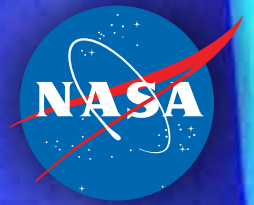


National Aeronautics and Space Administration

THE NRP POST

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2020 Issue 2



AUVSI at NASA Ames State of Urban Air Mobility & Unmanned Traffic Management

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RMV TO PROVIDE VIRTUAL TRAINING RISK MITIGATION OF COVID 19 FOR SPACE & DEFENSE MATERIAL HANDLING OF ELECTRONICS

Moffett Field, California, August 4, 2020

RMV Technology Group LLC (RMV), NRP Industry Partner and Service Disabled Veteran Owned Small Business considered an “Essential Business” by NASA, continues to test current and new products that are used in Mission Critical projects and those that may require more in-depth testing before launch for a successful deployment.

Product performance today is especially critical to protect the health and safety of the individual as evidenced by the influx of non-conforming and suspect counterfeit products flooding into the US marketplace.

From material handling procedures in the assembly operations, cleanrooms and incoming inspection areas for detection of unknown particulates related to packaging or Personal Protective Equipment (PPE), the potential risk of contamination is a higher risk in the “new normal” today for the Individual. The supply chain “global” outsourcing has lowered prices but at the same time increased the possibility of receiving non-conforming and suspect counterfeit products or consumables manufactured without adherence to quality or product integrity. This can well be the price you pay to get the buyer a lower cost but at the risk of sacrificing quality.

From the astronaut conducting experiments to the handling and staging of SmallSats on the ISS, the use of tablet displays, handheld ESD sensitive devices (ESDS) and electronic wearables must meet the rigorous requirements for conformance in a very harsh environment of 0% relative humidity in Space. A satellite may not deploy, a tablet could “lock up” or freeze, an ESDS could malfunction and compromise the mission! A deployment may be a “dead stick” before its liftoff. In like manner, a mission critical device fails that wipes out useable data that is retrievable from Space.

Recently, RMV has turned to a Virtual Online Training platform to pivot the Onsite Technical Training for ESD Program Monitors, Operators, Engineers and Technicians for a parallel, interactive connection with the Individual in a remote workplace.

In collaboration with the Veterans Business Outreach Center, Region IX (VBOC), RMV is partnering to create a Virtual Training Series aimed to educate individuals about COVID-19 Risk Mitigation ranging from materials handling to incoming inspection to lower one’s exposure in the workplace. This training will also focus on the most effective use of PPE materials and to create the awareness needed from the healthcare worker

to the professional staff in working with the patient.

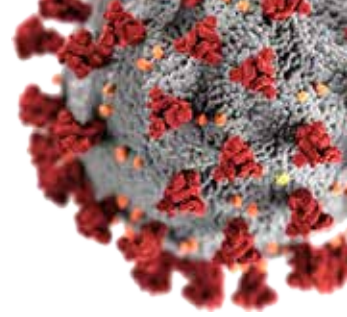
The unique and innovative method of engagement for the Virtual Training Series is designed to create a most effective platform for ease of delivery and maximum interaction in a live format by the CEO and Founder, Bob Vermillion, named the NASA ESD Technical Authority in March 2018 at NASA Quality Leadership Forum. In addition, Bob is a iNARTE® Certified Product Safety Engineer and iNARTE® Certified ESD

Engineer as well as a 2019 Inductee into the Military Packaging Hall of Fame.

Conveniently located in Building 19 of the NASA Ames Research Park, RMV has implemented safety guidance rules for onsite work in the R&D, assembly or cleanroom areas for UC Berkeley Space Science Labs and, most recently, for NASA Ames Research Center.

For more information on the Virtual Training Programs now being offered, please contact:

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SPACE NEWS

Article Published in SpaceNews <https://spaceneews.com/redwire-acquires-made-in-space/>

Redwire acquires Made In Space

by Jeff Foust — June 23, 2020

WASHINGTON — Made In Space, a pioneer of in-space manufacturing and assembly technologies, is being acquired by Redwire, a new venture that is rolling up a number of smaller space companies.

The companies announced the deal June 23, terms of which they did not disclose. Made In Space, founded in 2010 and based in Jacksonville, Florida, has developed 3-D printers flown on the International Space Station and has a NASA contract for a mission called Archinaut One to demonstrate the in-space assembly of solar arrays.

AE Industrial Partners, a private equity firm, formally established Redwire at the beginning of June by combining two companies it had acquired, Adcole Space and Deep Space Systems (DSS). Both companies are best known as suppliers of spacecraft components and engineering services, although

DSS has also developed a robotic lunar lander and is part of NASA's Commercial Lunar Payload Services program.

"What we wanted to do with Redwire is take some of the traditional space heritage from the small, agile and innovative companies out there like Adcole and DSS and combine them with a true innovator," said Peter Cannito, chief executive of Redwire, in an interview.

Made In Space, he argued, is that innovator. "The things that they're doing are things that have never been done and really have the potential to change the economics of space," he said. "That filled a key gap in our strategy."

For Made In Space, the acquisition gives it resources to expand its capabilities. "We were really looking at what would take us to the next level," said Andrew Rush, president and chief executive of Made In Space, in an interview. In discussions with Redwire, he

Made In Space will continue projects like Archinaut, a demonstration of in-space manufacturing and assembly technologies, as part of Redwire. Credit: Made In Space

said, “we found a common language and a common ground around creating an organization that had both great flight heritage and experience and an innovative approach.”

“There have been constraints by being that small, independent company,” he said. “Now, by joining forces with Redwire and having the resources and reach that they bring to the table, it’s really going to unshackle us and let us deliver faster on the possibilities.”

Rush said the Redwire acquisition made more sense than alternative approaches to growing the company, such as raising venture capital. “The conversations and the commonality of vision, that Pete and I have and the broader Made In Space and Redwire teams have, is what really brought us together,” he said.

Made In Space will continue its existing projects, like Archinaut, while looking to leverage the capabilities of the other Redwire companies. “In the coming months, we’re going to start to work together and bring new offerings to the

market for our customers that are integrated solutions,” Rush said.

For now, Made In Space and the other Redwire companies will operate separately, but Cannito said that over time they will combine under the Redwire name. “We’re going to let it evolve naturally,” he said. “Many of the brands that are involved in Redwire have a lot of history and meaning to their current customer set, so we want to respect that legacy.”

He also opened the door to other acquisitions. “We’re really trying to build that premier agile middle-market player in space,” he said, looking for companies “that recognize that they have something really innovative but, by joining Redwire, can accelerate their timelines significantly.”

As a part of the acquisition, Rush will become the chief operating officer of Redwire, while Mike Snyder, chief engineer at Made In Space, will become chief technology officer at Redwire.



CMU-SV Students Partner With Tech Titans

CMU Staff writer April 20, 2020

Students enrolled at Carnegie Mellon Silicon Valley (CMU-SV) have the unique opportunity to study in the Bay Area of California—a place that is booming with technical discovery and entrepreneurship. In the Integrated Innovation Institute and Information Networking Institute (INI), students also get the opportunity to work in their fields with major tech companies who partner with CMU-SV for internship, research, and networking opportunities.

Two such companies are Apple and Volvo. Jenny Elfsberg, the Director of Volvo's Innovation Lab Hub US says that they are excited to work with CMU-SV students because they “successfully work together throughout the co-creation process. This is a skill set that is extremely important for the future of Volvo and something that is not taught at all universities... There is a balance of the students' depth of knowledge and expertise, along with the ability for collaboration and successful teams.”

Bicoastal INI students and some Integrated Innovation students, depending on their degree, start their academic journey in Pittsburgh on CMU's main campus. After a year of study, INI students complete a three-month summer internship with a tech company, often in the Bay Area, before continuing their second academic year at the CMU- SV location. Not only does the internship provide students with invaluable real-world experience and access to professional mentorship; but it serves as their introduction to a new home.

*Source: CMU-Silicon Valley
Yixin Bao (center) got his photo taken with Apple CEO Tim Cook (r.) while on a campus trek.*



Yixin Bao is in his final semester of the MS Information Technology Mobility program in INI. His introduction to the West Coast was as a software engineering intern at Apple working on Bluetooth Core projects such as

AirPod connectivity, “It’s a very smooth transition,” says Bao. “One of the reasons I applied to this program is because I get to study in Silicon Valley, where you meet more people from industry and you get more opportunities for things like job applications.”

Bao is excited to graduate in the spring and return to Apple full time in the summer to start his career. Like him, many CMU-SV students go on to work in the Bay Area, sometimes with companies where they previously interned.

Integrated Innovation student Ida Wang is currently in the MS in Technology Ventures program with an expected graduation date of December 2020. Her introduction to the Bay Area was with Volvo’s Connected Solutions Innovation Lab as a solution developer intern exploring local traffic infrastructure. She noted that, for an international student like herself, the fact that companies are prepared to work

with CMU-SV students made her transition much easier than it could have been.

“Through Integrated Innovation, we have access to corporate sponsors, so this is a bonus point for me. It’s especially nice for international students,” adds Wang. She explains that companies have been very supportive of international students, who sometimes run into challenges with securing jobs or internships.

Internships are just one of the many ways that CMU-SV supports student engagement with the vibrant industry surrounding them in the Bay Area. Both Integrated Innovation and INI lead tech treks to visit local companies, host corporate speakers on site, and conduct events such as hackathons and networking nights to fully enrich student lives with professional opportunities that abound in the region.

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BREAKTHROUGH INITIATIVES WITH NASA LOOK FOR SIGNS OF ADVANCED EXTRATERRESTRIAL LIFE

San Francisco – October 23, 2019

Thousands of new planets found by TESS will be scanned for “technosignatures” by Breakthrough Listen partner facilities across the globe.

Data from TESS monitoring of stars will also be searched for anomalies.

Breakthrough Listen, the initiative to find signs of intelligent life in the universe, announced today, at the International Astronautical Congress in Washington, DC, a new collaboration with scientists working on NASA’s Transiting Exoplanet Survey Satellite (TESS).

The new collaboration will be led by TESS Deputy Science Director, MIT Professor Sara Seager; S. Pete Worden, Executive Director of the Breakthrough Initiatives; Dr. Andrew Siemion, leader of the Breakthrough Listen science team at the University of California, Berkeley’s SETI Research Center (BSRC); and will engage Listen partners and collaborators worldwide.

The TESS and Listen collaboration will expand Breakthrough Listen’s target list (adding over 1000 “objects of interest” identified by TESS); refine Listen’s analysis strategy (for example, utilizing new knowledge about planetary alignments to predict when transmissions might be more likely to occur); and provide more meaningful statistics in the event of non-detections.

Observations will take place using Listen’s primary facilities (the Green Bank and Parkes Telescopes^{1, 2}, MeerKAT², and the Automated Planet Finder), as well as partner facilities including VERITAS⁴, NenuFAR, FAST⁵, the Murchison Widefield Array, LOFAR stations in Ireland and Sweden, Jodrell Bank Observatory and e-MERLIN⁶, Keck Observatory, and the Sardinia Radio Telescope, along with the SETI Institute’s Allen Telescope Array⁷.

“It’s exciting that the world’s most powerful SETI search, with our partner facilities across the globe, will be collaborating with the TESS team and our most capable planet-hunting machine,” remarked Dr. Worden. “We’re looking forward to working together as we try to answer one of the most profound questions about our place in the Universe: Are we alone?”

The TESS mission measures “lightcurves” (how the brightness of stars changes over time) to look

for telltale dips caused by “transits” – where a planet passes in front of the star as viewed from Earth. The cutting-edge instruments on TESS are sensitive enough to detect small, rocky planets similar to Earth. Such planets are prime targets for follow-up by NASA programs, such as the James Webb Space Telescope, that seek to measure planetary atmospheres. Careful measurements of atmospheric composition could result in the detection of “biosignatures” – indicators that biological processes may be taking place on worlds other than Earth.

As well as looking for biosignatures, astrobiologists search for “technosignatures” – indicators of technology that may have been developed by advanced civilizations. Also known as SETI (the Search for Extraterrestrial Intelligence), technosignature searches use powerful telescopes to look for signals coming from space that appear to have arisen from transmitters, propulsion devices, or other engineering. No unambiguous technosignatures have been seen to date, but the chances of detection are higher than they have ever been, in large part due to Breakthrough Listen – the most sensitive, comprehensive, and intensive search for advanced life on other worlds ever performed. Listen is using facilities across the globe, including cutting-edge optical telescopes, to search for powerful lasers, and the world’s most capable radio telescopes to search for signals over a wide range of the radio spectrum.

In the past three decades over 4,000 exoplanets have been discovered – many by TESS’s predecessor, the Kepler spacecraft. According to recent estimates, the average number of planets per star is greater than one. As a result, technosignature searches operate in a “target-rich” environment, observing stars whether or not confirmed planets are known to exist around them. Nevertheless, as the haul of confirmed exoplanets continues to grow, the additional information about these systems is very useful for optimizing SETI strategies. Launched in April 2018, TESS has four wide-field cameras, each monitoring a region of sky 24 degrees across (about the width of the span of your

hand when held at arm's length). Lightcurves for 20,000 stars are measured every 2 minutes, and in addition, the brightness of every pixel in the cameras is recorded every 30 minutes.

TESS will observe over 85% of the sky – around 400 times more than Kepler – and is predicted to find as many as 10,000 new planets. Most of the TESS targets are considerably closer to Earth than those viewed by Kepler, enabling technosignature searches to probe for fainter transmitters. And because TESS only sees planets that pass in front of their host star as viewed from Earth, all the planetary systems it detects will be edge-on. A large fraction (roughly 70%) of radio leakage from Earth-based transmitters is emitted in the plane of Earth's orbit; if the same is true for any transmitters developed by extraterrestrial intelligence, observing the systems edge-on will offer the best chance of detection.

In addition to targeting of TESS planets with Listen facilities, the TESS lightcurves themselves will be searched for anomalies. A planet transit produces a well-understood variation in detected light from the star, but large-scale engineering projects (for example, “megastructures” constructed in orbit) could block the stellar light in more complex ways. The TESS analysis pipeline is in essence a wide-field anomaly detector, and stars that behave strangely are interesting not just as technosignature candidates, but as potential laboratories for studying interesting astrophysics.

“The discovery by the Kepler spacecraft of Boyajian's Star, an object with wild, and apparently random, variations in its lightcurve, sparked great excitement and a range of possible explanations, of which megastructures were just one,” said Dr. Siemion. “Follow-up observations have suggested that dust particles in orbit around the star are responsible for the dimming, but studies of anomalies like this are expanding our knowledge of astrophysics, as well as casting a wider net in the search for technosignatures.”

“We are very enthusiastic about joining the Breakthrough Listen SETI search,” said Prof. Sara Sea-

ger. “Out of all the exoplanet endeavors only SETI holds the promise for identifying signs of intelligent life.”

Breakthrough Listen is a scientific program in search for evidence of technological life in the Universe. It aims to survey one million nearby stars, the entire galactic plane and 100 nearby galaxies at a wide range of radio and optical bands.

The Breakthrough Initiatives are a suite of scientific and technological programs, founded by Yuri Milner, investigating life in the Universe. Along with Breakthrough Listen, they include Breakthrough Watch, an optical search for Earth-like planets in the habitable zones of nearby stars; and Breakthrough Starshot, the first significant attempt to design and develop a space probe capable of reaching another star.

Yuri Milner founded DST Global, which has become one of the world's leading technology investors and its portfolio has included some of the world's most prominent internet companies, such as Facebook, Twitter, WhatsApp, Snapchat, Airbnb, Spotify, Alibaba, and others.

Yuri lives in Silicon Valley with his family. He graduated in 1985 with an advanced degree in theoretical physics and subsequently conducted research in quantum field theory. Yuri and his wife Julia have partnered with Sergey Brin, Priscilla Chan and Mark Zuckerberg, Pony Ma, and Anne Wojcicki to fund the Breakthrough Prizes – the world's largest scientific awards, honoring important, primarily recent, achievements in Fundamental Physics, Life Sciences and Mathematics. In July 2015, together with Stephen Hawking, Yuri launched the \$100 million Breakthrough Listen initiative to reinvigorate the search for extraterrestrial intelligence in the Universe; and in April 2016 they launched Breakthrough Starshot – a \$100 million research and engineering program seeking to develop a technology for interstellar travel.

For More Information:

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Berkeley SETI: seti.berkeley.edu

Breakthrough Initiatives: breakthroughinitiatives.org

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2020: One Giant Leap for Silicon Valley

Silicon Valley AUVSI Brings Together Industry Heavy-Hitters for Technical Discussions at NASA AMES Surrounding State of Urban Air Mobility & Unmanned Traffic Management

January 20, 2020, Moffett Field, Ca. – The Silicon Valley Association for Unmanned Vehicle Systems International has announced a symposium on February 27, 2020 that'll bring together the brightest minds in the unmanned aviation industry to discuss the future of Urban Air Mobility (UAM) and the state of Unmanned Traffic Management (UTM).

Keynote speakers for this event include Dr. Eugene L. Tu, the center director at NASA's Ames Research Center, and Dr. Michael (Mike) Romanowski, the FAA Aircraft Certification Service's (AIR) Director of the Policy & Innovation Division (AIR-600).

Prior to joining AIR, Mike was the FAA's Director of Commercial Space Integration, where he provided executive leadership and direction for the evaluation and regulation of commercial spaceports, launches and reentries, and the integration of these operations within the National Airspace System. Mike also served as the FAA representative to the White House's

National Science and Technology Council and its Committee on Technology. He was the aviation advisor to the first-ever Chief Technology Officer of the United States during his time in the White House Office of Science and Technology Policy. Mike also served as the FAA Director of NextGen Integration and Implementation, with responsibility for ensuring the integrated application, planning, programming, budgeting, and execution of FAA's NextGen air traffic management modernization portfolio. In these roles, he focused on developing and advancing strategies and policies across the federal government and the private sector to promote innovation and accelerate the benefits of federal investments in aviation and aeronautics.

Dr. Eugene Tu leads a staff of civil servants and contractors in providing critical research and development support that makes NASA's and the nation's aeronautics and space missions possible. Eugene was most recently director of Exploration Technology at Ames, a position he held from November 2005 until his selection as Ames center director in May 2015. There he led four technology research and development divisions, including two of NASA's critical infrastructure assets: the consolidated arc jet testing complex and the agency's primary supercomputing facility. He began his career as

a research scientist conducting computational fluid dynamics research on the steady and unsteady aerodynamics of complex aircraft configurations.

This symposium is a unique opportunity for industry, press, and the public to have access to these panelists and presenters. Industry leaders will discuss the most pressing issues related to Urban Air Mobility and UTM on exciting panels that include: Remote Identification, Emergence of Autonomous Urban Air Mobility, Airframe Designs for Urban Air Mobility, and Venture Perspectives. The day will be filled with talks from NASA scientists and thought leaders, as well as industry change makers like Jennifer Richter, Greg Deeds, Dean Donovan and Dr. Lance Eliot. This unique open forum will allow attendees to ask questions and discuss real issues facing the industry including research and operational priorities.

Emergence of Autonomous Urban Air Mobility, moderated by NASA, will examine safety and progress in autonomous urban air mobility

services. Venture Perspectives, moderator by author and investor Dr. Lance Eliot, will feature Dean Donovan from Diamond Stream Partners, investors in such industry successes as Volaris Airlines and Elroy Air.

The day will also include a fireside talk by renowned Dr. Parimal "PK" Kopardekar of the NASA Aeronautics Research Institute (NARI) and Mr. Timothy Bennett, Department of Homeland Security (DHS).

This event is free and will take place in Silicon Valley at historic Moffett Field in Mountain View, California. The venue sits on the campus of NASA Ames Research Center. Symposium attendees will also have access to a networking reception at NASA's 'Spacebar'. Tickets are available now, and more information can be found at UTM3.com.

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Orbital Edge Computing

April 13, 2020

Carnegie Mellon University


As humanity moves into outer space, scientists and engineers must come up with innovative technology to get them there. In a recently published paper, Brandon Lucia, assistant professor of electrical and computer engineering, and Bradley Denby, a Ph.D. student, explore one such innovative idea: orbital edge computing with nanosatellite constellations.

The paper recently received the Best Paper Award at the 2020 Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS).

A satellite constellation is a large group of satellites that work together. Constellations are widely used today with various applications including GPS. Today, however, satellites are not managed as a constellation, instead being

individually remotely controlled by a human operator. Satellites are directed by an operator to collect information using sensors (like taking pictures of Earth) and they then send their sensor data back to a radio base station somewhere on Earth. Sending data to Earth from a satellite costs a huge amount of time and energy, and the model of manual control and sending all of the data collected on orbit makes today's satellite operations extremely expensive.

The cost goes up as satellites – now appropriately called nanosatellites – become smaller. Smaller satellites are cheaper and we can send more of them into space. As we create ever larger and more promising constellations, we also increase the human cost to manually control the satellites and the time and energy cost to beam their sensor data back down to Earth.



Lucia expects to see tens or hundreds of thousands of small, sensor-equipped satellites launched in the near future.

For media inquiries
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Growing constellations create a problem on Earth, too. Together, the satellites of a constellation collect and send down an enormous amount of raw data. As the number of satellites increases, eventually, ground stations can't keep up. The problem is in the operating model of satellites, which, today, expect data to be processed by computers in computing clouds on Earth. As constellations hit the limit of data downlinking, Lucia and Denby propose that the relationship between satellites and computers must change.

Lucia and his group propose that, instead of sending the data back to Earth, satellites in a constellation process their sensor data in orbit, a new model that they call "orbital edge computing". With orbital edge computing, the satellites don't send large amounts of raw data to Earth. Equipped with machine learning capabilities, they analyze the sen-

sor data, looking for signals of interest to any number of different applications and send down only the data that are actually valuable. Lucia's team's new software and hardware satellite control system supports orbital edge computing and ensures that a constellation avoids collecting redundant data. Using these techniques, the data size can be considerably reduced, and the data that's left can be sent much faster and cheaper. A constellation of thousands can be supported by a single operator and a few small radio ground stations on Earth to collect sensed data.

According to the paper, Lucia expects to see tens or hundreds of thousands of small, sensor-equipped satellites launched in the near future, which he says will be a perfect fit for the new orbital edge computing—and might even need it.



METIS

METIS PRESENTS AT AIAA SCITECH FORUM 2020 January 6, 2020

Metis engineers supporting NASA's Vertical Motion Simulator (VMS) led a unique experiment in collaboration with the US Coast Guard last year to study human performance related to small boat recovery operations. Design, implementation, and results of the Boat Recovery Simulation were presented at the AIAA Science and Technology Forum and Exposition (AIAA SciTech Forum) at Orlando, Florida in January 2020. This AIAA program covers the science, technologies, and policies that are shaping the future of aerospace, and is the largest event for aerospace research, development, and technology in the world.

Metis presented details of experiment setup, including a software operation model designed around empirical boat position data; development of a replica boat section manufactured to incorporate real-world task elements; and the means to collect objective and subjective data from human participants.

Ultimately, the U.S. Coast Guard and NASA experiment goals were achieved by designing an experiment using the VMS to simulate varying sea-states and collecting human performance data on small boat recovery operations. Participants reported that the motion experienced at the VMS was realistic and the artificial features added to the experiment for safety and experiment management requirements were appropriate. As the first experiment to simulate a boat at the VMS, the USCG and NASA successfully demonstrated a reliable approach to modeling different sea-states for the OTH-IV, building a bow section of the OTH-IV and fitting it to an I-CAB, and developing hazard mitigations and safety features. Additionally, the approach described in this paper leveraged the VMS's flexible architecture to develop a system that can introduce more variety in sea-state profiles, collect more data, and improve the simulation to incorporate more real-world features.

NASA Ames Photo Ops

NASA Ames Says Goodbye to Ron Brade as He Embarks on His New Career at the University of North Texas



"I'm proud of our collective accomplishments, particularly those in the NRP" Ron Brade, Associate Center Director

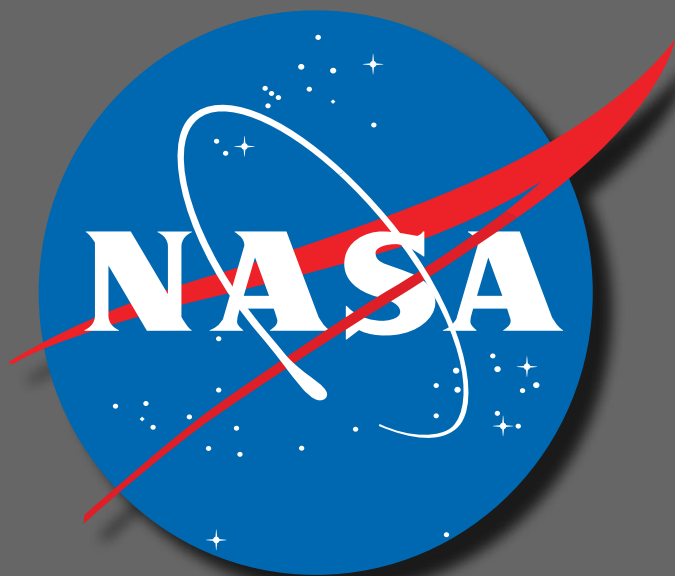
I've had a wonderful 29-year career with the Federal government (27 with NASA). In the short 9-months I've been at ARC, I'm proud of our collective accomplishments, particularly those in the NRP: the continued development of the Bay View campus, the construction preparations for the housing development beginning next year, and the new Enhanced Use Lease agreement with the University of California Regents. Additionally, the renovation of Building 25 will soon reflect the continued revitalization of the Historic District on campus. The NRP continues its vibrancy with existing tenants like USGS and Carnegie-Mellon University, along with many

others, seeking to leverage their close proximity with NASA to innovate, create, and tackle some of the most technical challenges that our Nation, if not the world, faces...and it's all taking place right here at NASA in Silicon Valley. I couldn't be prouder of our mid-sized Center performing as a large-sized R&D corporation. As a result of these collaborations and strategic partnerships, we continue to deliver on America's dream - and the world benefits!

As I begin my second career, returning to the world of contracts as the Associate Vice Chancellor of Strategic Acquisition/Senior Procurement Officer at the

University of North Texas, I know the great work of NASA, ARC, and the NRP continues because of the most valuable resource we have—our people, both civil servants and contractors. It has truly been the highlight of my career working at ARC, and I am so proud to wrap up my career at NASA in Silicon Valley. I'm grateful to you all for your support and commitment to advancing the Agency and Center missions, and I'm glad to have had the opportunity to be a part of this family.

Best wishes to all for continued success, and I can't wait for my return visit to see all that's been accomplished.



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