National Aeronautics and Space Administration

THE NRP POST

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Winter 2019

USGS & NASA Ames

Dr. Jim Reilly, Director of USGS and former Astronaut visited Ames on February 5, 2019 to discuss further collaborative opportunities with Dr. Tu and toured the USGS space in Building 19

IN THIS ISSUE

Planetary Ventures Building and NASA Research Park working together to build the Bay View Campus

September 2018, Moffett Field, California

Planetary Ventures Bay View Project in September, 2018.

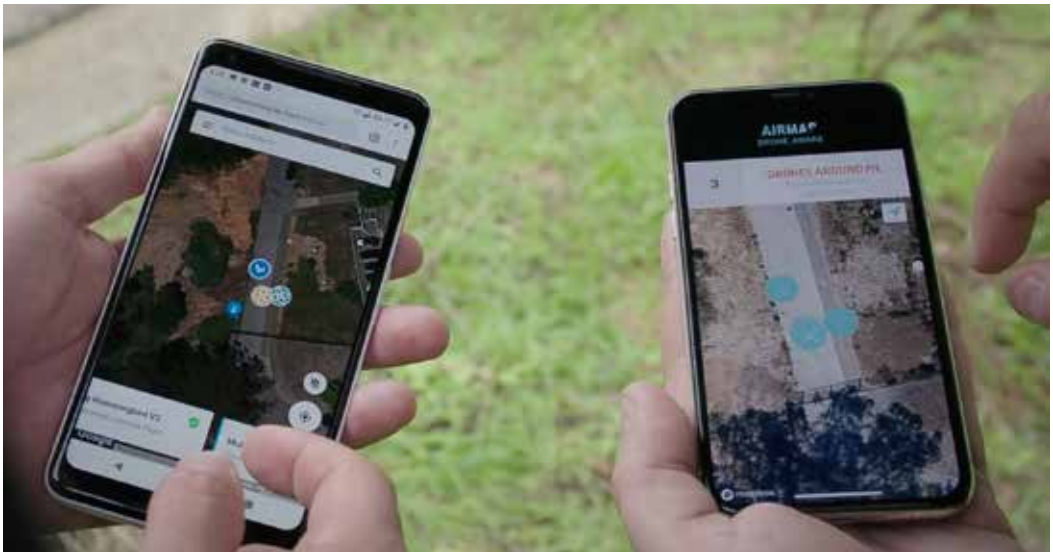
Planetary Ventures (PV) Bay View Campus Project is making great progress with steel erection underway. The Bay View Campus sits on a 42-acre site under a long-term lease between PV and NASA Ames Research Park. PV has worked closely with NASA Ames since 2016 through the planning and permitting of the project. One of the innovative and sustainable features of the Bay View Campus is that it will have the largest ground-source heat pump system installation in North America. The system uses the heat from the surrounding ground to power the building's climate control–and no fossil fuels. The steel canopy structure will incorporate large clerestories that optimizes natural daylight to interior workspace, and provides views out. The campus will also create 20 acres of open space planted with native species.

AIRMAP

Last month, AirMap, Alphabet's Wing and Kittyhawk.io demonstrated a network-based remote ID application on the InterUSS Platform™. The successful demonstration illustrates that a remote ID solution exists today for drone operations in networked areas, without the need for additional infrastructure or technology.

About the Demonstration

AirMap, Wing, and Kittyhawk.io are each UAS Service Suppliers (USS) of the FAA's Low-Altitude Authorization and Notification Capability (LAANC) for authorization to operate drones in U.S. controlled airspace. During the demonstration, multiple DJI and Wing drones were flown in controlled airspace, each connected to a unique USS, which exchanged data via a branch of the open source InterUSS Platform™.



Non-participating bystanders were able to visualize the drone operations in their vicinity in real time on a smartphone application, no matter which USS the drone was connected to. Only safety information was shared, protecting operator and consumer privacy.

Network-Based and Local Broadcast Remote ID

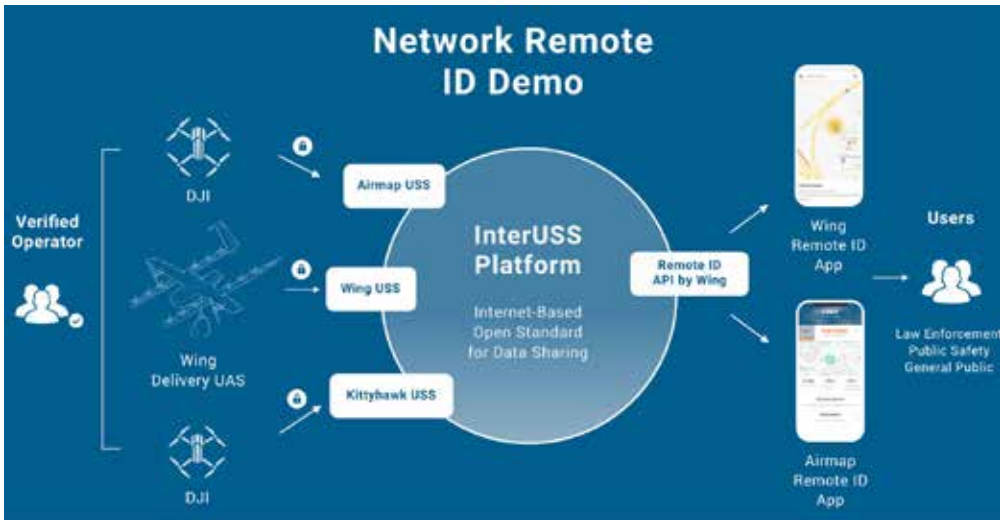
There is a global consensus among airspace stakeholders that remote identification is necessary before widespread advanced drone operations can be achieved. But many disagree on the best path forward in establishing and enforcing remote identification without imposing a burden on the operator or infringing upon privacy rights.

By validating an operator's identity through their respective USS, network-based remote identification offers a trusted picture of who is flying a drone, without requiring any additional information or equipment from the operator. This makes network-based remote ID an easy and effective way to facilitate transparent and accountable UAS operations – which increasingly provide valuable and personal services to the public in highly-networked locations.

Networked remote ID is also flexible. As new security needs arise, or technology implementations improves, network-based remote ID allows industry and operators to evolve to adopt new standards and realities, quickly and simply.

In remote areas where network coverage is sparse, remote identification data broadcasted by drones can be integrated into the same network remote identification apps. In this case, drones share information using integrated ground control station or cellular tracking devices. The AirMap UTM Platform supports networked and local broadcast remote ID.

“Before such wide-scale drone operations as autonomous deliveries can take place, we need to ensure that regulators – and the public – can easily assess whether or not a particular drone belongs to a good actor or requires intervention,” said Ben Marcus, Co-Founder and Chairman of AirMap. “Network-based remote identification applications like AirMap’s Drone Aware, augmented by local broadcast solutions when available, help airspace managers enforce aviation regulations while cultivating public trust in drone and also protecting the privacy of drone operators.”



The Demo in Detail

- The demonstration involved three operators and three UAS (2 DJI and 1 Wing Delivery). Each operator logged into their respective USS (Wing, AirMap, and Kittyhawk.io) with a validated identity.
- Each operator requested airspace access authorizations for their flights via their respective USS LAANC capabilities. Wing, AirMap and Kittyhawk.io are all LAANC providers.
- When the remote identification display applications were launched, the InterUSS platform was used to discover which USS were operating UAS flights in the area. Each USS provided relevant UAS data and the aggregated set was provided to both the Wing and AirMap remote identification applications. This allows for data sharing only as needed, providing a complete picture without the need for a single entity to have access to drone operations everywhere.
- AirMap, Wing, and Kittyhawk.io used industry standard authentication (OAuth 2.0) and security (HTTPS) for communications to the InterUSS platform and between USSs. LAANC already provides OAuth 2.0 authentication, and those credentials (or similar) can be used to authenticate communication between USS and to the InterUSS platform.

Why Bloom Energy Deserves More Scrutiny in 2019

Published: Thursday, December 20, 2018 - 1:00am www.greenbiz.com

Heather Clancy
Editorial Director
GreenBiz Group
www.greenbiz.com

Bloom founder K.R. Sridhar was inspired by a photograph snapped from outer space illustrating the vast swaths of planet Earth still in the dark, unconnected to the electric grid.

When rocket scientist K.R. Sridhar founded the technology startup that would become Bloom Energy in 2001 — and famously introduced its electricity-generating "box" to the world in 2010 during a "60 Minutes" segment — his inspiration was a photograph snapped from outer space illustrating the vast swaths of planet Earth still in the dark, unconnected to the electric grid.

He mused then, as he does now: If scientists could generate power for equipment on far-flung planets such as Mars, why can't they light up rural communities here on Earth? "In a digital world, electricity, like food and shelter, is a human need," said Sridhar, Bloom's chairman and CEO, during a relatively rare formal media briefing last week at the company's Sunnyvale, California, headquarters.

Almost 20 years later, that worldview looms large on a wall in the now-public company's corporate briefing room. It's a not-so-subtle reminder of Bloom's long-term mission "to make clean, reliable and affordable energy for everyone in the world."

Right now, however, the company's short-term concern is convincing high-profile commercial and industrial accounts to buy the Bloom Energy Server (the fancy name for its fuel cell technology) to reduce their reliance on the traditional grid. Bloom's solid oxide fuel cells generate electricity through an electrochemical reaction, rather than through a combustion process, which distinguishes its approach from on-site cogeneration options.

In the past year, it has scored some impressive wins, such as a contract with the world's largest internet co-location company, Equinix. Increasingly, the company has forged lucrative deals with utilities including Southern Co., Constellation and Exelon. "Utilities are emerging as some of our very best partners," said Matt Ross, executive vice president and chief marketing officer of Bloom.

Bloom's scale is still relatively modest. During the third quarter, which ended Sept. 30, Bloom reported a net loss of $78.6 million on revenue of $190.2 million, which was at the "mid-point" of its sales estimates. In its investor update, Bloom said it closed a record 206 "acceptances" during the three-month period. While more than half of Bloom's business comes from new accounts, long-time clients such as Intel, The Wonderful Company, eBay, Apple and Walmart continue to add new Bloom energy servers, according to a corporate presentation distributed to reporters.

We are experiencing a post-climate-change world. You need to address electricity not in a single dimension, but in many: reliability; resiliency; sustainability.
The issue is not about renewables, it's not about fossils, it's about emissions," Sridhar said. "Whether we like it or not, we are experiencing a post-climate-change world. You need to address electricity not in a single dimension, but in many: reliability; resiliency; sustainability."

The next update to Bloom's technology, coming online in early 2019, will continue to improve the generating capacity it can provide within the same footprint — its engineers cram more megawatts into each successive generation. In a strategy borrowed from the high-tech industry, Bloom is focusing on ways it can integrate its platform with other components, such as energy storage, and inverters that allow it to be installed alongside solar equipment.

What's more, the company is actively testing a module that will help its energy servers run more efficiently on biogas by "scrubbing" the gas of contaminants. About 9 percent of Bloom's installed servers already run on biogas, but the company's broader support of this option is meant to help assuage naysayers concerned over the company's reliance on natural gas as a fuel source.

Eventually, better support for biogas could be the missing link that helps open doors for Bloom's technology in rural regions around the world — at least, that's the hope of Bloom's founder. "There are enormous sources of biogas that we have not exploited. This is different from biofuels," Sridhar said, pointing to one possible scenario in which small hamlets, villages or communities could create small microgrids powered using local waste sources such as animal manure, human excrement or plant refuse. Individuals and businesses could "pay by the drink" for the electricity they use, in much the way many people in emerging nations are adopting mobile phone technology, he predicted.

One issue remains the distribution link: it's incredibly expensive to "pipe" biogas across a region to a central location. That's why Bloom is advocating an approach that would see its equipment colocated at capture sources.

Here's how Bloom plans to differentiate itself

Meanwhile, though, Bloom is out to make its mark in the commercial world. During the series of presentations in mid-December, Sridahar and other members of the Bloom executive team touted several factors that they say help the company close deals for its fuel cells. Chief among them:

The cost: The company has managed a 75 percent reduction in the material cost/watt since 2009, according to its presentation. That helps Bloom energy servers

achieve a 5 percent to 15 percent discount below grid electricity costs in many places, according to Bloom executives. That has translated into a 29 percent reduction in Bloom's costs per kilowatt-hour annually over the past three years, according to Bloom Chief Financial Officer Randy Furr.
All this is important because Bloom typically has relied heavily on incentive programs to help subsidize the cost of its installations. The February 2018 update (PDF) of the federal investment tax credit could help boost its value proposition, but the executive team's focus is on reducing costs enough for that to be a non-factor. Its utility relationships could also help its would-be customers tap into funding help. Now that it's public, investors and would-be customers will have a view into whether Bloom can deliver.

The density compared with on-site solar installations: A 250-kilowatt system is about the size of a shipping container. It typically takes 125x the space to generate as much power with solar photovoltaic. The GHG proposition: The company claims virtually no nitrogen oxide, sulfur oxide or particulate emissions. That doesn't address the methane leakage issue associated with natural gas production and distribution. But Bloom's argument is that its technology emits 60 percent less carbon dioxide than the typical baseload options available on the U.S. power grid. The company is also hard at work on a biogas clean-up module that will help Bloom servers use biogas produced by landfills, wastewater treatment plants and agricultural operations.

The uptime promise: A distributed Bloom server installation can be maintained without the entire system being taken offline, which isn't the case for things such as co-generation equipment. Plus, it can be connected directly at a site, which reduces a company's reliance on the grid transmission system.

During presentations in mid-December, Sridahar and other Bloom executives touted several factors that they say help the company close deals for its fuel cells.

Jim Cowell, vice president of facilities for the California Institute of Technology (Caltech), which generates about 90 percent of its annual 120 gigawatt-hour power consumption on site, uses Bloom technology for about 21 percent of that electricity. (That's 3 MWs so far.) During the eight years Caltech has been using the servers, they've never been offline, he said. The university's new neuroscience research building, slated to open by 2020, will use 1 MW of Bloom's technology as its primary generation source. That will bring Caltech's installations up to 4 MW of capacity.

One place you can expect to see Bloom ramp up its sales outreach during 2019 is in microgrid installations — the company is positioning its technology as both a viable standalone option as well as something that can be integrated cost-effectively with solar and energy storage. And unlike many microgrids powered by renewables, Bloom's technology can help negate the need for a diesel backup generate, according to the company.
In late August, for example, the company disclosed a deal with manufacturer JSR Micro. The contract covers a 1.1 MW installation that JSR will use as its primary power source.

Making friends with utilities

Another thing to watch in 2019: Bloom's relationships with utilities. It's already actively working with at least a half-dozen including Consolidated Edison, Constellation and Delmarva Power (both Exelon subsidiaries), Eversource and Southern.

Under the Southern deal, for example, Bloom Energy Servers are being combined with energy storage technology from Southern subsidiary PowerSecure to provide on-site generation to customers like the Home Depot. In this instance, you can think of Southern as a sales channel.

In New York, ConEd has been using Bloom's technology as part of the Brooklyn Queens Demand Management Program, an initiative that has been using fuel cells (among other technologies) to help defer the $1.2 billion capital expense associated with building another substation for the region. Instead, the utility deployed a combination of rooftop solar and fuel cells at a housing project to generate more onsite power for the surrounding neighborhood. It set aside a budget of about $200 million to help customer fund onsite investments in both generation and energy efficiency measures.

A 1.8-MW installation of Bloom fuel cells also was used to accommodate about 45 percent of the base load required by a major new, 342-bed medical center. The center received a $1.3 million incentive to help fund the project; over the 15-year contract, Downstate expects to see its cost of electricity decrease substantially.

What stands in the way of Bloom's progress?

The most obvious obstacle is the company's current reliance on natural gas as a fuel source. Not only are its installations dependent on the availability of distribution infrastructure, but Bloom also likely will be called upon more often to discuss how it handles methane, a super pollutant associated with natural gas and biogas that is a more potent contributor to global warming than carbon dioxide.

The company also continues to face many questions regarding the expense of its fuel cells and its ongoing reliance on financial incentives to get deals done — many of its big accounts are in California, in large part because of the generous incentive program that has been in place there in the state. There's also the question of how it will handle the disposal of aging technology. The latter is an issue in Delaware, for example, where the company hopes to swap out old fuel cells in favor of its newer, more efficient editions.

It was a rare combination of a balmy day, an endless line of Cumulonimbus clouds above the Kennedy Space Center and a glimpse of an endangered bird species flying overhead. Led by Russ DeLoach, SMA director, ISF Assistant Chief, KSC Program Managers and NASA Safety Center, the first official KSC photos were taken in celebration of the new iNARTE® ESD Aerospace & Defense Engineer™ recipients. The highest level of ESD certification and training for NASA, this technology centered program was developed over the past 5 years by RMV Technology Group LLC, a NASA Industry partner, to meet the evolving nonconformance and suspect counterfeit ESD material issues, EEE (ESD sensitive) part damage, electrostatic attraction challenges, ESD program implementation and other static electricity related flight hardware failure issues. The NASA ESD program managers under the leadership of Gene S. Monroe, NASA Langley, participated in the course instruction to secure their ESD engineering credentials.

This stand-alone training program is in line with the NASA ESD Stan-

Congratulations to Mercedes Zuk & Chris Berg, SMA Engineers on 24 October 2018 at NASA KSC.

NASA ESD Program Manager Training 26-30 March 2018

dard 8739.6 revision for more rewarding project deployment and mission success and to address the clearly defined shortcomings of current industry standards that do not meet NASA and US Military requirements in practice today.

The first class certified in the NEW iNARTE® Certified ESD Aerospace & Defense program was the NASA ESD Program Managers, JPL and NASA Safety Center. The initial kickoff celebration was held at GSFC on 24 August, followed by ARC on 19 September, culminating in this week's event on 24 October 2018 to recognize those that received their iNARTE® Certified ESD Aerospace & Defense Engineer™ certification. Classes are now scheduled for the prime contractor community including DoD civil servants and support suppliers, distributors and other federal agencies that may have similar requirements to lower risk while meeting the objectives for supply chain quality assurance and program success. For more information on the upcoming NASA technology training classes, please contact Renee Mitchell at renee@esdrmv.com or call Renee at 650-964-4792.

Verdigris Technologies announces latest smart building advancement revolutionizing building transparency and energy savings: Disaggregation

MOUNTAIN VIEW, Calif., Nov. 14, 2018 /PRNewswire/ -- Verdigris Technologies ("Verdigris," verdigris.co), innovator of the artificial intelligence (AI) platform for responsive energy management, announces the launch of our newest capability advancing IoT, Disaggregation. This feature enables X-ray-like vision into the built environment. With just one of our proprietary sensors, customers can get visibility into their various building equipment. One sensor has the power to see beyond a floor, beyond an electrical panel, beyond a circuit, to all individual devices plugged into that circuit. Other solutions require installing numerous hardware devices to see rough data. This leads to high installation and maintenance costs, and wasted time discerning causes of electrical consumption or device malfunction.

Disaggregation allows device-level visibility so customers can pinpoint ways to save energy, optimize building efficiency, and avoid costly hardware and maintenance fees.

"Verdigris is a fantastic tool that provides a phenomenal amount of data. We really liked the granularity of data because it allowed us to drill down and identify the issues that we would not have otherwise been able to catch…..we were able to spot times when chillers were running when they shouldn't be."
-Jim Hussey, CEO, Marina Mechanical

How does it work? Each piece of equipment- whether a light, refrigerator, HVAC system or coffee pot, has a unique electrical signal or energy pattern they emit. Our in-house sensors sense and collect data from electrical panels at such high frequencies that they can tease apart the unique waveforms corresponding to each device. Imagine the enormous implications this has for the facilities manager wanting to find the dead lightbulbs in a hotel without checking each by hand or the factory manager wanting to identify when industrial equipment is lagging. The executive trying to reach corporate sustainability goals too can benefit by mandating non-critical loads are turned off. In all these scenarios, disaggregation identifies ways to reduce cost that were previously unseen.

What if a building manager wanted to know which lights are on at low occupancy periods? Currently our customers can set alerts at a circuit level. When a circuit is using energy beyond or below a certain threshold, ping! They can check what devices the circuit is connected to for trends and anomalies. At a device level, our engineering teams can work with key customers to create tailored alerts.

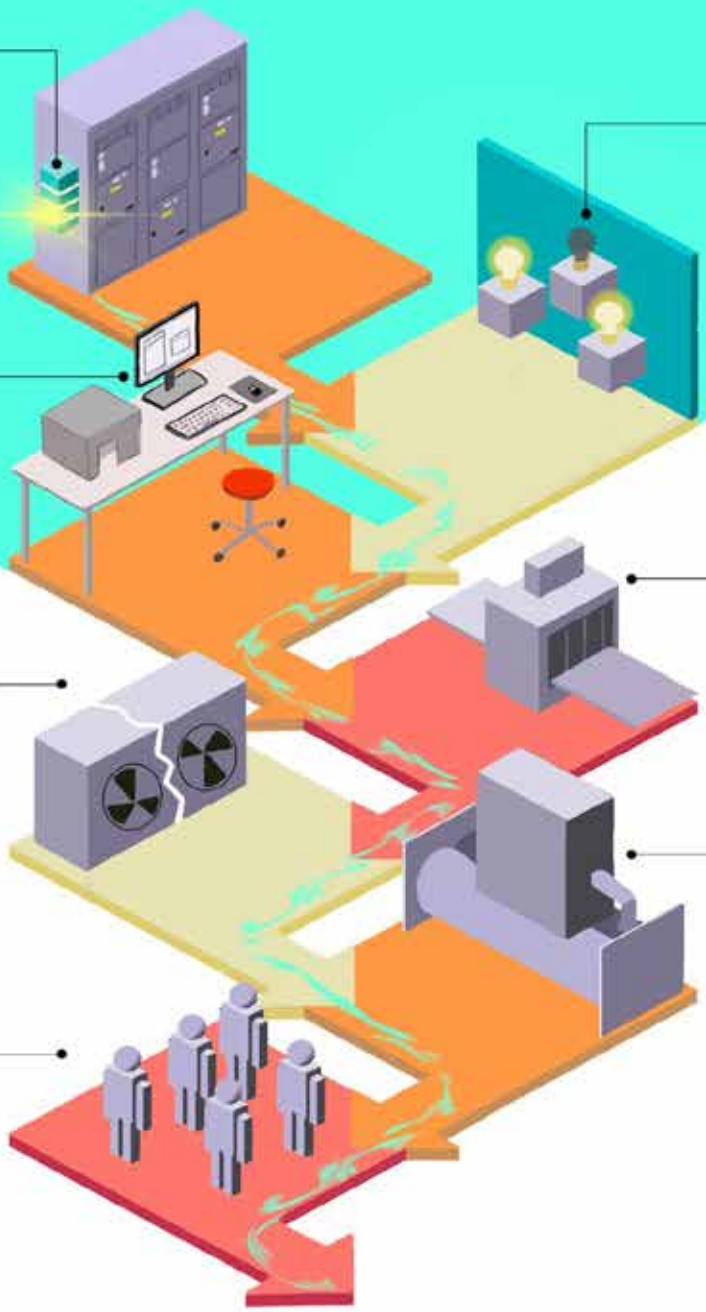
What's on our roadmap? This is just the beginning. Our roadmap includes making Disaggregation Alerts a core product and using AI to auto classify devices (right now labeling is manual). For more information on Disaggregation click here. Check out our website for other ways we are helping companies reduce energy consumption, cut costs, and reduce their carbon footprint. Please email info@verdigris.co for inquiries.

About Us: Verdigris makes equipment-level electricity monitoring inexpensive and simple. Leveraging the power of AI, Verdigris helps transform dumb buildings into smart buildings that are more reliable, efficient, and automated. Powerful analytics scan rich data streams, obtained via our IoT sensors, to find hidden inefficiencies, produce itemized utilities reports and empower building managers to optimize facilities management. Verdigris was named one of the top ten Most Innovative Companies in Energy by Fast Company and has a customer base which spans nine countries and 80+ enterprise customers. Headquartered at the NASA Ames Research Park in Moffett Field, Mountain View, California, Verdigris is a venture-backed company established in 2012 and has raised $22 million to date. For more information, visit www.verdigris.co.

SOURCE Verdigris Technologies
www.verdigris.co

VERDIGRIS
DISAGGREGATION

Install just one sensor to measure dozens of branch circuits and hundreds of electrical devices downstream. Verdigris uses proprietary hardware and artificial intelligence to put virtual meters on your electrical devices.



Use one Verdigris sensor to monitor individual power usage for multiple devices.

Identify abnormal/broken devices.

Boost office equipments efficiency.

Schedule better to shift demand peak.

Monitor fan and motor health in real time.

Detect short cycling faults.

Optimize AC usage based on building occupancy.

Achieve cost savings!

VASPER

ELEVATE • REJUVENATE • EXCEED

Vasper is a new exercise technology that is now commercially available. The Vasper system combines compression, liquid cooling, and interval training to drive your body's production of growth and recovery hormones, delivering the most significant benefits of high-intensity exercise in an efficient and low-impact 21-minute workout.

Vasper's headquarters are located at the NASA Ames Research Park. Here, we have a Vitality Center that serves as a fully operating Vasper gym. We serve people from all walks of life who are interested in engaging with their health in a new way. Come visit our headquarters to get the full Vasper experience, meet the team, become a member, and be inspired by all that is Vasper.

In the meantime, take a look at our recent scientific benchmarks:

CANTU CONCUSSION STUDY

Vasper was studied at the Cantu Concussion Center for work with people who suffer from prolonged concussion symptoms, a condition called Post-Concussive Syndrome. The study involved six weeks of exercise sessions (Vasper and control) followed by six weeks without exercise. The Vasper group demonstrated significantly improved quality of life and also showed improvements in the follow-up period. The Vasper group had a significantly more stable recovery and specifically more stability in emotional and sleep contributions after 6 weeks of no rehabilitation. Symptom variability and stability of recovery is a particularly difficult issue in Post-Concussive Syndrome rehabilitation and this study demonstrates that Vasper is an effective way to address this.

COVENANT HEALTH DIABETES STUDY

The most potent lifestyle intervention for treatment of Type II Diabetes (T2D) is consistent exercise. However, for many patients with the condition, other comorbidities such as osteoarthritis, hypertension, and high body mass indexes prevent them from being able to exercise intensively and consistently enough to experience optimal metabolic benefits. Vasper was selected as a technology that could specifically address the needs of this population and was studied at Covenant Health in

Type II Diabetics. In this study, three months of Vasper sessions, three times a week, were completed by subjects and the baseline weight and Glycohemoglobin was measured. There were significant improvements in weight and Glycohemoglobin after three months of Vasper sessions. The preliminary results of this study suggest Vasper has promise in contributing to effective management of T2D with a low physical burden.

JAGIELLONIAN UNIVERSITY STUDY

Peripheral Artery Occlusive Disease is a chronic inflammatory vascular disease. PAOD is diagnosed in 20% of Europeans and Northern Americans above 55 years old and is one of the main causes of death and disability in highly developed countries. This study seeks to understand if the intervention of Vasper has the potential to increase endothelium function and angiogenesis in patients with PAOD. The results from the healthy subject trial demonstrated improved markers of neoangiogenesis activation (VEGF, CD31, CD34) and improved acute changes in endothelial function, including arterial stiffness parameters. This means that Vasper could be a safe and effective way for those with Peripheral Artery Occlusive Disease to safely exercise and increase the resilience of their cardiovascular system.

Bay Area Environmental Research Institute

Numerical Model Simulates Entire Evolution of a Solar Flare for First Time

For the first time, a numerical model has simulated the entire evolution of a solar flare. In these events, a huge amount of energy is released in several ways: thermal and magnetic energy, and kinetic energy in the form of energized particles. The simulated evolution of the flare and eruption starts with the rise of magnetic field through thousands of kilometers below the solar surface and finishes with an explosive release of energy in a brilliant flash in the outer solar atmosphere. The work describing this sequence of events has been published in Nature Astronomy. NCAR has recently released this news (https://news.ucar.edu/132648/emergence-eruption).

Dr. Mark Cheung at Lockheed Martin Solar and Astrophysics Laboratory (LMSAL) and a visiting scholar at Stanford University and Dr. Matthias Rempel at National Center for Atmospheric Research (NCAR) led the research supported by the NASA's Heliophysics Grand Challenges Research opportunity. This investigation has been possible thanks to a large collaboration involving several institutions and universities, including two co-authors from Bay Area environmental Research Institute (BAERI): Dr. J. Martinez-Sykora (left) and Dr. A. Sainz Dalda (right).

This work is relevant for understanding the appearance of sunspots and how they sometimes can produce flares which could lead to a coronal mass ejections. The mass expelled can reach up to 10^12 g which is comparable to Mount Everest which sometimes may eventually impact the Earth magnetosphere. Particles on these events can reach velocities up to a fraction of the speed of light. The physics responsible for this evolution and energy release is extreme and not possible to reproduce in the laboratory, requiring the combination of many different physical processes all playing in concert. Flare eruptions may have widespread impacts on the Earth, producing auroras, disrupting power grids and communications networks, damaging satellites, and endangering astronauts. Consequently, this study is of great interest for space weather; but, not only that, flares are also of great interest for understanding fundamental physics such as reconnection of magnetic field and particle acceleration.

NASA Ames Photo Ops

August 6, 2018

NASA CFO Jeff DeWitt visits Ames and take a tour of the NRP

October 22, 2018

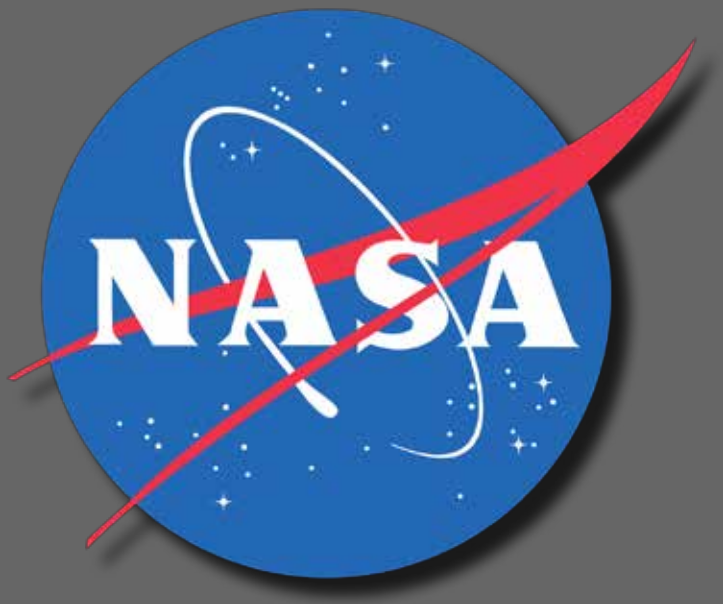
Ames Deputy Director Carol Carroll provided welcome and ARC Overview to the Young Innovators, and a Global Entrepreneurship Ecosystem

September 11, 2018

NRP Deputy Director Mejghan Haider briefing to Brazilians

September 11, 2018

Dr. Reilly of USGS and Dr. Tu of NASA visit NRP Building 19 second floor under construction by USGS



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