

National Aeronautics and Space Administration



# THE NRP POST

A Publication of NASA Research Park

Bay View  
Campus at a  
Glance





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UC Berkeley leadership and faculty visited NASA Ames in September to enhance collaboration between the two organizations



On October 26, Dr. Eugene Tu, Ames Center Director and NASA Ames Science leaders met with Martha Roberts, Senior Interior Staffer, Appropriations Committee Senate for Interior, Environment, and Related Agencies, Anne Barrett, USGS Associate Director for Budget, Planning, and Integration, Steve Farrell, Departmental Budget Examiner for USGS (DOI), Eric Reichard Regional Director, USGS Southwest Region and Jane Reid Deputy Director, USGS Southwest Region to discuss existing and potential NASA-USGS partnerships.



On August 4, visit of Susie Perez Quinn, NASA Chief of Staff, Casey Swails, Deputy AA for Business Operations and staffers from Senator Feinstein's Office, Zac Vaden, Justin Pedroso, Marshall Wu, Caitlin Fong.





# Construction Begins on New USGS Research Building

On June 16, 2022, the signing of the structural steel beam marks the beginning of construction of the new USGS research building, Bldg. 800. Several members of the USGS leadership team and design team were present for the signing including, former USGS Southwest Regional Director, Mark Sogge, who spearheaded the agreement to move USGS from Menlo Park to Moffett Field. It was a celebratory moment not only for USGS but for project architect, SmithGroup, general contractor, Hensel Phelps, and their trade partners on hand. The new two-story USGS research building of approximately 48,000 sq. ft. will house all research programs currently operating in Menlo Park under one roof. It is a major consolidation of laboratories from programs including the Water Mission Area, the Geology Minerals Energy and Geophysics Science Center, the Volcano Science Center, Ecosystems, and the Earthquake Science Center that are currently spread out on the 17-acre campus in Menlo Park. Construction is projected to be complete in late 2023 with occupancy beginning early 2024.



# CMU Launches Initiative to Transform Nanosatellite Capabilities

By Ryan Noone

Researchers aim to develop computationally capable constellations of nanosatellites, equipped with machine learning techniques that extract valuable insights from data while still in orbit.

“There is a huge opportunity in getting sensor-enabled computer systems in orbit to provide applications like public safety, defense and intelligence, traffic management, precision agriculture, and weather modeling, among others.”

Researchers say this new technology will provide the ability to detect the initial signs of problems before they occur. The group points to examples like monitoring suspicious activity at crowded, large-scale events such as the upcoming 2028 Summer Olympics in Los Angeles, or detecting early signs of wildfires, enabling response teams to make mitigation efforts before forests are set ablaze.

Carbon mapping is another potential application for the new sophisticated distrib-

uted computing platforms. Current technology and ground infrastructure cannot handle the vast amounts of data this type of work requires. However, by processing the data on orbit and extracting only relevant information, scientists could be looking at a new tool to help combat climate change.

The project’s team, made up of CMU Associate Professor Gauri Joshi , Associate Professor Swarun Kumar , Assistant Professor Zac Manchester , Professor Vyas Sekar , and Lucia, is comprised of world-leading experts in critical areas like federated learning, wireless communications, security and networking, and nanosatellite design.

*“We are at the beginning of the era of computational space systems.”*

Brandon Lucia, Professor , Electrical and Computer Engineering





Professor Brandon Lucia

“This group has a long track record of success in the constituent areas of this project, and CMU has the best graduate students in the world,” says Lucia. “Together, we will combine theory and technologies to realize this new era of computational nanosatellites constellations.”

The grant from NSF’s CPS Frontiers Program will fund a large team of graduate students who will be working to define the field of computational nanosatellite systems. It will also provide the resources needed to build and launch satellites into orbit as part of a test deployment that will showcase the new technology’s capabilities.

Additionally, the program will include several outreach initiatives, one of which will involve high school students who will work to develop applications that will run on these satellites. Another is an artist in residence program, which will help illustrate the work, making it more accessible and providing insight into the value of the research. Ultimately, the outreach effort aims to broaden participation in computer and cyber-physical systems research.

For media inquiries, please contact Ryan Noone at [moone@andrew.cmu.edu](mailto:moone@andrew.cmu.edu)







# Aitken Leaps Over Pleiades to Become NASA's Most Powerful Supercomputer

By Michelle Moyer, NASA Advanced Supercomputing Division

With its latest expansion, the Aitken supercomputer became NASA's most powerful high-performance computing (HPC) system—surpassing the agency's longtime HPC workhorse, Pleiades, which held the title for 14 years after its deployment in 2008. Both systems are located at the NASA Advanced Supercomputing (NAS) facility at Ames Research Center in Silicon Valley, CA, where Aitken is installed in the energy-efficient Modular Supercomputing Facility (MSF).

The addition of four new HPE Apollo system racks containing 512 Rome nodes brings Aitken's total node count to 3,200—with 308,224 cores—and fills up the first module of the MSF, which was deployed in August 2019. Coming in at number 58 on the June 2022 Top500 list of the world's most powerful supercomputers, Aitken's theoretical peak performance is now 13.12 petaflops (quadrillion floating-point operations per second).

This sizeable enhancement—a 16% increase in performance since its previous expansion,

and a 49% increase since last year, when the system was ranked at number 72 on the June 2021 Top500 list—translates to solving larger problems with faster results for important NASA research projects in aeronautics, space exploration, Earth science, and astrophysics.

## Enabling NASA Science and Exploration

Aitken is a key resource for hundreds of NASA-associated scientists and engineers working on projects across all of the agency's mission directorates. For example, aerospace engineers at Ames are supporting upcoming Artemis missions by simulating the launch environment at Kennedy Space Center. Their high-resolution simulations—which run for weeks across thousands of Aitken's cores—predict aerodynamic loads on the launch vehicle, mobile launcher, tower structures, and flame trench, and include the water effects from the launch pad's sound suppression system. Results provide a more complete picture of the extreme conditions of the launch environment, helping NASA reduce mission risk by increasing safety, and potentially saving significant amounts of time and money.



Scientists at NASA Goddard are running cutting-edge kinetic plasma simulations on Aitken to learn more about the structures and dynamics of magnetic reconnection—the way the Sun’s magnetic fields connect and disconnect with those of Earth’s magnetosphere. This work enables scientists to interpret and analyze observational data obtained by NASA’s Magnetospheric Multiscale (MMS) Mission spacecraft, and supports the development of predictive capabilities such as space weather forecasts. The research is also helping to guide science planning for several upcoming heliophysics missions, including HelioSwarm, the Solar-Terrestrial Observer for the Response of the Magnetosphere (STORM), and the Tandem Reconnection and Cusp Electrodynamics Reconnaissance Satellites (TRACERS).

### Benefits of the Modular Approach

The module containing Aitken uses an innovative cooling method uniquely suited to the San Francisco Bay Area’s temperate weather. A combination of outdoor air and fan technology cools water in a closed loop system to remove the heat generated by the computer’s processors; two adiabatic coolers adjacent to the module are used to cool the water loop when the ambient air temperature is too high.

Located on a one-acre site with the infrastructure to support a total of 16 modules for computers and data storage, the MSF’s potential for future expansion highlights another significant benefit of using the modular approach: the flexibility to construct additional modules and add computing power relatively quickly to meet changing priorities and respond to new challenges for agency missions.

Over the next two years, NASA will install a second compute module and a new data module at the MSF. The data module will provide filesystems that are independent of the existing file storage in the NAS facility. This will allow maintenance to be performed independently on the NAS facility and

the MSF while still keeping the other systems running so that scientists and engineers can continue to run their simulations uninterrupted.

### Four Supercomputers to Support 1,500 Researchers

While Aitken is NASA’s newest supercomputer, it is just one of four powerful systems provided by the High-End Computing Capability (HECC) Portfolio at the NAS facility. Together, these four systems—Aitken, Electra, Pleiades, and Endeavour—are used by more than 1,500 researchers from NASA centers, universities, and industry to support the agency’s challenging mission to explore space and to understand our planet and its place within the universe.

### Related Links

- [NASA’s Newest Supercomputer Gets a Power Boost](#)
- [Grand Opening of Modular Supercomputing Facility](#)
- [Aitken Resource Page](#)
- [Pleiades Resource Page](#)

### Related Facts

- The MSF uses an innovative cooling method, suited to Silicon Valley’s temperate weather: by using outdoor air and fans to cool Aitken’s racks, it requires water only on very hot days.
- In its first year of operation, the MSF required only 16% of the energy needed for cooling, and reduced water usage by 91%, as compared with the traditional NAS facility.

### Image Caption (TN\_MSF\_Aitken.jpg):

NASA’s Modular Supercomputing Facility at Ames Research Center. The facility houses Aitken, the agency’s newest petascale supercomputer, to help solve NASA’s most challenging problems in an environmentally conscious way that provides flexibility, power efficiency, and cost savings. Aitken’s name comes from a large impact crater on the surface of the far side of the Moon’s south pole, which was named for Robert Grant Aitken, an American astronomer who specialized in binary star systems. Derek Shaw, NASA/Ames



# Rhombus Makes America Stronger

Rhombus AI is experiencing extraordinary growth as it serves America's defense and national security community. Founded in Building 19 of NASA Research Park at Moffett Field just twelve years ago to address an unmet need for innovation in energy and defense, the DIU partner enterprise Rhombus is now trusted and relied on across the United States government, from the Air Force to Space Command. "People say this is the Information Age, but what good is information if we can't use it to make good decisions in time?" asked Rhombus Founder and CEO Dr. Anshu Roy. Answering that question for the national security community has been Rhombus' mission ever since, and it explains why its partnership with the government is growing so rapidly, opening an East Coast headquarters in Washington DC close to its Pentagon customers, a compliment to offices similarly situated in Omaha and Denver, and soon an office in Hawaii close to the Indo-Pacific Command.

Rhombus is transforming the nation's defense and national security enterprises with Guardian, its patented, signature Artificial Intelligence platform for strategic, operational and tactical decision-making at the speed of relevance. The company's current work is in building an AI-native digital nervous system that accelerates decision-making and elevates organiza-

tions to leverage a higher plane of Ambient Intelligence, with applications from warfighting to strategic budgeting. "The Air Force says the most powerful weapon is sitting on the desk of every airman, and we want those dashboards and systems to empower them to make the very best recommendations and decisions in areas where the stakes are literally life and death," said Dr. Roy.

Rhombus is advised by an array of lifelong national security leaders, including Retired General Stanley McChrystal, the former commander of US and International Security Assistance Forces (ISAF) Afghanistan and the former commander of the nation's premier military counter-terrorism force, Joint Special Operations Command (JSOC). McChrystal is providing his expert perspective on defense, intelligence, and a range of national security challenges. "Stan always says that information dominance is the theater that will determine who wins the second half of the 21st Century, and our job is to help the United States win that domain," added Dr. Roy.

Ret. General HR McMaster, who conceptualized the Army Futures Command as the director of the Army Capabilities Integration Center and the deputy commanding general of the US Army Training and Doctrine Command, is



helping Rhombus think about the biggest threats facing the United States, and helping its leadership incubate and deploy new technologies to benefit US planning and warfighting. Admiral Tom Fargo, former Commander of United States Pacific Command, and Admiral Bill Moran, the 39th Vice Chief of Naval Operations and a past Chief of Naval Personnel, are both advising Rhombus as the organization thinks harder about the next-generation needs of a modern Navy, and especially as the national security community's gaze turns eastward. Former Under Secretary of Defense for Policy Michele Flournoy, the highest-ranking woman in the history of the Department of Defense, and Robert "Bob" Work, the 32nd Deputy Secretary of Defense, are also collaborating with Rhombus on the needs of a 21st and 22nd Century military, including modernizing planning and budgeting through exponential technology.

Rhombus has built a remarkable team, and one that is growing exponentially to meet surging demand with the United States government, including as the company's focus expands to include civilian security and issues like global climate change, transboundary disease, and other threat multipliers. Among the company's latest additions

to address these types of asymmetric issues is Dr. Ramakrishna Nemani, previously a research scientist with NASA with over thirty years of experience in theory and application of optical remote sensing, numerical bio-geochemical modeling, climatology and machine learning. Nemani was awarded NASA's highest honor, the "Distinguished Service Medal" as a pioneer in the field of ecological forecasting and collaborative Earth science. He served as a member for several NASA missions including EOS (Earth Observing System), LDCM (Landsat Data Continuity), and NPP (NPOES Preparatory Project).

Rhombus continues to grow, in keeping the vision of a founder who has always been attracted to the toughest problems in need of new thinking. Before starting Rhombus, Dr. Roy teamed up with Nobel Laureate Prof. Alan Heeger to set a world record in solar cell efficiency. Dr. Roy and his exceptional team spent five years on the ongoing cleanup at Fukushima Daiichi Nuclear Power Plant in Japan, through his invention called Mercury™ – Rhombus' patented platform for solid-state subatomic particle detection platform. Anshu earned his PhD from the University of Michigan in Ann Arbor.





# CMU Team Designs the Airports of Tomorrow

By Nicholas Zurawsky

An interdisciplinary team from Carnegie Mellon University won NASA's Blue Skies: Airports of Tomorrow competition with their project focused on sustainability and connected autonomy, earning them internships with NASA this upcoming year.

**T**he team from Carnegie Mellon University won NASA's Gateways to Blue Skies: Airports of Tomorrow competition with their project: Sustainability and Connected Autonomy: A New Era for Aviation. The new NASA competition asks teams from universities around the United States to “develop external airport infrastructure design concepts to support the emerging aviation technology and markets that will comprise the climate-friendly aviation industry of tomorrow.”

The team included Aaron Burns, an engineering and public policy Ph.D. student; Tahaseen Shaik, an electrical and computer engineering and robotics undergrad; Ashima Sharma, a civil and environmental engineering undergrad with minors in human-computer interaction and technology and policy; and Shruti Prasanth, a communication design undergrad with a minor in human-computer interaction .

The challenge of this year's Blue Skies competition was to design an airport to support the future of sustainable, eco-friendly aircraft in the year 2050. “Our response to that design problem was to look at existing airports and technologies. We found the most effective techniques and designs that we could improve by the year 2050 and integrated that into our design,” said Shaik.

Because their areas of expertise were so diverse, the team's solution improved almost all aspects of airport infrastructure. “One of the things the judges said they appreciated about our design was how holistic it was,” said Sharma. “I think the fact that we had such a wide variety of backgrounds really helped. I feel like projects like these are really helpful because in the workforce you will be working with all of these people. Especially working with people outside of engineering, like design students, gives you a totally different perspective.”

*“Working with people outside of engineering, like design students, gives you a totally different perspective.”* Ashima Sharma, Undergraduate student, Civil and Environmental Engineering



“Going into this project, and especially handling the technical content was a challenge for me, and put me out of my comfort zone as the graphic designer for my team. I think it was one of the greatest experiences I’ve had because it showed me the power of a multidisciplinary team, and that my role is equally valued and necessary to succeed,” said Prasanth about her experience.

The group’s proposal included many modern sustainable fuel options ranging from batteries to sustainable aviation fuel (SAF)—similar to the jet fuel we use now but made from sustainable sources and products that would otherwise be wasted, such as agricultural waste and cooking oil. They predict that by 2050, the largest proportion of our fuel used in planes will be SAF. They propose many new designs for airplanes, the two most likely being blended wing body and strut-based wing design, both of which are more fuel-efficient than the current airplane design. Sharma also mentioned that United Airlines has already bought supersonic aircraft to add to their fleet and plans to use them commercially by 2029. Supersonic jets are notoriously far less environmentally friendly; however, Boeing proposes they will be able to add these jets to their fleet and have them run entirely on SAF. The team also proposes battery power for most of the domestic activities in the airport, such as baggage transportation and airplane preflight inspection drones.

The team’s plans also evoke images of autonomous human-sized drones powered by batteries ferrying people from the city to the airport while autonomous robots take care of the preflight checks on

the planes and clean the terminal and tarmac. A large, centralized energy hub charges the batteries of these robots and allows them to simply swap out batteries when they need to instead of waiting for them to charge. The major drawback to batteries is that they are heavier and generate less energy than many other power sources, so they are not ideal for use in airplanes themselves.

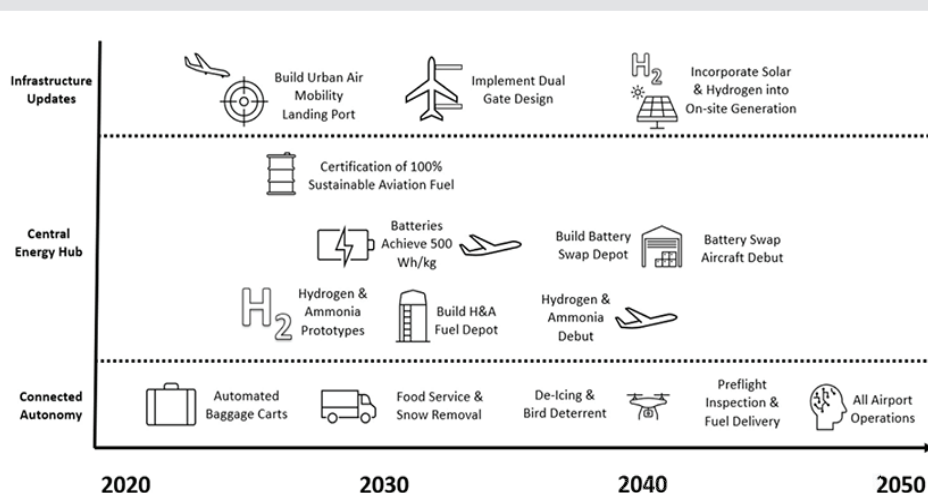
The group provided an expected timeline for these technologies to be commercially viable. Shaik explains that it is a rough estimation, based on industry sources and research publications to predict the readiness levels of each technology. Some innovations are already being tested and in mass production, while others rely on technology that is not yet available or on scientific advances that have not been made.

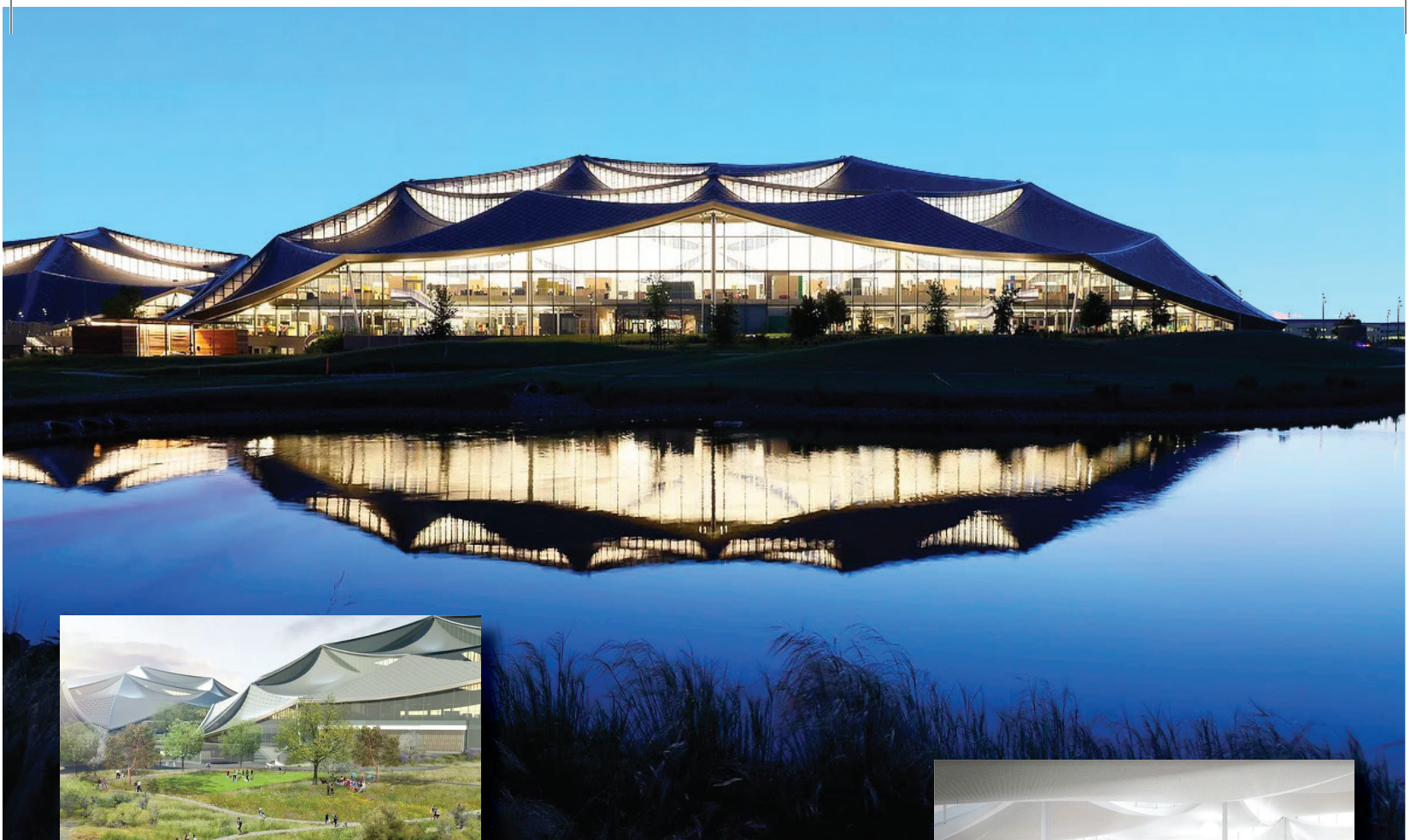
The team was awarded the opportunity to intern with NASA during the 2022-23 academic year. They were also given the opportunity to present their climate-friendly airport integration concept at the Airports Council International - North America Annual Conference and were encouraged to publish their paper presenting their ideas. This is a perfect opportunity for team members whose career aspirations lean toward the aeronautics industry. “I’ve been really interested in aviation and robotics since high school, so I was really excited that I was able to incorporate that into this project,” Shaik said.

For media inquiries, please contact Daniel Carroll at [dccarrol@andrew.cmu.edu](mailto:dccarrol@andrew.cmu.edu).

Source: Carnegie Mellon University team presentation

A speculative timeline of when different technologies featured in the team’s presentation will be commercially available.





# Bay View: Redefining Human-centric, Sustainable Design

An all-electric, water-positive workplace built by Google on the NASA Research Park.

*From "Bay View and Charleston East." originally published by Google Real Estate, Google, [realestate.withgoogle.com/bayview/](https://realestate.withgoogle.com/bayview/)*







A photo by Iwan Baan of Bay View 100's second floor and expansive, tube net canopy.

**B**ay View rethinks how buildings integrate with nature, providing healthy, sustainable places for people to do their best work. Totalling 1.1 million square feet across three buildings, Bay View is on track to achieve LEED-NC v4 Platinum certification and be the largest facility to ever attain the International Living Future Institute (ILFI) Living Building Challenge (LBC) Water Petal Certification.

Situated on a 42-acre site next to the NASA Ames Research Center in Silicon Valley, Bay View consists of 20 acres of open space along with two office buildings, an event center, and short-term employee accommodation units.

Bay View's immediate adjacency to the San Francisco Bay makes water an important focus. Bay View was designed to meet the LBC's definition of net water-positive, with all the site's non-potable

water demands met using the recycled water generated on-site. [Google's project team] engineered stormwater management ponds, where the water can be drawn down and combined with treated wastewater from the building to create a sustainable, on-site source of non-potable water.

Bay View is a 100% electric building where even the kitchens are electric to decrease carbon emissions. The buildings are powered in part by a first-of-its-kind dragonscale solar skin, which generates 40% of its annual electricity. Combined with power from nearby wind farms, Bay View will be one of Google's first campuses to operate on carbon-free energy 90% of the time. To heat and cool the buildings, Bay View also houses the largest geothermal pile system in North America, which is estimated to reduce carbon emissions by almost 50% and water used for cooling by 90%.

A photo of Bay View by Iwan Baan shows the San Francisco Bay in the foreground and the Santa Cruz Mountains in the background, with the building reflecting off the water.





*“We realized that what people really need are their teams, and what teams really need are communities. The larger organization works best when there aren’t barriers fragmenting teams. The question became about how to organize the space and get the best of both worlds: collaborative and heads-down space.” – David Radcliffe, Google VP of Real Estate and Workplace Services.*

*“We know that how we choose to build today can have major impacts on access to water for our communities for generations to come. It was about looking at the community benefit of these projects through the lens of using less and sharing more” -Asim Tahir, Google Director of Energy and Carbon.*

*“On a megaproject like this, it’s very easy for challenges to arise because inevitably there are conflicting priorities and difficult trade-offs with each decision. That’s why from the beginning and continually throughout the project, we invested a lot of time and effort into creating and nurturing a transparent, collaborative, and supportive team culture... so we could rely on each other’s expertise to conquer challenges and build something that has not been built before. Personally, the friendships and connections I’ve made on the Bay View project have been the most fulfilling part of my experience, and the most valuable lesson that I will take with me to all future projects and teams.” - Yayu Lin, COO of Sares Regis Group of Northern California, Commercial Division.*



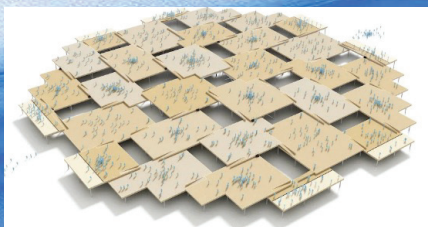
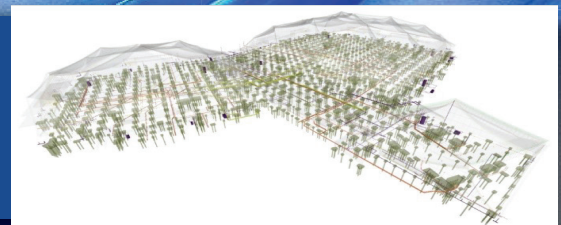
A photo by Iwan Baan of Bay View 100’s second floor and expansive, tube net canopy.

The buildings feature a first-of-its-kind dragonscale solar roof, equipped with a total of 90,000 silver solar panels across all four buildings that use the latest building integrated photovoltaic (BIPV) technology. The solar roofs give Bay View and Charleston East a combined 7 megawatts of installed renewable power – providing roughly 40% of their annual energy needs.



An aerial rendering showing the three canopies at Bay View and the larger site.

Bay View incorporates an energy recycling system integrated with structural piles that uses the geothermal properties of the soil to help heat and cool the buildings. The result: the largest geothermal pile system in North America, with pipes totaling nearly 100 miles in length and covering a surface area equal to 12 American football fields.



Visualization of the interior “human scale” second floor. The large floorplate is broken down into a series of smaller “tables” separated by courtyards and connected via ramps that gradually elevate as one moves to the center of the building.



# Bay Area Environmental Research Institute

## What does science mean to you?

The Bay Area Environmental Research Institute (BAERI) is a scientist-founded research institute headquartered at NASA Research Park. Since its founding in 1993, BAERI has supported hundreds of researchers across a wide range of Earth Science and Space Science projects.

Earlier this year, we asked 14 of our current and alumni researchers one big question: What does science mean to you? Here's what they said.

(You can also listen to the following by searching for 'For the Love of Science' wherever you get your podcasts.)

Christina Hedges: What does science mean to me...

Amber McCullum: What does science mean to me?

Geert Barentsen & Nikki Tulley: Oh, that's a really good question.

Amber McCullum: That's a hard one.

Cindy Schmidt: You know, science to me is investigating the truth.

Amber McCullum: Science means always asking questions, even when you know the answers might be challenging or difficult.

Susan Hoban: The pithy answer is: Science is figuring out how the world works. The less pithy answer is... the engagement of the human brain with the natural world, in ever increasingly clever ways, in order to figure out how the world works.

Darlene Lim: Science means discovery. Science is a joy. Science is a frame of mind.

Juan Torres Perez: You really don't think about it, but you use the scientific method every single day in your lives. You just don't know.

Geert Barentsen: The method of systematically trying to make predictions and then falsifying those predictions based on data? It's the best tool we have to try to find answers to complicated questions.

Katie Stern: I think science is an avenue to exploration, an avenue to help make things better.

Nikki Tulley: It's a way to help people live, essentially.

Alex Sehlke: Science is making progress, I think. It's... evolving. It's pushing the boundary of what we know, creating a better life for us and the ones that come after us.

Emily Schaller: It's inspiring the next generation to think big and have big dreams.

Nikki Tulley: We become science. All of that energy, all of that light, you really can't create nor destroy energy. And so it's just a revolving cycle, and we're just all a part of that cycle.

Cindy Schmidt: It's investigating the truth and not actually discovering the absolute truth. It's a process, but it's a process we trust and believe in.

Zara Mirmalek: There's so much more to still learn, and it's possible we don't actually have to do things one way.

Ann Marie Cody: Some folks seem to think that science is like a belief system, but it's not really. It's all about experimenting and testing and then taking that result and trying to repeat it. I like to think that everyone is a scientist, it just requires some level of curiosity and wanting to know how things work.

Christina Hedges: It's trying to understand the world and the universe better. And that's very fulfilling, just trying to find... just any kind of truth, and trying to use what we already know to figure out and discover more things.

Sommer Nicholas: I think it encompasses the human spirit in a way, too, and just never tiring of asking the question: Well, why?

Darlene Lim: That's... Yeah, that is it for me.

**Link and QR code to entire audio interview:**  
<https://bit.ly/3UcsBm6>

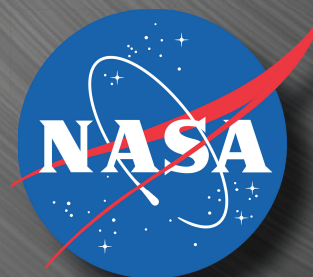


SCAN ME





On September 12, 2022, Carol T. Christ, Chancellor, UC Berkeley along with campus leadership and key members of the faculty visited Ames to continue discussions on mutual areas of partnership. The visit included tours of ARC facilities and showcasing of technologies to further collaboration.



National Aeronautics and Space Administration

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A Publication of NASA Research Park

**NASA Research Park**  
Editor, Layout and Design: TED TRIANO  
Phone: (650) 604-2NRP  
Email: arc-dl-nrp-post@mail.nasa.gov  
Website: [www.nasa.gov/researchpark](http://www.nasa.gov/researchpark)