

Spring 2012 - A Quarterly Publication

## NASA Ames Unveils New Energy-Efficient Building

BY RUTH MARLAIRE

NASA is leading the way to a better quality of life on Earth. Meeting the White House challenge to lead by example, NASA has taken a second look at its aerospace technologies and has repurposed them in imaginative and innovative ways to create a “smart” building unlike any other government building ever constructed. Designed in harmony with its environment, it is a highly intelligent, intuitive, new building, called Sustainability Base, located at NASA Ames Research Center, Moffett Field, Calif.

Sustainability Base is designed to be “native to place,” which means it incorporates surrounding elements into its new design. This 50,000 square-foot, two-story building is oriented to take advantage of the sun’s arc and the prevailing winds from San Francisco Bay. It is capable of anticipating and reacting to changes in sunlight, temperature, wind, and occupancy, performing automatically and in real-time to these internal and external changes.

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NASA photo by Eric James

NASA Ames Research Center Director Pete Worden (center), assisted by (from left to right) Associate Center Director for Research Steve Zornetzer, Associate Administrator for Mission Support Woodrow Whitlow, U.S. Congressional Representative Zoe Lofgren, D-San Jose, Calif., U.S. Congressional Representative Anna Eshoo D-Palo Alto, Calif., California State Treasurer Bill Lockyer and William McDonough, the architect of the building, cuts the ribbon during a dedication ceremony April 20, 2012 for Sustainability Base.

## NASA’s Kepler Mission Marks Major Milestones

BY MICHELE JOHNSON

In April 2012, NASA’s Kepler mission was approved for extension through fiscal year 2016 based on a recommendation from the agency’s 2012 Senior Review of Astrophysics Missions.

The extension provides four additional years to find Earth-size planets in the habitable zone -- the region in a planetary system where liquid water could exist on the surface of an orbiting planet.

“Kepler has revolutionized our understanding of exoplanets and the study of stellar seismology and variability,” said Roger Hunter, Kepler project manager at NASA Ames. “There is currently no other mission in development that can replace or surpass the precision of Kepler. This extended mission will afford Kepler a unique opportunity to rewrite our understanding of the galaxy and our place in it.”



NASA photo by Kim Shiflett

The Kepler team also marked the third anniversary since beginning its science operations on May 12, 2009, when the spacecraft began collecting data.

To celebrate these momentous occasions, the Kepler team, center personnel and invited guests gathered at the NASA Exploration Center at Ames on May 15, 2012. The team also honored William Borucki, Kepler’s principal investigator and transit photometry pioneer, who celebrated 50 years of service at Ames in June 2012.

Launched in March 2009, the mission’s discoveries beyond our solar system include the first unquestionably rocky planet; the first multiple-transiting planet system; the first small planet in the habitable zone; the first Earth-size planets; the smallest Mars-size planet; and the confirmation of a new class of double-star planetary systems.

## More than 150,000 People Discover Airborne Astronomy

BY NICHOLAS A. VERONICO

In the fall of 2010, displays depicting the history and achievements of NASA's Stratospheric Observatory for Infrared Astronomy (SOFIA) were installed at three Northern California venues – NASA Ames' Exploration Center, the Ames Exploration Encounter, and the Hiller Aviation Museum. One year later, more than 150,000 guests have seen the displays and had an introduction to astronomy at infrared wavelengths.

The NASA Ames Exploration Center at Moffett Field provides visi-

aircraft as it was in SOFIA's predecessor, the Kuiper Airborne Observatory. The model was later reconfigured to reflect SOFIA's final design with the telescope in the left waist section and extensively tested to see how air flows over the open telescope cavity.

In addition to the wind tunnel model, the SOFIA display features a pair of cameras that show images of visitors in both visible and infrared light.

"It's incredible to watch the public engage and become excited by this display on infrared astronomy and SOFIA," said Cara Dodge, Exploration Center manager. "Guests can see and

suits, flying helmets, and a 100-seat immersive theater with a 14-foot tall and 36-foot wide wrap-around screen. Visitor information can be found at: <http://www.nasa.gov/centers/ames/home/exploration.html>

### "Field Trip Favorite"

The NASA Ames Exploration Encounter (AEE) is a unique educational program designed to inspire positive attitudes about science, technology, engineering and math for students in the fourth through sixth grades. The AEE is located in the old 6-foot by 6-foot supersonic wind tunnel and is a docent-led, field trip experience for students. More than 15,000 students have experienced the SOFIA display since September 2010.

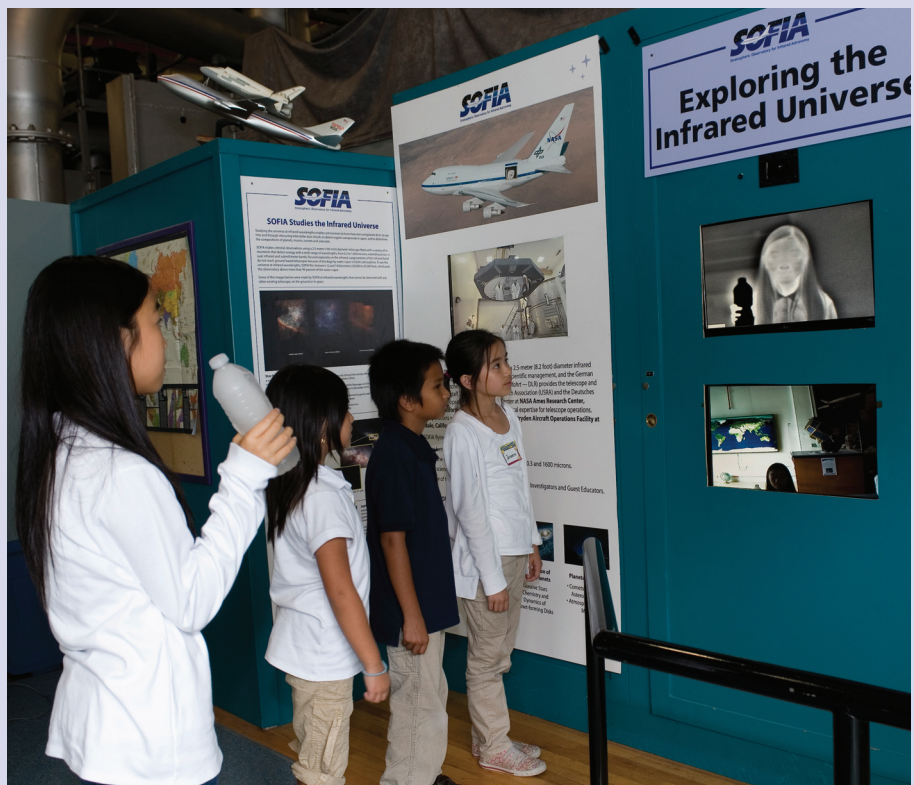
"The SOFIA exhibit is a field trip favorite! There are so many students (and chaperones) that are completely amazed to learn about and experiment with the IR universe. Once they understand infrared, we then can connect the concepts to the unique laboratory that is SOFIA, transforming it from 'some NASA plane' to an exhilarating and incredible research tool," said AEE Operations Manager Brenden Sanborn.

At the AEE, students experience four hands-on educational stations: Exploring Physics, Exploring Flight, Exploring Space, and Exploring Earth. The SOFIA exhibit crosses-over all four themes and consists of a looping video about the aircraft and its science, a visible light camera paired with an infrared camera, and a series of educational panels showing the infrared spectrum, as well as comparison photos of everyday objects seen in visible light and in the infrared. More information about field trips to the AEE can be found at: <http://www.nasa.gov/centers/ames/education/programs/encounter/>

### SOFIA in a 747

The third, and certainly the most unusual, display was installed in the nose section of a Boeing 747 at the Hiller Aviation Museum located less than 20 miles north of NASA Ames along Highway 101 at the San Carlos Airport. The museum features more than 50 full-size aircraft ranging from an 1869 Avitor steam-powered airship replica, to the Boeing Condor, a

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NASA photo by Eric James

*Students interact with the SOFIA display at the Ames Exploration Encounter during a class field trip. Notice how cold items appear in shades of black on the infrared screen (bottle of ice water), while warm objects (student's fingers), are white. These same principles are used to study how dust and gas interact in space.*

tors with a glimpse into the science of NASA and the research accomplished at NASA Ames. Here, more than 50,000 visitors have seen the SOFIA one-fifteenth-scale model used in the NASA Ames 14-foot wind tunnel to predict properties of airflow over the open telescope cavity. This model was first used to test the potential of having the telescope cavity in the nose of the

understand how SOFIA's capabilities enable scientists to look farther into, and learn more about, our universe."

Along with the SOFIA exhibit, the Exploration Center features an International Space Station mock-up, a genuine moon rock (recovered during Apollo 15's expedition to the Hadley-Apennine region), a Mercury Redstone 1A (MR-1A) space capsule that was launched on Dec. 19, 1960, space

## NASA Showcases Innovative Method to Grow Algae-Based Biofuels

BY HUONG NGUYEN

NASA recently showcased the latest research and technology developed to grow algae, clean wastewater, capture carbon dioxide and ultimately produce feedstock for refining biofuels without competing with agriculture for water, fertilizer, or land.

NASA's unique floating algae cultivation system, called Offshore Membrane Enclosure for Growing Algae (OMEGA), managed by NASA's Ames Research Center, Moffett Field, Calif., is now available to transfer to the commercial sector. Members of the algae-for-biofuel community and industry are invited to take the OMEGA concept and further explore its potential commercial applications.

A small-scale OMEGA system was developed in seawater tanks at the California Fish and Game laboratory in Santa Cruz, Calif., and scaled up to a 450-gallon system at the Southeast Wastewater Treatment facility in San Francisco.

The OMEGA system is designed to grow freshwater algae in municipal wastewater using NASA's photobioreactors, which are flexible plastic tubes that float in seawater. In the process of growing, the algae treat wastewater and address environmental problems by consuming nutrients from the wastewater and carbon dioxide. The nutrients, if left unconsumed, would otherwise be released into the coastal waters contributing to undesired algae blooms. Just like shrubs and trees, algae have an appetite for the greenhouse gas, carbon dioxide. The algae release oxygen into the air as they absorb carbon dioxide, retrieve their nutrients from wastewater, and use energy from the sun to grow. These tiny, single-cell algae are the fastest growing plants on the planet.

Depending on the amount of sunlight, nutrients, water temperature and a few other environmental condi-

tions, algae can double their numbers every day and be ready to harvest in just three to five days. Some kinds of algae make oil, which can be converted into environmentally friendly and sustainable biofuels. In addition, the remains of the algae, after removing the oil, can be used to produce other products, such as fertilizer, natural gas, and animal feed.

Among other research results published in May, the OMEGA research team demonstrated that the floating plastic tubes of algae pose no apparent threat to marine animals in a set of small-scale experiments.

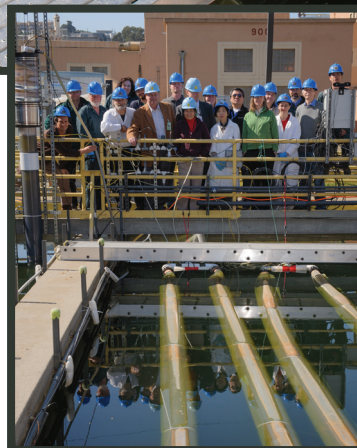
"We have continuous video of various prototypes of photobioreactors, day and night, over a six-month period. We see birds and sea otters interacting with the system, but it does not impact their well being," said Jonathan Trent, OMEGA project scientist at NASA Ames. "Preliminary data showed that the interactions of these animals are not problematic to the system or its functions."

In developing OMEGA, scientists



NASA photo by Dominic Hart

The NASA OMEGA floating photobioreactor prototype shown in a seawater tank at the Southeast Wastewater Treatment facility in San Francisco. The four flexible plastic tubes are filled with algae and wastewater, which circulates through the system.



NASA photo by Dominic Hart

NASA's OMEGA system consists of large flexible plastic tubes floating in seawater with freshwater algae growing in wastewater. The algae use energy from the sun, carbon dioxide and nutrients from the wastewater to produce biomass that can be converted into biofuels as well as other useful products such as fertilizer and animal food.

were inspired by NASA's closed-loop life support systems used on the International Space Station that optimize the use of resources and minimize waste. OMEGA focuses on self-sustaining cycles that convert waste from one part of the system into assets for another part. NASA used its unique expertise in life support systems to develop the OMEGA technology and lower the potential technical risks to the private sector looking to pursue larger-scale systems.

"We've addressed some of the more daunting technological problems for implementing OMEGA," said Trent. "Now the hope is that other organizations and industries will realize the potential of the OMEGA technology for wastewater treatment and ultimately to produce sustainable biofuels."

# Sutter Mill Meteorite Discovery Spurs Hunt For More Pieces

BY KAREN JENVEY

Meteorite fragments were recently scattered around Sutter's Mill in California, the same region where the first nugget of gold was found that sparked the Gold Rush in 1848.

Scientists believe the meteorites may hold answers to unsolved mysteries about our solar system and the origins of molecules necessary for life. When the Gold Rush began, people headed to California seeking their fortune. Now, with this meteorite hunt, people once again have flocked to this area to search for scientific treasures.

What scientists call the Sutter's Mill Meteorite landed at 7:51 a.m. PDT on Sunday, April 22, 2012, outside of Lotus, Calif., in a horse pasture located in the Sierra Nevada mountains. The de Haas family owns the property.

"It sounded like a sonic boom, but longer," said Alan Ehtagott, who lives in the Sutter Mill area. "It seemed to last 45 seconds. It stopped me in my tracks."

The de Haas family has generously donated the meteorite to NASA.

Merv de Hass, who owns the land where the meteorite was found, donated the fragment to NASA. "If I could contribute to science in some small way, then that would be great," said de Haas. "I'm looking forward to the results."

Eugena de Haas lives on the land where the meteorite was found. She informed NASA scientists that they were approved to search that land. "I feel like I have done a service to my country," she said.

"The de Haas family has welcomed NASA's involvement with open arms," said NASA Lunar Science Institute (NLSI) Director Yvonne Pendleton. "I want to express my personal gratitude to them. They should be commended for their contribution to scientific discovery."

This is a very rare type of meteor and scientists have precious few samples of this kind of material. The meteorites are very interesting to scientists from an astrobiology perspective, as they contain molecules related to how the building blocks for life on Earth may have been delivered from outer space. Scientists believe that this meteor could hold the answers to the origin of life on Earth and the universe. By studying the meteor, scientists also will learn more about the early solar system and the formation of our planets.



NASA photo by Eric James

SETI meteor astronomer Peter Jenniskens takes a closer look at the image from the AVS Cineflex HiDEF camera mounted on the nose of the Eureka Airship. Mike Coop can be seen in the background checking the map. Further back, other flight members continue to look for potential impact sites.

"This is among the most primitive meteorites," said NLSI Deputy Director Greg Schmidt. "It's like asking 'how did life on Earth begin?' and then having a fossil fall right in your back yard. This is exciting stuff — who knows what's inside? The Sutter's Mill Meteorite could be the most profound sample collected in over 40 years."

People who work at NASA had an opportunity to participate in the meteor hunt. Peter Jenniskens, a meteor astronomer with the SETI Institute working in collaboration with NLSI, led the search. A group of NASA Ames employees went to the mountains to assist in the search on Thursday, May 3 and Friday, May 4, 2012.

"It's heartwarming to see people coming together in the name of science," said Pendleton.

For Jenniskens, finding this meteorite is equivalent to winning the lottery. Because this discovery is a very rare carbonaceous chondrite that decomposes quickly in damp weather, the science team covered a large amount of terrain to identify possible candidate pieces for recovery before they decompose.

As Jenniskens found the meteorites, he noted their exact location to better understand the meteor's fall to Earth.

"I am grateful this meteorite was found quickly," Jenniskens said. "We

need to recover as much material as possible from the damp environment before weather affects the rocks too badly."

Since there was such a large piece of land to search in a short amount of time, Airship Ventures' Zeppelin was called in to help conduct the search. The airship provides an ideal search vehicle, due to its ability to fly slowly and methodically over an area with a group of trained observers aboard to relay possible candidate coordinates to a ground team for investigation. The airship also carries a high definition gyrostabilized camera, often used to help photograph sporting events. In addition to the camera mounted on the airship, observers in the ship used binoculars and cameras to help spot burn patches and potential impact sites.

"I suspect this is the first time in history that anyone has searched for meteorites with an airship," said Schmidt.

So far, the fragment donated by the de Haas family was one of the largest meteorites recovered. The search for even bigger samples will continue over the next few months. However, scientists will be studying these meteorite samples for many years to come.

# NASA Ames Unveils New Energy-Efficient Building

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It is simultaneously a workplace, a showcase for NASA technology and a living prototype for future buildings. It is NASA's latest mission on Earth.

Recently, the U.S. Green Building Council announced it has awarded Sustainability Base its highest level of Leadership in Energy and Environmental Design (LEED) certification, LEED Platinum. To receive this premier rating, the building must receive more than 80 out of 100 points across five major categories: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, plus additional points for innovation in design and regional priority.

"What makes our building different than the other NASA LEED buildings is that preliminary data are already showing a net-energy positive profile. The building site contributes more energy to the grid than it receives from the grid. Ames also repurposed NASA aerospace technologies to optimize the building's performance," said Steven Zornetzer, Associate Center Director for Research at Ames.

Already reaching reduced-energy consumption estimates, this ultragreen federal building generates much of its own renewable power. It uses photovoltaics (solar panels) and solid oxide fuel cell technology from a Bloom Energy Box, an example of repurposed NASA space technology for on-site energy generation.

The facility also is expected to consume 90 percent less potable (drinkable) water than conventionally constructed buildings of equivalent size. This is partially due to a repurposed water recovery system, derived from one that was originally designed for the International Space Station. Recycled water is cleaned on site and then used again to flush toilets and urinals. Additionally, the building's landscaping includes California native plants and non-invasive, draught-tolerant species. The site's irrigation water will be recycled groundwater obtained from another site on the Ames campus.

What really makes this facility a "smart" building is the innovative application of NASA technologies. One such application is the building's embedded advanced intelligent control technology, which was derived from software originally developed for NASA's Aviation Safety Program.

This technology "considers" mul-



NASA photo by Eric James

*NASA's Sustainability Base is unlike any other government building ever created. Using NASA innovations originally engineered for space travel and exploration, the 50,000 square-foot, lunar-shaped Sustainability Base is simultaneously a working office space, a showcase for NASA technology and an evolving exemplar for the future of buildings.*

multiple options and constraints simultaneously to determine the best strategy for meeting performance goals. For example in aviation, fuel efficiency is a consideration. Data input may be estimates of factors that affect efficiency, such as aircraft lift and drag, engine performance, aircraft location, and orientation. The software helps plan the optimal flight path for fuel conservation.

Similar intelligent control technology has been developed for the building. To determine a high-performance strategy, zones are established throughout the building. Each zone has sensors strategically located that relay real-time data to a central controller about the building's environment.

Data factors include access to weather forecasts, predicted heat load from the sun, estimates of body and laptop temperatures and occupants' calendars to predict density numbers at meetings. With this information, the central controller can predict internal temperatures, and adjust the heating and cooling systems for human comfort.

Another technology given new application is NASA's advanced Computational Fluid Dynamics (CFD) tools that are used to simulate, quantify and understand the ways fluid flows in a given environment. For example, CFD examines how air flows through a jet engine or around an aircraft, or how blood circulates through the body in different environmental circumstances. This technology has been used by NASA for a variety of applications, from development of next-generation space exploration vehicles to engi-

neering biomedical devices.

In Sustainability Base, CFD is used to simulate environmental flows in- and outside the building. Simulated external flows include seasonal wind patterns in varying weather conditions. Internal simulations include air circulation patterns throughout the building, which are used to assess flow-control devices, such as automated windows and heating, ventilation and air conditioning units. Both sets of simulation data allow the building's control system to develop strategies for maintaining a comfortable, internal temperature while minimizing energy demands.

NASA's new, environmentally-friendly building was named in honor of the first humans to walk on the surface of the moon more than 40 years ago. The landing site for the Apollo 11 spacecraft was named Tranquility Base.

Sustainability Base already has won prestigious national awards. They include the 2010 U.S. General Services Administration (GSA) Award for Green Innovation; 2010 San Jose Silicon Valley Structures Award for Best Green Public Building; the 2011 White House Greengov "Lean Clean and Green Award"; and CEIL, the "Leadership in Innovation Award."

"We are thrilled to be applying NASA aerospace technologies to our everyday living and working environments. This building brings NASA technologies down to Earth to leverage taxpayer investment and improve the quality of life for everyone," said Zornetzer.

## More than 150,000 People Discover Airborne Astronomy

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super-secret robotic spyplane from the 1980s. The Condor has a wingspan more than 200-feet-wide, which is larger than that of a 747. In addition to the aircraft, the Hiller Aviation Museum features other aviation technologies, such as engines and rotorcraft, and offers many great educational programs.

Through a series of large donations to the Hiller Aviation Museum, enough money was raised to acquire the double-deck nose section of a former British Airways Boeing 747. The aircraft was in storage in Roswell, N.M., where the nose was removed from the fuselage, sectioned to enable it to travel cross-country on a wide-load trailer, and delivered to the museum in San Carlos. There it was reassembled and restored by museum volunteers and skilled tradespeople from United Air Lines.

The SOFIA display is located in the seating area in the front of the

former business class section of the 747. Here visitors see an overview video that details SOFIA's history and the types of objects the observatory studies while in flight. There are also panels about the electromagnetic spectrum, why NASA built a flying observatory, the observatory's interior layout, how SOFIA inspires educators and the next generation of students through its Airborne Astronomy Ambassadors program, and information on other special-use 747s.

"The SOFIA interpretive station is an integral part of the museum's Boeing 747 exhibit," said Jon Welte, Hiller's Education Programs director. "It provides an easy-to-understand description of both the SOFIA aircraft and infrared astronomy, and illustrates a unique application of the Boeing 747 that is being used today as an important tool of scientific research."

To date, more than 75,000 visi-

tors and 11,000 school students have seen the SOFIA exhibit inside the 747 cockpit. Details about the Hiller Aviation Museum, its collection, and its educational programs can be found at: [www.hiller.org](http://www.hiller.org).

### Educational Opportunities

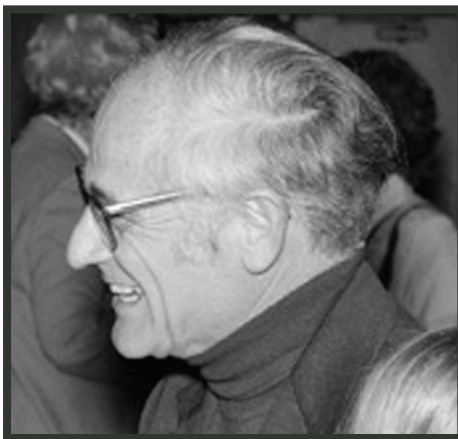
SOFIA offers a number of resources and programs for schools and educators, ranging from classroom speakers, to downloadable presentations and posters on the electromagnetic spectrum and SOFIA science, to the Airborne Astronomy Ambassadors program where educators are able to participate in SOFIA science during flights. Details on SOFIA's free educational resources can be found at [www.sofia.usra.edu](http://www.sofia.usra.edu) under the Education and Public Outreach tab.

## In memorium

Elliott D. Katzen was born in Baltimore on April 30, 1920, and earned his engineering degree from the University of Maryland in 1943 and his Masters degree from the University of Minnesota in 1947.

Katzen started at Ames in 1944, and his first major project was working with Jack Boyd and Charlie Frick in the 6-foot-by-6-foot wind tunnel on supersonic airflows over the 63 degree swept wing airfoil, which became a standard experimental model. He was part of one of the most dynamic groups ever in aerodynamics. Walter Vincenti was his branch chief and Harvey Allen his division chief. Al Eggers, Dean Chapman, R.T Jones, Doris Cohen, Milton van Dyke, John Spreiter, and Wally Davis were among the giants of that Ames High-Speed Research Division. In the early 1950s, Katzen did a series of tests, collaborating with Jack Nielsen and George Kaatari in the 1-foot-by-3-foot supersonic wind tunnel on interference at supersonic speeds between aircraft bodies and triangular wings of varying planforms.

This work provided, at the birth of supersonic flight, the same sort of aerodynamic parameter-variation catalog that the NACA airfoil series had so crucially provided at the birth of



low-speed flight. In 1955, he presented research conducted with Leland Jorgensen about the aerodynamics of missiles employing very thin "arrowhead" wings, work that provided a theoretical and empirical foundation for the design of new air-to-air and other short-range missiles. One of his wing planforms, refined in his work with R.T. Jones, was a highly swept shape that provided maximum lift-to-drag ratio at Mach 3. It was represented as the red chevron across the NASA logo to show that the new agency merged both aeronautics and space.

In the early 1960s, Katzen worked on lifting bodies, computing their trajectories as they might enter Earth's atmosphere to modulate their lift or

drag for optimum performance. He then moved into technical management, serving from 1962 to 1965 as Assistant Chief of the Gasdynamics Branch with Brad Wick, from 1966 to 1971, as Chief of the Hypersonic Aerodynamics Branch managing the 3.5 foot hypersonic wind tunnel and the Mach 50 helium tunnel. There he led a group conducting experiments on the aerodynamics of delta wing spacecraft during reentry that paved the way for the success of the space shuttle orbiter. In 1971, he filed a patent with two colleagues in Cleveland for an aeroshell encapsulating a plutonium-238 source that made radioisotope thermoelectric generators safe to launch into space.

This design was used on most NASA missions requiring nuclear power as a long-term electrical source. In the early 1970s, as Ames was the discerning place within aerodynamics for the new discipline of computational fluid dynamics at Ames, Katzen served as Technical Assistant to Astronautics Directors Glen Goodwin and Dean R. Chapman. Katzen retired in July 1975 after a 31-year career at Ames and passed away on Feb. 28, 2012.

He leaves behind an adored and adoring family: his wife Helene Fertig-Katzen, children Phillip, Sandra and Sheila, stepchildren Karen, Eric and Heidi, and ten grandchildren.

## NASA's Pleiades Supercomputer Collaborates with Kepler Mission

BY JILL DUNBAR

The discovery that planets orbit the sun in ellipses, rather than circles, was made by 16th century mathematician and astronomer Johannes Kepler using only the observations of his predecessors and his own unique calculations—without the aid of the yet-to-be-invented telescope and long before modern computers were dreamed of.

Today, with the help of one of NASA's largest space telescopes and its most powerful supercomputer, scientists are analyzing observational data gathered from that pioneering astronomer's modern-day namesake—the Kepler mission spacecraft—to search the skies for Earth's sister planets and make new astronomical discoveries.

Launched in March 2009 with the goal to explore the structure and diversity of planetary systems and search for other life-supporting planets, the Kepler spacecraft continuously monitors more than 150,000 stars in the Milky Way constellations of Cygnus and Lyra. Kepler's custom-designed photometer, a highly precise light sensor, will continue recording data from this single group of stars over the entire life of the mission.

"The Kepler Mission has already transformed our understanding of how planetary systems work," said Todd Klaus, lead software engineer in the Kepler Science Operations Center (SOC) at NASA's Ames Research Center, Mountain View, Calif. NASA's Pleiades supercomputer, operated by the NASA Advanced Supercomputing (NAS) Division at Ames, is an "essential component to make these planet searches possible," Klaus said.

As of Feb. 27, 2012, the Kepler team has found 2,321 planet candidates—so called because they have not yet been confirmed as true planets—orbiting 1,790 stars. Of these, 61 have been confirmed as bona fide planets.

The team has identified well over 200 Earth-size planet candidates and more than 900 that are smaller than twice Earth-size (super Earths). Of the 46 potential "sister planets" found in the habitable zone, the region in the planetary system where liquid water could exist, ten of these are near-Earth-size.

In September 2011, the team discovered the extraordinary existence of a planet orbiting two stars, called a circumbinary planet. Then, in January



Image credit: NASA/JPL-Caltech

*This artist's concept depicts a small planetary system. Astronomers using data from NASA's Kepler mission and ground-based telescopes recently confirmed that the system, called KOI-961, hosts the three smallest exoplanets known so far to orbit a star other than our sun. An exoplanet is a planet that resides outside of our solar system.*

2012, the team announced the discovery of two more double-star worlds, Kepler-34b and Kepler-35b. With the discovery of these three worlds, Kepler has also established a new class of planetary system.

Since then, the Kepler mission has discovered the first Earth-size planets (Kepler-20e and Kepler-20f) orbiting a sun-like star outside our solar system. While they are too close to their star to be in the habitable zone, they are the smallest exoplanets ever confirmed around a star like our sun. And just last month, astronomers using Kepler mission data discovered the three smallest planets yet detected orbiting a single star (called KOI-961) beyond our sun. The smallest of these planets is about the size of Mars.

Groundbreaking findings such as these are made possible by a 95-megapixel digital camera residing in the Kepler photometer—the largest digital camera to ever fly in space. Pixels are downloaded once a month and transferred to the SOC, where they are calibrated, combined to form light curves, corrected for systematic errors introduced in the photometer, and then searched for the signatures of transiting planets. When a planet passes (or transits) in front of its host

star, it blocks a small fraction of the light from that star that appears as a tiny, repeating pulse or beat. "By measuring the frequency of these beats and the amount of light blocked, we can detect the planets and calculate their size and orbital distance," Klaus explained.

This is where the computational power of the 112,896-core Pleiades supercomputer comes in. After the light curves are corrected, automated copies of the data are transmitted between the Kepler science processing and data analysis pipeline and Pleiades to run the transiting planet search and data validation, which are the most computationally intensive portions of the analyses.

"Pleiades has enabled us to do the computationally intensive planetary transit search on Kepler light curves for more than 200,000 observed stars in less than a day," said Klaus, noting that the same search would take more than a month to complete on Kepler computers. "Three years into the mission, each of these light curves already contains over 30,000 individual data points, which represent a significant computational challenge for the transit search. Pleiades makes this search possible," added Klaus.

## NASA Hosts Conrad Foundation's 2012 Spirit of Innovation Summit

BY RUTH MARLAIRE

Young innovators from around the world came to solve the challenges of the 21st century by creating breakthrough technologies for the Conrad Foundation's 2012 Spirit of Innovation Challenge. Competition finalists traveled to the Innovation Summit March 29-31, 2012 at NASA's Ames Research Center, Moffett Field, Calif. This year's categories for team entries were: aerospace exploration, clean energy, and health and nutrition.

The Spirit of Innovation Challenge is an annual Conrad Foundation

competition challenging students to solve real-world problems by creating commercially viable science and technology-based solutions to global challenges.

Fifteen finalist teams and their teachers were joined by well-known entrepreneurs, industry leaders, scientists and government officials for a three-day collaborative forum featuring student presentations, fireside chats, NASA tours, and interactive workshops, such as refurbishing a rocket. The event concluded with a ceremony awarding the coveted Pete Conrad

"Spirit of Innovation Award."

Supporters at the event included Director of NASA Ames Pete Worden, Google representative Vint Cerf, Apollo astronaut / entrepreneur Rusty Schweickart, entrepreneur, author and columnist for The Washington Post and BusinessWeek Gina Rudan, Chief executive officer of Flight of the Century, Inc. Chip Yates, ePilot and Chief Technologist, IDEO Rickson Sun, and Senior Director of Sustainable Development PepsiCo, Inc. Dan Bena.

## Ames Honored for 2011 NASA Government Invention of the Year

BY LUBNA SHIRAZI

NASA's Ames Research Center, Moffett Field, Calif., has won the 2011 NASA Government Invention of the Year award.

Ames received the award for developing Toughened Uni-piece Fibrous Reinforced Oxidation-Resistant Composite (TUFROC), a low-cost, lightweight, two-piece, thermal protection system (TPS) for use on space vehicles during atmospheric re-entry at hypersonic speed. TUFROC, a patented technology invented by David A. Stewart and Daniel B. Leiser of Ames, has been successfully demonstrated on the X-37B Reusable Launch Vehicle.

The technology consists of a high-temperature, impregnated carbonaceous cap mechanically attached to a lightweight fibrous silica-base material. The key innovations enable the integration of the surface treated carbon cap with the silica base insulation, which otherwise would fail from mechanical, chemical or thermal factors. TUFROC is the first lightweight, low-cost, flight-proven, reusable TPS with sustained operational capabilities at temperatures above 3,000 degrees Fahrenheit.

"It's truly an honor to win NASA's Government Invention of the Year award again in 2011," said Ames Director Pete Worden. "I am extremely proud of our advances in thermal protection systems. This award not only exemplifies the major contributions in TPS research at Ames over the past five decades, but signals that Ames will continue to lead the way in advancing entry systems for future NASA and commercial spacecraft."

Stewart and Leiser will be honored



NASA photo by Dominic Hart

(From Left) Dave Stewart, Daniel Leiser and Kristina Skokova pose with the Toughened Uni-piece Fibrous Reinforced Oxidation-Resistant Composite (TUFROC) model.

at the NASA Project Management Challenge Conference early next year.

Each NASA field center submits nominations for the awards, which are evaluated by NASA's Inventions and Contributions Board. The board determines which nominations qualify for each category, ranks the nominees, and makes recommendations to the NASA Office of the General Counsel for review and approval.

Ames previously won the NASA Government Invention of the Year award in 2007 for the invention of PICA and SIRCA Low-Density Resin Impregnated Ceramics. Ames also

received the award in 2008 for the invention of a high-speed 3-D laser scanner with real-time processing, and in 2010 for inventing aircraft traffic management methodologies which are implemented in the Future ATM (Air Traffic Management) Concepts Evaluation Tool, or FACET software that creates simulations for managing air traffic scenarios. Ames also won NASA Commercial Invention of the Year in 2010 for the Powder Handling Device for Analytical Instruments.



## Ames Ongoing Monthly Events Calendar

African American Advisory Group (AAAG) Mtg., last Tuesday of each month, 12 - 1 p.m., Bldg. N255 Rm 101C. POC: Rose King, ext. 4-3442.

Moffett Aikido Club, Monday and Wednesday evenings, 6:30 p.m., Bldg. 944. Aikido is a non-competitive, defensive martial art known as the "Way of Harmony." POC: Diane Pereda (650) 575-9070 or Robert Dean (650) 787-1007, email: mfaikido@aol.com

Ames Amateur Radio Club, third Thursday, of each month, 12 noon, N-T28 (across from N-255). POC: George Tucker, at ext. 4-2200.

Ames Bluegrass Club, every Tuesday from 11:30 a.m. to 1 p.m. in Bldg. 944. Players of all instruments and all levels are welcome, but we are particularly interested in experienced players willing to help improve the group's musical skills. POC: Bob Haberte at ext: 4-5494 or email: robert.m.haberte@nasa.gov

Ames Bocce Ball Club, Ames' newest Exchange-sponsored club is seeking members. POC: Mike Lindsay email: michael.c.lindsay@nasa.gov

Ames Bowling League, Homestead Lanes Thursdays at six p.m. Need substitute bowlers. Sign up questions: Steve Howard at ext. 4-4884.

Ames Contractor Council Mtg., first Wednesday of each month, 11 a.m., Bldg. N-200, Committee Room. POC: Herb Finger at ext. 4-6598.

Ames Federal Employees Union (AFEU) Mtg, third Wednesday each month, noon. Bldg. N-204, Rm. 101. Guests welcome. Check for occasional schedule changes at: <http://www.afeu.org>. POC: Paul K. Davis, ext. 4-5916.

Ames Golf Club, Members will have the opportunity to play about 13 tournaments per year at a variety of 18-hole golf courses in the Bay Area and Monterey area. POC: Barry Sullivan: Barry.T.Sullivan@nasa.gov.

Ames Green Team (formerly the Green Ames Working Group) meetings are held the first Tuesday of each month in N237, Room 101, from 10-11 a.m. For information, call Roger Ashbaugh, Ames Environmental Management Division, ext. 4-5660. <http://environmentalmanagement.arc.nasa.gov/reports/eo-13514.html>

The Hispanic Advisory Committee for Excellence (HACE) Mtg., first Thursday of each month, 11:30 a.m. - 12:30 p.m., Bldg. N-255, Rm. 101C. POC: Jeanette Zamora, jeanette.zamora-ortega-1@nasa.gov.

Ames Jazz Band Club, Bldg. 944, 5:30 p.m. - 7 p.m., POC: Ralph Bach, email: ralph.e.bach@nasa.gov

Jetstream Toastmasters, Mondays, 12 p.m. - 1 p.m., Bldg. N-269/Rm.179. POC: Tim Steiger, ext. 4-0195, tim.steiger@nasa.gov. Web: <http://jetstream.freetoasthost.com>

Ames Nimble Knitters Club, every Tuesday at 11:30 a.m., Bldg. N210/Rm 141. POC: Rosalyn Jung, knifan2@yahoo.com or Diane Alexander at ext. 4-3140. URL: <http://knit.arc.nasa.gov>

Ames Roller Hockey Club, meets daily from noon to 1 p.m. at rink on north end of the 80-foot-by-120-foot wind tunnel, Players should have skating experience and wear protective equipment. POC: Alex Nichol, alexander.p.nichol@nasa.gov

Ames Safety Committee, third Thursday of each month, 10 a.m. - 11 a.m., Bldg. N-237, Rm. 200. POC: John Livacich, jlivacich@mail.arc.nasa.gov, ext. 4-3243.

Women's Influence Network (WIN), first Wednesday of each month, Bldg. 241 room 237, 11:30 - 12:30 p.m., POC: Elena Serna, elena.serna@nasa.gov

## Exchange Information

Information about products, services and opportunities provided to the employee and contractor community by the Ames Exchange Council. Visit the web site at: <http://exchange.arc.nasa.gov>

**Beyond Galileo Gift Shop N-235 in the cafeteria , 8 a.m. to 2 p.m., ext. 4-6873**

**Visitor Center Gift Shop (White Tent N-943-A, Tues-Fri, 10 a.m. to 4 p.m., Sat. - Sun, 12 - 4 p.m., ext. 4--5412**

Remember to purchase your baby shower, birthday, holiday gifts at Ames' two gift shops!

**Mega Bites Cafeteria N-235, 6 a.m. to 2 p.m., ext. 4-5969/Catering ext. 4-2161**

**Barcelona Café Bldg. 3, 6:30 a.m. to 2 p.m., ext. 4-4948/Catering ext. 4-4948**

See daily menus at: <http://exchange>.

**Moffett Field Golf Club with 'Tee minus 1' Grill and Sports Bar.** Catering available. Call (650) 603-8026. Extended Happy Hour Thursdays, \$5 and \$6 pitchers of beer starting at 4 p.m. to 8:30 p.m.

**RV Lots Available Call to reserve a space at (650) 603-7100/01.**

Civilian/Contractors, \$50/mo; military \$25/mo

**NASA Lodge (N-19) 603-7100**

Where to stay when you're too tired to drive home? What about the lodge?! Two types of rooms: Bldg. 19 (43 rooms), rate: \$55/night (\$5 ea add'l adult); Bldg. 583 (150 rooms), rate: \$45/night (\$5 ea. add'l adult)

**Ames Swim Center (N-109) 603-8025**

Closed for repairs, for updates visit <http://amesexchange.arc.nasa.gov/swim/index.html> The pool is heated year round! The pool is currently

Reservations for Chase Park call ext. 4-4948  
Reservations for ARC Park call ext. 4-5969

## Ames Emergency Announcements

To hear the centerwide status recording, call (650) 604-9999 for information announcements and emergency instructions for Ames employees. You can also listen to 1700 KHz AM radio for the same information.

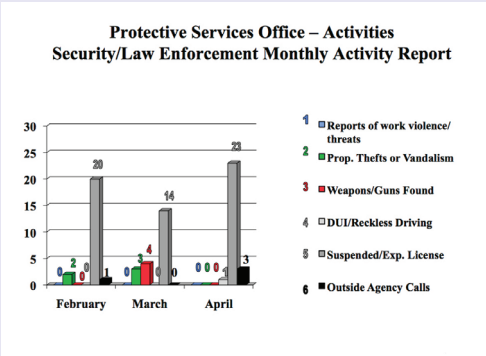
## Ames Cat Network

The Ames Cat Network needs help finding homes for cats trapped at Moffett. They range from feral to abandoned/lost pets. Tested, altered and inoculated. Call Iris at ext. 4-5824 if you or someone you know are interested in fostering or adopting a cat.

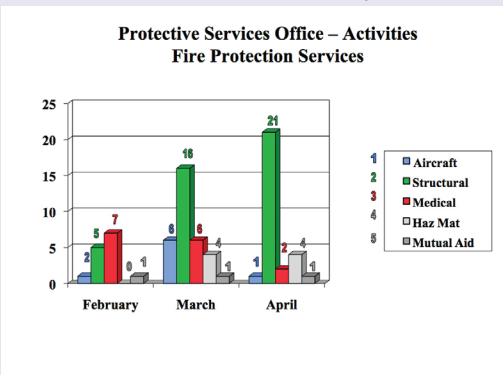
## Protective Services monthly activity

A statistical summary of activities of the Protective Service Division's Security / Law Enforcement and Fire Protection Services units for the month of March 2012 is shown below.

### Security / Law Enforcement Activity



### Fire Protection Activity



## Ames Hosts Inaugural Small Business Counseling Session

BY GREG HITE

The Ames Contractor Council, in conjunction with the Ames Small Business Office, recently held its inaugural Small Business Joint Initiative Counseling Session.

The event showcased woman-owned small businesses specializing in physical engineering, life sciences, environmental activities, financial activities, high-end computing, networking, and construction.

It also provided an opportunity to network and learn about NASA Ames' and Small Business Administration's programs.

Audience members included civil servants and representatives from prime contractors who had the opportunity to meet with 39 woman-owned small businesses.

During their presentations, Ames Associate Center Director Deb Feng and Ames Procurement Officer Kelly Kaplan encouraged the fostering of relationships between large and small businesses.

San Francisco Small Business Administration (SBA) Procurement Center Representative Paul Chann also was a featured presenter at the meeting.

Attendees listened to company presentations and visited information booths highlighting each company's capabilities and qualifications.

The Ames Contractor Council Small Business Committee is looking forward to hosting another event in August 2012 focusing on veteran-owned and HubZone small businesses.



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Ames Research Center  
Moffett Field, CA 94035-1000



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