as director for the Astronomy and Physics Directorate, associate director for project formulation and strategy, and finally director for the

Solar System Exploration Directorate. As leader of solar system exploration at JPL, he oversaw successful operations of such NASA missions as Juno, Dawn, and Cassini, the implementation of the Mars InSight lander and MarCO CubeSats, as well as ongoing development of Europa Clipper, Psyche, and all of JPL's instruments and Ingenuity.

The JATO assisted Douglas A-20 bomber in April 1942.

The First JPLers, Part 6: Liquid JATO

By: Erik Conway

In last month's column, we looked at the development of solid-fueled Jet Assisted Take-Off motors by JPL's founders. This month, we'll look at the development of liquid-fueled JATO motors, which took place in parallel. The leader of this effort was Martin Summerfield, a Caltech graduate and once Frank Malina's roommate.

After their early tests in the Arroyo with the alcohol and gaseous oxygen motor, the Caltech rocketeers had experimented with a variety of other possible fuels, both solid and liquid. What their U.S. Army sponsors wanted, though, were fuels and oxidizers that were relatively easy to transport and store. By 1941, they had settled on gasoline as their fuel, and instead of oxygen, they had chosen red fuming nitric acid, or RFNA, as their oxidizer (HNO_3+NO_2). Like gasoline, it was a liquid at room temperatures. Like gasoline engines in cars, though, this combination needed an ignition source. They used spark plugs.

Summerfield's own first innovation was shrinking the size of the combustion chambers that the group had been using. Guggenheim Aeronautical Laboratory at Caltech (GALCIT) director Theodore von Kármán had believed the chambers had to be relatively large to withstand the heat of combustion, but Summerfield proved him wrong. Shrinking the combustion chamber both saved weight and partly resolved a thorny problem with their liquid motors—sometimes they wouldn't start, and sometimes when they did, the motor

pulsed. The pulsing then led to the motor's explosion. This combustion instability problem they reduced by careful redesign of the injector, but didn't solve it that way. The solution came from outside the group.

In February 1942, the GALCIT project's chief engineer, Frank Malina, visited the Navy's Engineering Experiment Station in Annapolis, Maryland. The Navy had twisted Robert Goddard's arms into coming to work for them at the onset of World War II and stationed him at its Engineering Experiment Station. The officer in charge of the experiments was a homegrown rocketeer, Robert Truax. Truax grew up in Alameda, California, reading Popular Mechanics; for a high school project, he'd designed a regeneratively cooled rocket motor (i.e., it used the fuel to cool the motor). At the Naval Academy in 1937 and 1938, he'd gotten the Academy machinist to let him actually build it out of scrap. Truax tested it in September 1938 at the Engineering Experiment Station and on the American Rocket Society's test stand in December. By the time Malina visited, Truax and Goddard were working on JATO motors for the Navy's PBY Catalina flying boat.

Martin Summerfield, left, and an (overdressed) assistant outside the machine shop (near the current East Gate). Image Credit: NASA/JPL-Caltech

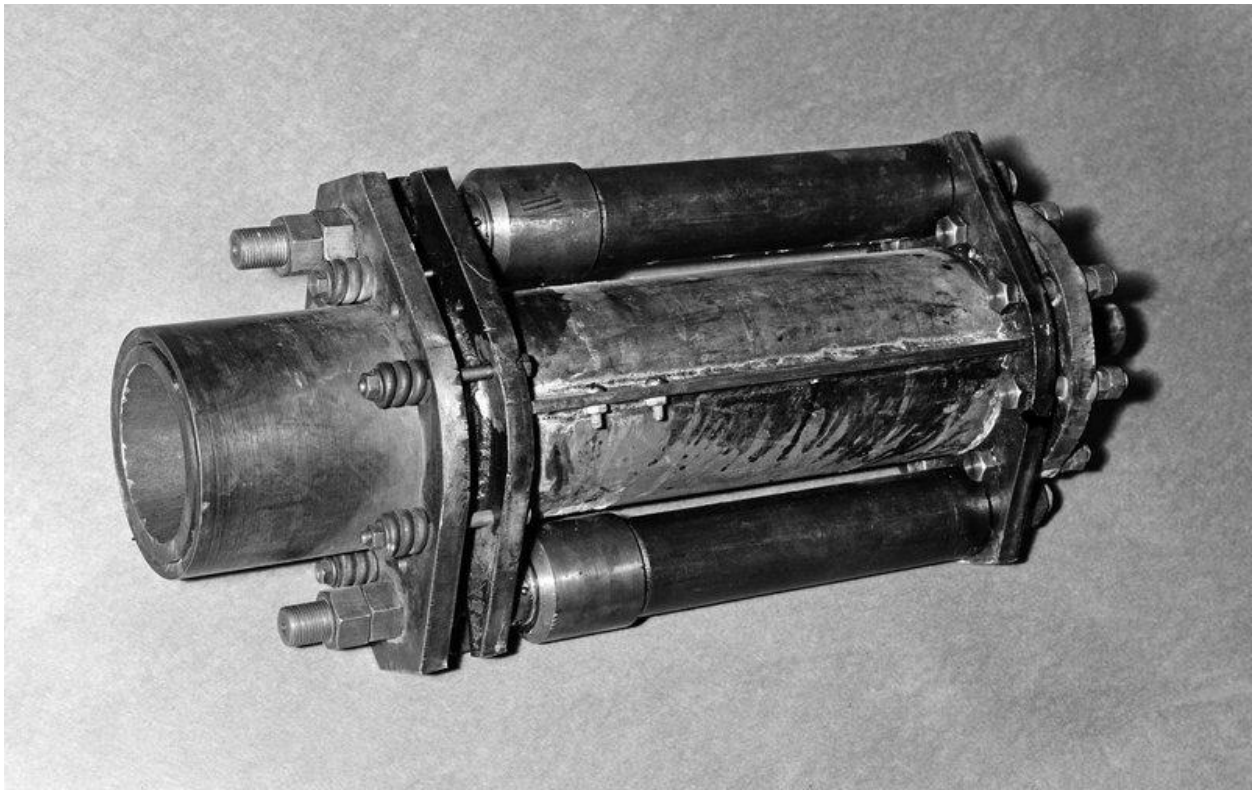
One of Truax's officers, a chemist named Ray Stiff, suggested the solution to the combustion instability problem Summerfield faced: ditch the gasoline for aniline (or C6H5NH2.) The combination of aniline and RFNA did not need an ignition source. They spontaneously react. Malina telegraphed Summerfield to relay the suggestion.

Decades later, in 1973, one of Summerfield's team members, Walter B. Powell, remembered how Summerfield had tested it: "Summerfield came out and tied a glass beaker on to the end of a long pole and filled it with aniline and dumped it into the acid. We had a big fire and we were under way."

The combustion instability problem had been one of milliseconds. If the gasoline/RFNA mixture did not ignite instantly, the chemicals built up enough in the chamber to cause an explosion. And that happened if the spark plug was slightly fouled, or its spark was a little weak. But the aniline/RFNA mixture did not need an igniter. It always ignited instantly. The motor designer just had to ensure the injector provided an appropriate mixture.

We use the German word 'hypergolic' for this kind of self-igniting fuel/oxidizer combination, although the method appears to have first been used by Soviet rocket experimenter Valentin Glushko in 1931.

By April 1942, Summerfield's team had redesigned the motor and arranged flight tests for it out at Muroc Dry Lake, now host to the NASA Armstrong Flight Research Center, on a Douglas A-20A bomber. The A-20 had a gross weight of 18,600 pounds, far more than the 800-pound Ercoupe they had tested Parsons' solid motors on only seven months before. Summerfield's new motor developed 1,000 pounds of thrust, and they installed two, one each behind the bomber's two piston engines. The motors would fire for 25 seconds.



Summerfield's 1000-lb-thrust liquid JATO motor. Image Credit: NASA/JPL-Caltech

Between April 9 and April 24, they conducted 38 tests of the rocket-assisted bomber, reducing its takeoff run by an average of 30 percent. Their principal challenge during the test program was some early cases of the two rocket motors not starting at the same time, which they traced to a misbehaving valve in one motor. Their pilot had no troubles maintaining control despite the unbalanced thrust, though.

The previous month, Malina, von Kármán, Summerfield, Jack Parsons, Edward Forman, and von Kármán's attorney, Andrew Haley, had formed a company to manufacture their JATOs at a large scale. They named it Aerojet, and they'd set it up as a private company because the Army did not want GALCIT to go into mass production itself.

Aerojet was initially located in a car dealership just outside what is now Old Town, Pasadena, though it soon moved to Azusa. Summerfield, Parsons, and Forman went to Aerojet full time, while Malina and von Kármán stayed attached to the GALCIT Rocket Research Project. It would be another year before the GALCIT project was fully out of the JATO business and off doing what Malina, Parsons, and Forman had wanted to do when they'd met back in 1935—developing high-altitude rockets.

Finally, just as the GALCIT rocketeers had not been the only ones working on JATOs for aircraft, they were not the only ones working on rockets at Caltech. Next month, we'll look at a parallel, but very different, program run out of the Physics Department, a sidewalk away from GALCIT.

Image Credit: PhotoLab

Biden Congratulates Mars 2020 Team

By Taylor Hill

On March 4, the Mars 2020 team once again found themselves in Mission Control holding their breath for a signal—not from a rover, but from the president of the United States.

Calling on a video link from the Roosevelt Room in the White House, Joe Biden congratulated the Mars 2020 team on the successful landing of Perseverance on Feb. 18. The president spoke with Lab Director Michael Watkins and Mars 2020 Guidance and Controls Operations Lead Swati Mohan, while members of the Mars 2020 team watched and cheered from the Mission Support Area and the Dark Room. Another 3,400 JPLers viewed a live stream of the 10-minute call.

“I just can’t tell you how much I believe historians are going to write about what you did at the moment you all did it,” President Biden said. “You guys did it. You should take such great pride — such great pride in what you did.”

Watkins thanked Biden for taking the time to talk with the team, noting the collaborative effort a mission like Mars 2020 demands, and pointing out how the global attention to Perseverance’s landing helped raise awareness of the importance of STEM.

“It was a great opportunity for us to show the country what we can do — and the world, really — to bring a whole new generation of STEM into the fold,” Watkins said. “I think we had a lot of people watching who didn’t know that they were STEM people, but now they are.”

Reflecting the next day on Biden’s call, Watkins said: “I am grateful for the incredible teamwork at JPL that combines daring and success to build the steps to the stars. As the president noted, we are proud of the unique opportunity to Dare Mighty Things for our country and for the world.”

After talking with Watkins, the president turned his attention to Mohan. “I was told I was going to hear from Swati,” Biden said—words the engineer never thought she’d hear.

“When the president said my name, my jaw dropped. I had no idea he knew of me!” Mohan told JPL Space.

Despite feeling more nervous than when confirming Perseverance’s touchdown Mohan kept her composure. She told the president that watching Star Trek as a child drew her to space exploration. But it wasn’t just the fantastic space imagery that sparked her interest: it was watching the close-knit team working together and manipulating a “technological marvel” with the purpose of exploring space and seeking new life.

“Being able to work with an incredibly diverse talented team that has become like a family, spending years creating our own technological marvel has been a privilege,” Mohan told Biden. “To see those images come back from Mars, to see the place where we had never been able to go to on Mars before and go there... just made it feel like I was living in a dream.”

“Well, I tell you what, you said you feel like you’re ‘living a dream’ — you’ve created a dream for millions and millions of young kids, young Americans,” Biden said.

“One of the reasons we’re such an incredible country is we’re such a diverse country. We bring the best out of every single solitary culture in the world here in the United States of America, and we give people an opportunity to let their dreams run forward. It’s so much bigger than landing Perseverance on Mars. It’s about the American spirit. You brought it back. You brought it back in a moment we so desperately need it.”

This was not Biden’s first congratulatory call. On Feb. 18, shortly after watching on television as Perseverance touched down on Mars, Biden called NASA’s Acting Administrator Steve Jurczyk to pass on his congratulations to the Perseverance team.

The call from a president to JPL is not unprecedented. JPL Historian Erik Conway pointed to President Ford’s call in 1976 following the Viking landings, and Vice President Al Gore’s call to the Pathfinder team in 1997. In 2004, Vice President Dick Cheney visited JPL to congratulate the Mars Exploration Rover project team, and Vice President Mike Pence visited Lab in 2018, one week prior to the launch of Insight.

But in contrast to previous calls and visits, JPLers could eavesdrop live on Biden’s video greeting.

Virtual Events

Von Karman Lecture Series: Science on Ice: What Ice Says About Past, Present, and Future Climate

Thursday, April 15 at 7 p.m.

› Click here to watch the event live on Ustream

Celebrate Earth Day with JPL as we explore the world's ice and what it can tell us about our climate. We'll talk with scientist Alex Gardner about our cryosphere and how it affects our future.

Speaker: Dr. Alex Gardner, Glacier Scientist, NASA/JPL

Host: Nikki Wyrick, Public Services Office, NASA/JPL

Co-Host: Shannon Forrey, Public Outreach Specialist, NASA/JPL

› Click here for the YouTube playlist of past shows

Diverse Minds Seminar Series: A Conversation with Ayana Elizabeth Johnson

Wednesday, April 28 at 4 p.m.

> Register for this webinar

Join Caltech for a conversation with marine biologist, policy expert and writer Dr. Ayana Elizabeth Johnson. Johnson will discuss her recent book, "All We Can Save," the future of oceans and climate change, and her personal journey from Brooklyn NY to marine biology to climate policy, and answer audience questions.

Moderated by Professor Victoria Orphan, and hosted by the Resnick Sustainability Institute.

Ayana Elizabeth Johnson is a marine biologist, policy expert, writer, and Brooklyn native. She is founder of Urban Ocean Lab, a think tank for coastal cities, and co-creator and co-host of the Spotify/Gimlet podcast How to Save a Planet. With Dr. Katharine Wilkinson, she co-edited the climate anthology All We Can Save, and co-founded The All We Can Save Project. Recently, she co-authored the Blue New Deal, a roadmap for including the ocean in climate policy. Previously, she was executive director of the Waitt Institute, developed policy at the EPA and NOAA, served as a leader of the March for Science, and taught as an adjunct professor at New York University. Johnson earned a BA from Harvard University in environmental science and public policy, and a PhD from Scripps Institution of Oceanography in marine biology.

JPL Family News

Retirees

The following JPL employees recently announced their retirements:

40+ Years:
Michael J. Mangano, Section 3500, 40 years

30+ Years:
Page Garcia, Section 4300, 39 years

Walter Rutley, Section 7070, 39 years

Brian Cox, Section 312E, 37 years

Leon Alkalai, Section 1500, 32 years

20+ Years:
Frank Ramirez, Section 355D, 27 years

Parviz Danesh, Section 5150, 26 years

John B. Sosnowski, Section 333K, 23 years

Passings

The following memorial tribute to Arden Acord was published in JPL Space Family News in December, but was inadvertently omitted from the monthly Universe newsletter sent to retirees and friends of JPL. The JPL Space editorial team extends our heartfelt apologies and sympathies to Arden's family.

Arden Acord died on Nov. 14, 2020. Acord joined JPL as a summer intern and then as a contractor in 1971. He started in programming, when programmers would carry boxes of punch cards (Hollerith/IBM) to be inserted as program data and instruction into early computers for programming. His storied 49-year tenure included major contributions to a wide array of JPL's most iconic flight projects, beginning with Viking and Voyager test and launch operations all the way up to current day projects in development, including Mars Sample Return and NEOCam. He served tirelessly as the test director and deputy engineering team chief for Galileo, the deputy ATLO manager for Cassini, the launch system manager for MRO, and as the section manager for system verification, validation and operations, including the deputy manager for the environmental, health and safety program office, and influenced so many more. Acord is survived by his wife, Gillian; their son, Jeremy; niece, Melissa; twin sister, Colleen; and his little sister, Debbie. Information on services is pending and will be shared once they are known. Individuals wishing to send a note of condolence to the family may mail these C/O Lyn Repath-Martos, 3144 Pontiac Street, La Crescenta, CA 91214. These will be collected and provided to the family. In lieu of flowers, Arden and Gillian supported the Leukemia Society and the Leukodystrophy Foundation.

Lawrence ("Monty" or "Larry") Montgomery, 94, passed away peacefully at home after a brief illness surrounded by family on March 14, 2021.

Monty started at JPL in 1955, as a member of the Sargent Missile design team. Soon he began work on solid rocket propellants, and he received three JPL patents for his work on safe sterilization techniques needed to ensure the upcoming exploration of our solar system would not contaminate the Moon or planets.

In 1963, he was assigned the task of creating the System Safety Office to ensure the safety of spacecraft and the people working around them. In that capacity, he and his team "wrote the book" on flight project system safety. In addition to managing the System Safety Office, Monty was the safety engineer for a wide variety of JPL missions, including the Surveyor missions to the Moon in the 1960s, and concluding with the Galileo Mission to Jupiter. He retired from JPL in 1994.

Monty is survived by his wife, Anne, to whom he was married for 68 years, and his children Marc Montgomery (Peggy), Kevin Montgomery-Duban (Dennis), and Melissa Miller (Maury). Monty was very proud that he was the first of three generations of JPLers with a total of 96 years (and counting) of JPL service. His son Marc retired from JPL in 2018 after 39 years, and his grandson, Ryan, is still actively employed. He and Anne have seven grandchildren and 11 great-grandchildren.

During his career, Monty received many citations and awards. He was always proud of the contribution JPL has made to scientific knowledge and technology, and was one of JPL's most ardent ambassadors until the end. He will be greatly missed!

A memorial service was held at home with family on March 17, 2021. In lieu of flowers, please send contributions to the Shriner's Children's Hospital at https://donate.lovetotherescue.org.

Ronald F. Draper was born on Dec. 15, 1933, in Imperial, Nebraska to Everett and Edith "Marita" Draper. He grew up in Eureka, California, graduating from Eureka High School in 1952 with honors.

After high school, he attended Carnegie Institute of Technology (now Carnegie Mellon University) in Pittsburgh, Pennsylvania. He was in Alpha Tau Omega; Omicron Delta Kappa; Pi Tau Sigma; Scabbard and Blade; Pershing Rifles; Intramurals; Student Council; Dorm Council; Society of Automotive Engineers; American Society of Mechanical Engineers; and ROTC. He received a Bachelor's Degree in Mechanical Engineering in 1956. He attended Caltech in Pasadena, where he received a Master's Degree in Aeronautics and Space Engineering in 1961.

He served in the Army at Fort Leonard Wood, Missouri as a Basic Training Instructor, 1st Lieutenant. This is where he met his soon-to-be spouse, Adah Pascua.

He started working for JPL in Pasadena in 1961, where he worked on many projects including Mariner 4, Mariner 5, Voyager, Galileo, Mariner Mark II, CRAF, and ending with being the Deputy Program Manager for Cassini. He was awarded the American Astronautical Society of Achievement Award – Voyager Program (1980), and the JPL/NASA Medal of Outstanding Leadership – Voyager Spacecraft (1981). Even after retiring in 1999, he worked part-time as a consultant.

Ronald had a lifetime association with the Boy Scouts, where he was able to pursue his love of hiking and the outdoors. He earned the top rank of Eagle Scout in his youth, was a troop leader for his son, Kevin, and served in various positions including being a member of the executive board of both Verdugo Hills and

Orange County Councils for many years. Ronald was awarded the Silver Beaver, which is the highest honor a council can bestow on a volunteer. He was so proud that not only his son but all three of his grandsons also earned Eagle Scout honors.

Ronald married Adah in 1961 in San Francisco. They were happily married for 60 years and had two children, three grandsons, and their beloved dog, Biskit, of 16 years. They spent many years with the "Gourmet Group" of close friends having dinner parties and going on camping trips. They enjoyed going to the theatre and loved to travel.

Ronald was 87 and was surrounded by his family when he passed peacefully on March 12, 2021, in his home in Mission Viejo, California. It was family that mattered most to him. He is survived by his wife Adah; daughter Monique Bottger and her husband, Roy; son Kevin Draper and his wife Christie, his grandsons Torren Draper, Dylan Draper, and Keaton Draper; sister Barbara Buchanan; brother Dennis Draper; and numerous nieces, nephews, and other relatives.

Ron Draper's Celebration of Life Service will be at South Shores Church, 32712 Crown Valley Parkway, Dana Point, California 92629 at 1 p.m. on Sunday, April 11, 2021.

Condolences to the family may be posted to the online guest book at www.mccormickandson.com/obituaries/Ronald-Draper-3.

The Celebration of Life Service will also be live-streamed and the link will be posted on that site soon.

Gifts in memory of Ronald may be given to South Shores Church, 32712 Crown Valley Parkway, Dana Point, California 92629, or to the Boy Scouts of America.

Randall Kieth (Randy) Bartman (1954- 2021) passed away after a long illness on Feb. 22, 2021. Randy was a loving spouse, father, dog parent, and an engineer and deputy section manager at JPL for 42 years.

Randy moved to California from Wisconsin as a 17-year-old freshman at Caltech, and he completed his BS degree and did graduate work at Caltech as well. Randy interned at JPL while at Caltech and then joined the technical staff in 1979. Throughout his tenure at JPL, he remained passionate about doing excellent technical work, teaching and mentoring others, and supporting the technical community. Bartman provided leadership, management and support for many JPL projects including the Keck Interferometer, the Large Binocular Telescope Interferometer, the Space Interferometry Mission, the Spitzer Space Telescope, the JWST mid-Infrared Instrument (MIRI), the Roman Space Telescope Coronagraph Instrument (CGI), and numerous other significant project and instrument developments ranging from deep space probes to Mars laser spectrometers, Earth-sensing instruments, and ground-based telescopes.

He was recognized throughout his career with many individual and team awards that called out his extraordinary efforts, expert technical advice, proposal leadership skills, and exceptional achievement. In addition to his love of the people and the work of JPL, Randy enjoyed hanging out with his family, the Big Island of Hawaii, reading and collecting books, sudoku, good music, art, origami, animals, and nature. He loved learning and teaching others what he knew. He valued community and contributed to building community in his neighborhood, at All Saints Church in Pasadena, as well as at JPL. Randy is survived by his wife, Beth Houskamp, his son Seth Bartman, his mother by marriage Alyce Houskamp, and his siblings by marriage John (Beth) Houskamp, Kathy (Joel) Ruiter, and Bill (Amy) Houskamp. He is also survived by numerous nieces and nephews, and his loving golden retriever, Kira. He is preceded in death by his parents George and Doris Bartman, and his father-in-law Dick Houskamp. A celebration of life service will

be held later, when it is safe to gather together as the community Randy loved.

Awards

IEEE Names Nacer Chahat Outstanding Engineer of the Year

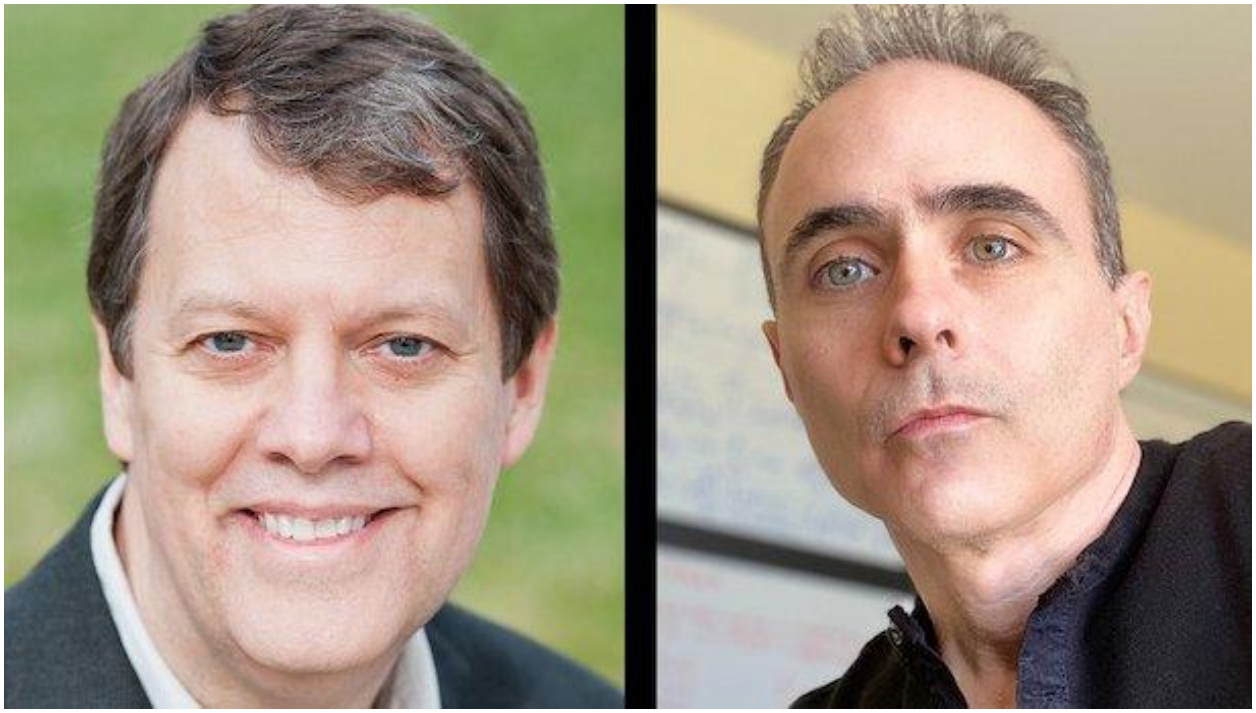
Nacer Chahat received the award for innovation and leadership in developing antenna technologies for deep space, Earth science, and, most recently, the Mars Ingenuity helicopter and Europa Lander.

“I am humbled to receive this prestigious award, and this wouldn’t be possible without all my colleagues who contributed to this work and to the success of these missions,” Chahat said.

Since joining JPL in 2013 as a postdoc and 2014 as a full-time employee, he has worked on several flight projects: Mars 2020, Ingenuity, Mars Cube One (MarCO), RainCube, Surface Water and Ocean Topography (SWOT), and more. One of his main contributions was development of the Europa Lander high-gain antenna, which enables direct-to-Earth communication from the surface of Europa, reducing the cost and complexity of the potential lander.

Chahat has published a book about CubeSat antenna design and authored and co-authored over 100 technical journal articles and conference papers.

New AIAA Fellows: Ioannis Mikellides and James Polk



(Left to right): James Polk and Ioannis Mikellides

Two JPL engineers – Ioannis Mikellides and James Polk – are newly elected Fellows of the American Institute of Aeronautics and Astronautics.

Mikellides is a principal engineer with the Electric Propulsion Group whose work centers on the theory and numerical simulation of laboratory and space plasmas. He led the breakthrough in Hall thrusters known as magnetic shielding and is currently Lead for Plasma Modeling on the joint NASA-industry program to develop the Advanced Electric Propulsion System for the Lunar Gateway. He has also supported InSight, Mars 2020, and the Mars Sample Return Campaign in various roles.

Polk is a principal engineer in the Propulsion, Materials, and Thermal Engineering Section. He is also a lecturer in the Caltech Aerospace Engineering Department, manages JPL's high power electric propulsion tasks, and works on the Advanced Electric Propulsion System, a 12.5 kW Hall thruster system which JPL and the NASA Glenn Research Center are developing for use on the Lunar Gateway.

Polk and Mikellides will be formally inducted later this year.

AIAA confers the distinction of Fellow upon individuals to recognize "their notable and valuable contributions to the arts, sciences or technology of aeronautics and astronautics." The organization is the world's largest aerospace technical society.

More information on the 2021 class of AIAA Fellows is at:
https://www.aiaa.org/news/news/2021/02/25/aiaa-announces-its-class-of-2021-honorary-fellows-and-fellows

IDG's CIO Names JPL a 2021 CIO 100 Award Winner

JPL has been named by IDG as a recipient of the 2021 CIO 100 award. The 34th annual award program celebrates the top 100 organizations and teams that are using IT in innovative ways to deliver business value. The award exemplifies the highest level of operational and strategic excellence in information technology (IT) and is an acknowledged mark of enterprise excellence.

CIO Randi Levin said of the announcement, “I am thrilled with our selection to the 2021 CIO 100. Being named with this honor is another example of how JPL IT taps into the expertise of its people, enabling them to create innovative and effective IT solutions for the Lab.”

The 2021 CIO 100 class is special due to the pandemic; many honorees helped their organizations transition to a new reality through their creativity and expediting of new technologies. This is JPL’s tenth consecutive selection to the CIO 100. The complete list of winners is available at https://www.cio.com/article/3391918/2021-us-cio-100-winners-celebrating-it-innovation-and-leadership.html.

The winning companies will be honored at the virtual 2021 CIO 100 Symposium & Awards Ceremony in August.