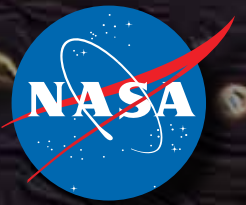


National Aeronautics and Space Administration

THE NRP POST

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Summer 2019



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USGS Ribbon-Cutting at Historic Building 19

By Christy Ryan July 2019

Last Wednesday, July 10th, was an exciting day in our on-going Menlo-to-Moffett relocation. About 150 people—USGS and NASA officials and employees, local government representatives, members of Congress and the media—took part in the official ribbon-cutting ceremony that marks the opening of new USGS offices at Moffett Field.

The ceremony was a key milestone event in a process that began more than six years ago, led by the USGS in close collaboration with Congressional representatives (notably the Honorable Anna Eshoo), NASA, and the General Services Administration. The event celebrated the first phase of employees moving from the Menlo Park campus and the Western Ecological Research Center to the new USGS Moffett Field campus.

An array of science centers will be housed at Moffett Field. They are the Geology, Minerals, Energy, and Geophysics Science Center; the Earthquake Science Center; the Western Ecological Science Center; the Western Geographic Science Center; the California Volcano Observatory; the Earth System Processes Division (Water Mission Area); and the USGS Innovation Center. Key science support teams who underpin and enable everything we do will be there as well, including the Office of Communications and Publishing, Office of Enterprise Information, Office of Science Quality and Integrity, and others.

These USGS employees will be united under one roof in a newly refurbished building at the Moffett Field campus. Though best known for housing NASA's Ames Research Center, Moffett Field is also home to Carnegie Mellon University, Google and other agencies, institutions, and companies. This co-location creates an outstanding environment for collaboration. USGS and Ames have a long history of working together and have ramped up their engagement over the past two years. New and exciting collaborations are being formed, and innovative and cutting-edge ideas are being explored, all while leveraging the skills, the scientific assets, and the resources of the respective institutions housed on the Moffett Field campus.

The move taking place this summer is just the first part of the overall Menlo-to-Moffett relocation. In the coming months and years, the remainder of the USGS team will move from Menlo Park to Moffett Field. Once the last have arrived by the end of 2022, roughly 400 USGS employees will be based here at Moffett.

This move was made possible by the extraordinary work of many people within the USGS, NASA, GSA and many other organizations. I can't begin to express my gratitude for the perseverance and creativity exhibited in order to make this move possible. This move ushers in a new era for the USGS, one that will carry on the outstanding science legacy of the Menlo Park campus.



NASA Administrator “Flying” a Lunar Lander at SimLabs

By Sumedha Garud
Photos: NASA/Dominic Hart
Moffett Field, CA

On May 31, 2019, NASA Administrator Jim Bridenstine visited the NASA Ames Simulation Laboratories (SimLabs) and experienced what it’s like to pilot and land a spacecraft on the Moon at the world’s largest Vertical Motion Simulator (VMS). In a highly realistic simulation, the Administrator piloted a spacecraft (with a cockpit configured like the Apollo Lunar Module) to successfully touch down on the lunar surface.

Administrator Bridenstine then flew Rep. Anna G. Eshoo in the VMS, discussing work on NASA’s Artemis program to go forward to the Moon by 2024. Past VMS studies have shown that landing on the Moon is extremely challenging for a control point of view, and motion-based simulation is critical for autonomous and piloted flight to study sensor and dynamics issues. After the lunar simulation demonstration, both Bridenstine and Eshoo posted glowing reviews on their social media – with Bridenstine stating, “@NASA Ames will be instrumental in putting the first woman and next man on the surface of the Moon as part of our Artemis program.”

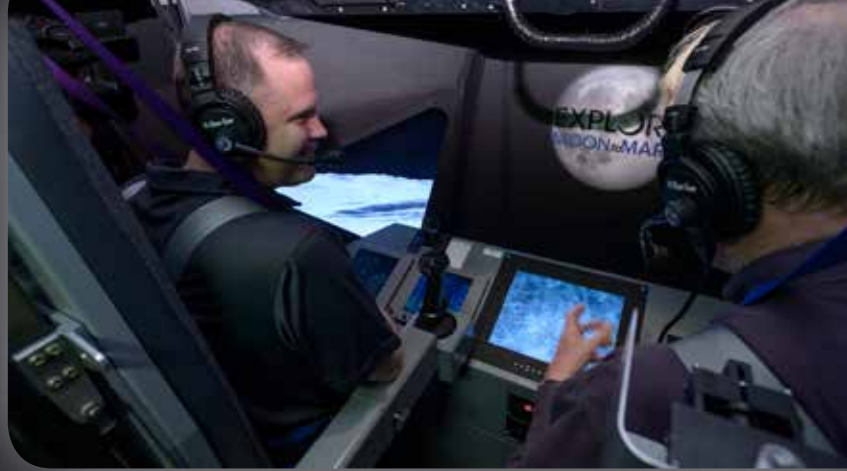
The VMS is just one of several simulation facilities located at NASA SimLabs. These immersive human-in-the-loop simulation capabilities are used for research to develop new aerospace concepts and technologies. The Administrator also spoke with several media outlets while flying them in the VMS lunar lander simulation.



As Bridenstine said to one reporter, “So when our astronauts go to the Moon in 2024... we will have not just trained our astronauts in this simulator here at Ames, but we will have used this simulator to test the various designs, modeled the designs... we will have had those astronauts assess whether or not these designs are working or not working, and how to make them better.”

NASA SimLabs boasts nearly 40 years of successful partnering with commercial space companies, academic institutions, and other government agencies – for more information please visit: www.nasa.gov/simlabs.

NRP resident Metis Flight Research Associates (MFRA) was proud to help make this lunar lander demonstration to the NASA Administrator a resounding success. The Contracting Officer’s Representative for SimLabs, Steve Cowart, stated that, “Of special note is the nearly heroic effort put forth by the VMS support contractor MFRA, and the civil service staff, to develop, fabricate, and integrate all the hardware and software necessary to build the lunar lander simulator for the Administrator’s visit... it performed flawlessly, and the support staff can take great pride in the workmanship that made the lunar lander demo a reality.”



NASA Administrator Jim Bridenstine (pictured above left) experiences the lunar lander simulation at the VMS. Astronaut Karol “Bo” Bobko (pictured above right) served as the “flight instructor” and guided the Administrator to complete several successful landings.



More information on how NASA SimLabs can “Simulate Future Space” is available at: www.nasa.gov/simlabs/simulate-future-space





NASA Invests in 3D Printing for Aviation

By Emily Durham

CMU has been selected by NASA to lead a research team dedicated to examining new ways to build and power aircraft of the future, through NASA's University Leadership Initiative.

Additive manufacturing (AM), also known as 3D printing, is a promising new technology for all areas of aviation manufacturing. AM's flexibility in design and customization, cost reduction, and speed in delivering finished parts make it a perfect fit for creating parts used in aviation contexts.

ership Initiative. As part of the Transformative Aeronautics Concepts Program, Carnegie Mellon will help solve the nation's most pressing problems in aviation.

Carnegie Mellon's project will be led by Tony Rollett and Jack Beuth, faculty co-directors of Next Manufacturing, and will include additional

"We believe this project will continue to substantially advance U.S. manufacturing capabilities in the aerospace and aviation industries."

At the bleeding edge of this new frontier in aviation is Carnegie Mellon University's Next Manufacturing Center and Manufacturing Futures Initiative (MFI).

Carnegie Mellon has been selected by the National Aeronautics and Space Administration (NASA) to lead a research team dedicated to examining new ways to build and power aircraft of the future, through NASA's University Lead-

Carnegie Mellon faculty Erica Fuchs, Elizabeth Holm, and Kenji Shimada. The team will receive nearly \$7 million over three years.

"We are truly honored to be selected for this NASA ULI," said Rollett, a professor of materials science and engineering. "Over the last eight years, metals AM has had a significant impact on aviation manufacturing for jet engine components, airframe structural elements, and

other applications. We believe this project will continue to substantially advance U.S. manufacturing capabilities in the aerospace and aviation industries.”

The research team—which will include partners from Argonne National Laboratory, ANSYS, Lockheed Martin, Trumpf, Eaton, General Electric, Pratt & Whitney, Northrop Grumman, Metal Powder Works, Siemens, Materials Solutions, and The Barnes Group—will explore new methods for using additive manufacturing to reduce costs and increase the speed of mass-producing aircraft without sacrificing quality, reliability, and safety.

Studies and testing will be carried out in Carnegie Mellon’s new advanced manufacturing facility in the Hazelwood neighborhood of Pittsburgh. The new building is being constructed entirely within the enormous skeleton of the historic steel mill known as Mill 19, located on the Hazelwood Green development site. Mill 19 will be a central hub for advanced collaboration in the manufacturing space, housing MFI, industrial-scale activities of the Next Manufacturing Center, and the Advanced Robotics for Manufacturing (ARM).

“Process qualification is one of the most important challenges for additive manufacturing over the next 5 to 10 years. This project, our university-industry team, and the facilities

at Mill 19 are coming together at just the right time,” said Beuth, professor of mechanical engineering.

The successful implementation of the project’s qualification framework for laser powder bed fusion 3D printing will bring down the cost of manufacturing, particularly for short production run parts and replacement parts, as well as boost economic growth through enabling small contractors to qualify their AM processes and equipment.

The NASA ULI program was created to initiate a new type of interaction between ARMD and the university community, where U.S. universities take the lead, build their own teams, and set their own research path. This initiative seeks new, innovative ideas that can support the NASA ARMD portfolio and the U.S. aviation community.

Carnegie Mellon faculty Elizabeth Holm (materials science and engineering), Kenji Shimada (mechanical engineering), and Erica Fuchs (engineering and public policy) will bring expertise in machine learning, robotics, and commercialization to the project. Other partners on this project include the University of Pittsburgh, Case Western Reserve University, Worcester Polytechnic Institute, Colorado School of Mines, the University of Texas at El Paso, and the Air Force Research Laboratory’s Materials and Manufacturing Directorate.

Carnegie Mellon University

Silicon Valley



Bob Vermillion Inducted Into Military Packaging Hall of Fame

The National Institute of Packaging, Handling and Logistics Engineers (NIPHLE) consisting of the US Army, US NAVY, USMC, DLA, USAF, DCMA and Industry, inducted Bob Vermillion, CPP, Fellow, RMV Technology Group, LLC (RMV) into the Military Packaging Hall of Fame in a special ceremony on 22 March 2019.

In 1990, the Military Packaging Hall of Fame was established for recognition of individuals whose leadership and technical expertise has contributed to successful development of the packaging industry. Initially, Aberdeen Proving Ground, Aberdeen, Maryland honored the first recipients for induction into the School of Military Packaging Technology.

Nominees are first voted on by a group of Industry Subject Matter Experts and the DoD Packaging Group. Those who achieve entry into the Hall of Fame are voted upon by a panel of 25 electors that represent the

military packaging community. Inductees include individuals who served in the Army, Navy, Air Force, Marine Corps, DLA, GSA and the private sector.

In 1999, Bob developed a Mars Mission Approved material followed by numerous developments and training programs for Aerospace & Defense engineers, technicians, scientists and supply chain professionals.

Most recently, RMV has developed a unique and interactive 5-day “hands-on” instrument driven educational program for Space & Defense to meet current and future requirements for the packaging, handling, storage and transportation of flight hardware and traceability to the updated standards of NASA and the DoD in austere environments for mission success.

Exclusively developed and trained by RMV leadership with 3rd party international certification by Exemplar Global, an affiliate of ASQ,

an individual can achieve the highest level of iNARTE® Certified ESD Aerospace & Defense Engineer or Technician certification.

RMV developed methods for the detection and identification of suspect counterfeit and non-compliant EEE components by first inspecting the external packaging or material protection of flight hardware is also included in the newly developed training program for NASA and the DoD. Prime contractors and the support subcontracting community are now invited to register for upcoming classes.

NASA ESD program managers center-wide were the first to obtain the iNARTE® Certified ESD Aerospace & Defense Engineer® certification in March 2018. Specifically designed for the technology professional, the iNARTE space & defense training can certify engineers or technicians depending upon the level of education and work experience as required by iNARTE®.

Now open for registration, the next class is scheduled for March 2020. Please contact Renee Mitchell at 650-964-4792 or email Renee at irene.a.mitchell@nasa.gov for early



placement on the attendee list. For more information, please visit the RMV training website: www.esdaerospacetraining.org/inarte-training

Prepared by
Renee Mitchell, President
RMV Technology Group LLC
A NASA Industry Partner



Verdigris Improves Advanced Energy Metering Offering— expanding capabilities to allow customers to easily find savings in their building

By Thomas Chung

In the first half of 2019, we added powerful new capabilities to Verdigris. Customers across all segments can now do more with the existing product they are already familiar with.

Measurement and Verification (M&V) dashboards are available by default for all customers. We have taken what we have learned from working with energy service companies to build dashboards that make it easy to verify savings based on changes to the building.

Key performance indicators (KPIs) were added to weekly reports. This allows customers to easily monitor changes in the key equipment they care about without needing to spend a lot of time digging through the data. A Fortune 10 customer has already used these reports to find substantial process changes that could result in \$10,000s in annual energy savings for a single facility.

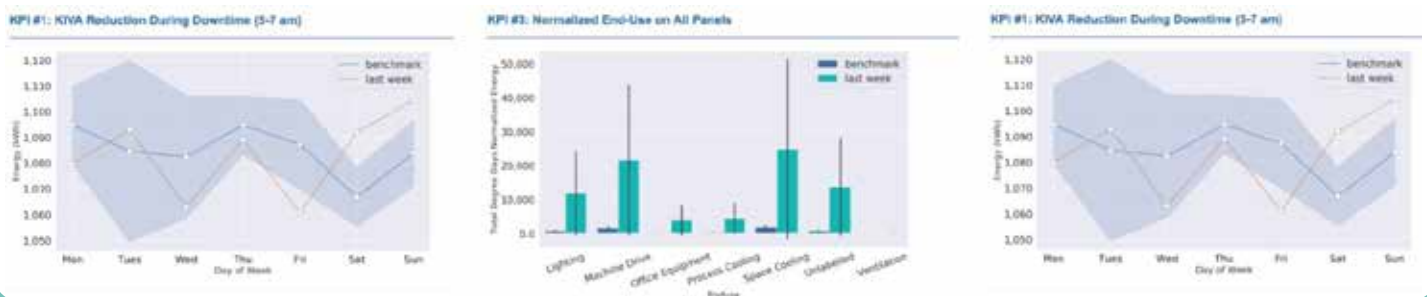
Verdigris now has the ability to integrate with Building Management Systems (BMS). Combined with our other algorithms, this allows us to bet-

ter learn a building's operation in order to build a full end to end solution that automatically generates energy savings. This intelligent optimization (IO) product is currently being piloted with 3 customers including in GSA buildings. Please reach out to sales@verdigris.co to learn more about our pilot program.



Verdigris improved the accuracy of our ability to detect short cycling and energy anomalies (e.g. a spike in chiller energy usage), improving our suite of intelligent alerts (IA). We make it easy to catch unexpected behavior in equipment that is not detectable through regular maintenance while not having to spend all day looking through spreadsheets.

KPI dashboard shows data for three customized key performance indicators



About Verdigris:

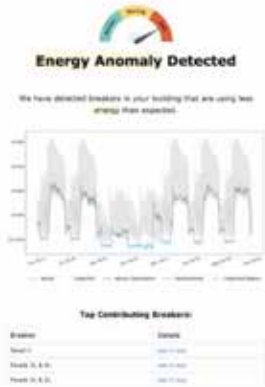
Verdigris combines proprietary hardware, artificial intelligence and software applications to deliver differentiated insights about building operation and energy consumption. Verdigris smart sensors placed at the electrical panel sample at extremely high frequency. We take hundreds of millions of more data points than a utility smart meter – every hour. This high-frequency data is fundamental to algorithmically "learning" a building. Our algorithms use this information to create a "virtual physical layer" of data, producing energy forecasts, motor fault sensor streams, and device-level energy information. Verdigris offers a suite of applications based on this innovative data platform. These products enable an unprecedented depth of energy analysis and enable building managers to move beyond "firefighting." Facility and operations teams can proactively manage their buildings to improve operational outcomes.

IGRIS

Dashboard shows a comparison of energy usage and costs between two time periods



Equipment failure was detected and an alert was sent to the customer



Case Study E

Problem: Equipment failure

Impact: Broken and code violation

Description: Low voltage on one phase of a heating element meant it wasn't getting to temperature. Walkthrough missed it because it is not perceivable outside of automatic detection of phase imbalance.

Buffering, Burstables, and Better Websites

By Anne Boyle May 16, 2019

Most people know the frustration of a lagging website. You want to watch another show on Netflix, but it won't stop buffering. You want to open another tab, but the browser crashes. You want to click a link, but your cursor turns into the spinning beach ball of death. Luckily, people like Carlee Joe-Wong are working to make website performances—and the revenues of the people who run them—the best they can be.

Joe-Wong is an assistant professor in Electrical and Computing Engineering at Carnegie Mellon University Silicon Valley. She researches computer and information networks, with a particular focus on economics and how to apply theory to practice. For the last year and a half, she has been investigating how cloud providers can optimize their use of burstable instances.

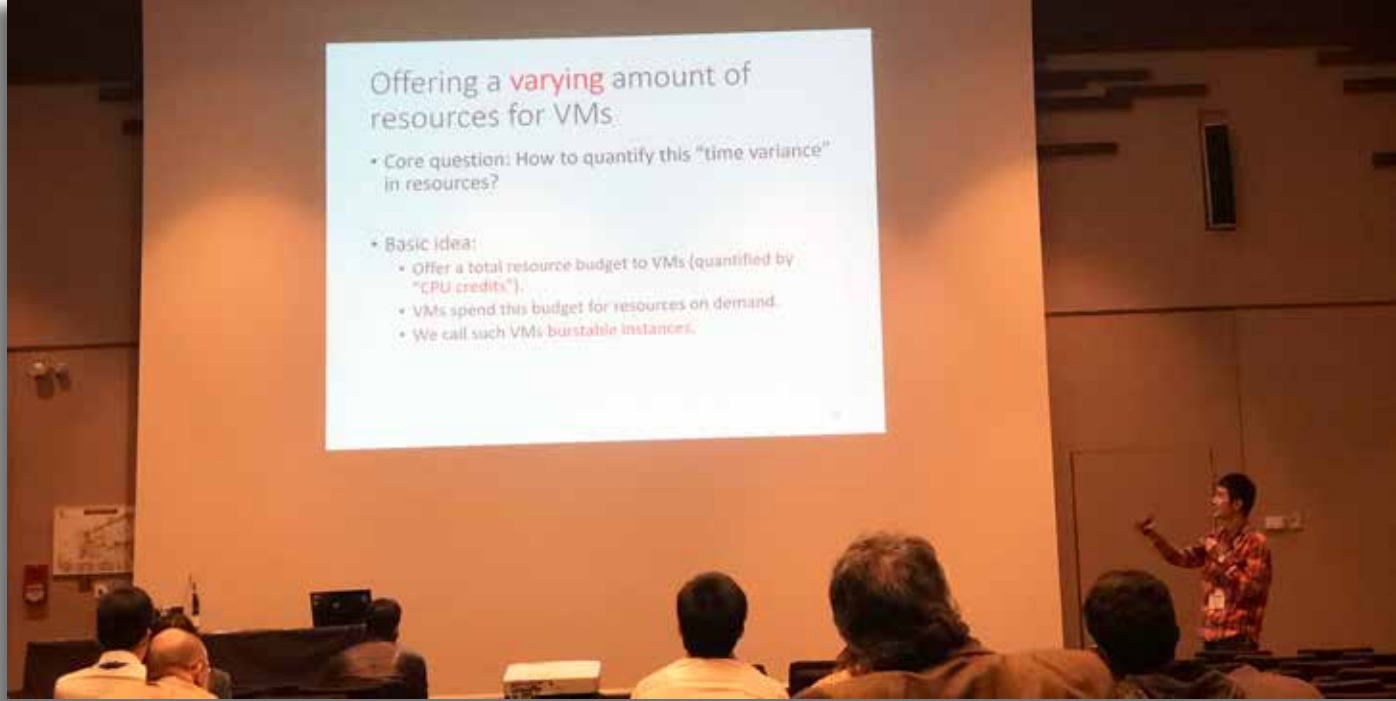
A cloud provider is a company that delivers computing-based services and

infrastructure. Users usually pay cloud providers for a fixed amount of resources so they can host websites and other information online. However, sometimes a website can get a sudden influx of visitors, and the fixed amount isn't enough anymore. The users then have to choose: pay for higher services they normally don't need or let their website buckle under the weight of the traffic.

Burstable instances attempt to circumvent this problem. "With burstable instances, you get a baseline amount of resources most of the time," Joe-Wong says, "and then you can request bursts of resources, which is a temporary increase in the amount of resources available to you." This means that users can customize their resources to fit their needs.

Although burstable instances don't cost much, cloud providers still need to regulate them to prevent people from bursting all the time and using up all available resources. Most providers





Offering a varying amount of resources for VMs

- Core question: How to quantify this "time variance" in resources?
- Basic idea:
 - Offer a total resource budget to VMs (quantified by "CPU credits").
 - VMs spend this budget for resources on demand.
 - We call such VMs *burstable instances*.

handle this with something called a token bucket. "A token is essentially a virtual piece of money," Joe-Wong says. "You can accumulate tokens at a predetermined rate over time, and then when you want to request a burst, you have to spend some of your tokens."

Burstable instances are relatively new, and the research community has done little to understand them from a theoretical perspective. Joe-Wong hopes to fill that gap. She worked with a visiting Ph.D. student, Yuxuan Jiang, and collaborators at Princeton on a framework that can be used to model, analyze, and optimize burstable instances.

"We were looking at a couple different things," Joe-Wong says. "How fast can you accumulate tokens? How often can you burst? And how does this affect the cloud provider's ability to manage everybody's burst requests?"

They referenced various empirical papers, adjusting and adapting techniques along the way. Joe-Wong and Jiang mostly worked on the theoretical model, while the Princeton collaborators worked to validate it. The end result is a model that will be able to help both cloud providers and users alike.

"We used our model to figure out how cloud vendors should price these different classes of burstable instances," Joe-Wong

says. "And that allows them to actually get more revenue." If application developers use burstable instances better, then that could translate to cheaper services for users.

The model could also help users pay for resources more efficiently. "Any given user has a profile of needs," Joe-Wong says. "So we look at that and ask, which class of burstables is better for you? Is the baseline service class enough, or is it actually worth it for you to pay for a higher service class?"

Their paper on the topic, *Burstable Instances for Clouds: Performance Modeling, Equilibrium Analysis, and Revenue Maximization*, was presented at the IEEE International Conference on Computer Communications. The team has hopes it will inspire more conversation in the area. "This is really the first model about burstable instances, and there's a lot of ways it can be refined," Joe-Wong says. "So I definitely hope other people will follow on to this."

The team is also going to continue investigating this topic. "We're continuing to work on this project and refine the model," Joe-Wong says. "We're still trying to make it more realistic and investigating better methods for optimizing user experience." With any luck, the model will only get better. Goodbye, spinning beach ball of death; hello, revenue and high performance.

Eugene L. Tu announces new appointments

MESSAGE FROM CENTER DIRECTOR

I am pleased to announce that on June 9, 2019, Ms. Janice Fried joined the Director's staff as a Special Assistant to the Center Director, and Ms. Meighan Haider was appointed the Director of the NASA Research Park (NRP) at NASA Ames Research Center (ARC).

As Special Assistant to Center Director, Ms. Fried provides expertise and advice on labor relations law and policies. Ms. Fried will also continue as the Ames Center Anti-Harassment Coordinator and support both the Center and Agency in this role.

Ms. Fried was appointed to the Director of the NASA Research Park (NRP) in February 2016 and previously served as the Director of the Office of Human Capital. Prior to her appointment to the Senior Executive Service in 2008, she served as ARC's Deputy Chief Counsel and as an attorney for both ARC and NASA Headquarters for more than eight years. During 2007, Ms. Fried served as the Acting Deputy Assistant Administrator for Human Capital Management at NASA Headquarters, and represented NASA as the Deputy Chief Human Capital Officer. Her educational background includes a Masters of Law degree in Environmental Law from the George Washington University Law School, a J.D. from Whittier Law School, and a Bachelor's degree in History from the University of California, Los Angeles.

As Director of the NRP, Ms. Haider oversees partnership development, land use planning, leasing, and property management.

Ms. Haider started her Federal career in 1988 working in the Army Aeroflight Dynamic organization and joined ARC in 1990 working in the Office of the Chief Financial Officer as a Budget Analyst. In 1998, she joined the External Affairs Office as a Community Relations Specialist where she was involved in early planning of the NASA Research Park on matters including land use, community relations, Environmental Impact Study, and NASA Ames Development Planning. In 2004, Ms. Haider was named Deputy Director of the NRP. As the Deputy Director, she has been instrumental in the Center's large-scale lease negotiations including Bay View, Moffett, and the Housing development. She has also recently been an influential contributor to the U.S. Geological Survey's relocation to NASA Ames and is considered an expert in lease negotiations within the Agency. Ms. Haider earned a Bachelor's Degree from San Jose State University and the University of Phoenix and she holds a MBA from Golden Gate University.

Please join me in welcoming Ms. Fried and Ms. Haider to their new roles.

Eugene L. Tu



Meighan Haider
Director, NASA Research Park

NASA Ames Photo Ops



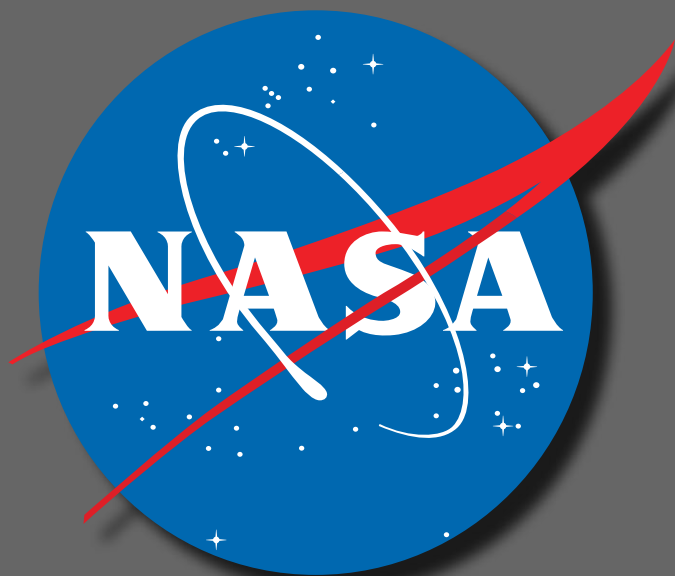
UC Berkeley Chancellor Carol Christ and Executive Vice Chancellor & Provost Paul Alivisatos along with UC delegation, visited the NRP on July 11, 2019. They discussed numerous collaborative and development opportunities with Dr. Tu, Carol Carroll and Dr. Korsmeyer.



February 25, 2019 NASA Deputy Administrator Morhard to ARC and tour of NRP



June 4, 2019 GSA Commissioner visit to NASA Ames



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