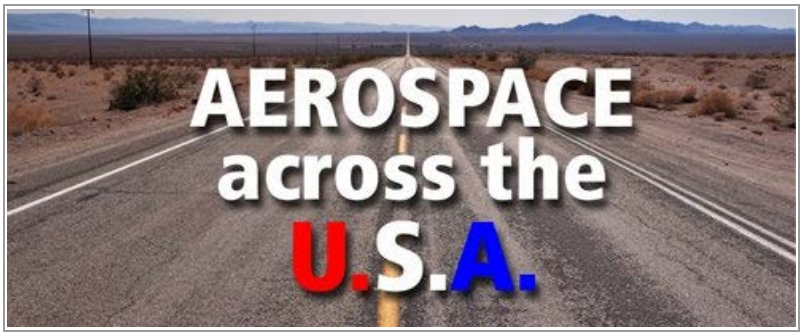
AEROSPACE Orbiter

Print March Article Archive

Article Archive for March 1st to March 31st.
Generated on April 2, 2013, 10:40 pm

Aerospace Across the U.S.A. — NASA Ames



Posted March 29, 2013 · Feature

This Orbiter article about the NASA Ames office of The Aerospace Corporation kicks off an intermittent series that will feature people and projects at the smaller Aerospace locations spread across the country, often at customer locations.

By Heather Golden

A project supported by Aerospace at the NASA Ames Research Center in Mountain View, Calif. means the United States is one step closer to putting a person on the moon — and keeping him or her there.

The five-person Aerospace team recently supported integration and testing of NASA's Lunar Atmosphere Dust Environment Explorer (LADEE), set to launch in August.

NASA originally invited Aerospace onto Ames five years ago to support an early-stage spacecraft and mission design work. Now, the same group's focus is almost entirely on LADEE.

Ames Office At A Glance:

- **Number of employees – Five.**
- **Major customer – NASA.**
- **Location – Mountain View, Calif.**
- **Location type – Embedded with customer.**
- **Nearest major city – San Jose and San Francisco.**
- **"Top dog" – Jon Neff, Ph.D., Senior Project Leader**
- **"I wanted to be an astronaut when I was a kid. I guess I never grew out of it." – Dr. Jon Neff**

LADEE will orbit the moon at a 50-kilometer altitude to investigate lunar dust and residual atmosphere. NASA made critical design changes to LADEE's S-band transceiver engineering unit, based on Aerospace recommendations, that incorporated a digital automatic gain control (AGC), instead of the original analog AGC. It was Chester Wolejsza, an Aerospace senior engineering specialist, who discovered the gain of the analog AGC circuits was "falling off at lower received power levels" and suggested using the digital version instead, said Dr. Jon Neff, the Aerospace team's senior project leader at the NASA Ames facility.

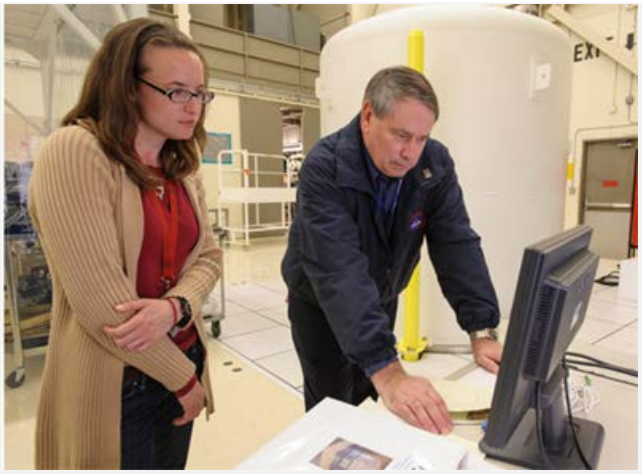
The LADEE project first came to life during the most recent Bush administration, when space exploration was high on the list of national priorities. Its mission was to study the moon's environment before and after large-scale human interaction, such as in the case of establishing a permanent moon base.

Even though national priorities have changed, LADEE is still going to answer questions the scientific community has been asking since the United States' last moon landing, said Neff.

"The Apollo astronauts saw the dust several kilometers above the surface," he said. "They didn't have the equipment with them to test it. It was tantalizing."

LADEE's research is about more than simply wanting to know what the Apollo astronauts saw glowing above the moon.

"Most people think of the moon as having no atmosphere, as being a complete



NASA Ames Research Center Director S. Pete Worden reviews LADEE thermal vacuum test data with Alisa Hawkins of the Aerospace NASA Programs Division. (Photo courtesy NASA.)

vacuum," Neff added. "But, in fact, there are little particles of dust that constitute a very thin atmosphere."

"We want to understand [the atmosphere] for the sake of future missions if we go back," Neff said. "If we do ever build a base, we're going to want to know more about it."

For LADEE to be a success, NASA still needs government approval to use a specific spectrum of radio frequencies to transmit data back and forth to LADEE. Aerospace engineers are helping make this a reality. The same Aerospace support is concurrently being provided for another NASA project, the Interface Region Imaging Spectrograph (IRIS).

"Spectrum engineering is the art and science of identifying the appropriate spectrum for a project," Neff said. "It's a combination of science and engineering, and part of it is understanding the regulations, too.

LADEE will also carry a Laser Communications Relay Demonstration (LCRD) package, Neff said. The system will demonstrate how laser communication, or lasercom, can be used to transmit more data at much higher speeds than what is currently possible using a standard radio frequency system. Lasercom "will enable NASA, or other government agencies and the commercial space industry to undertake future, complex space missions requiring increased data rates, or decreased mass, size and power burdens for communication," according to a recent NASA press release.

With LADEE's upcoming launch fast approaching, Neff's team is always on the lookout for more ways to lend NASA their expertise.

Both NASA Ames and Aerospace have active cube satellite programs, although the two organizations do not currently conduct joint CubeSat missions. But, Neff said it is a prime example of the "common interests" the two share.

"Aerospace is making a real contribution to the nation in our work for NASA," Neff said. "We are constantly exploring additional avenues for collaborative research operations and activities. Our civil space customers greatly value our expertise.

"We offer a breadth and depth of capability that is hard to find anywhere else," he added.

Taking in the local atmosphere

The Ames facility, located in the heart of Silicon Valley, was founded in December 1939 as a facility of the National Advisory Committee for Aeronautics. It became a part of NASA nearly 20 years later, in 1958, when NASA was formed.

The area has been referred to as a "research cluster," and Ames is surrounded by a multitude of laboratories, high-tech companies and universities, all focused on the advancement of technology.

Many of the companies are also entrepreneurial in nature, and that spirit of innovation is contagious, Neff said.

However, life at Ames is not all about the workload for the Aerospace team. When they are not helping keep space missions on track and successful, the group relaxes with a little quality recreational time together.

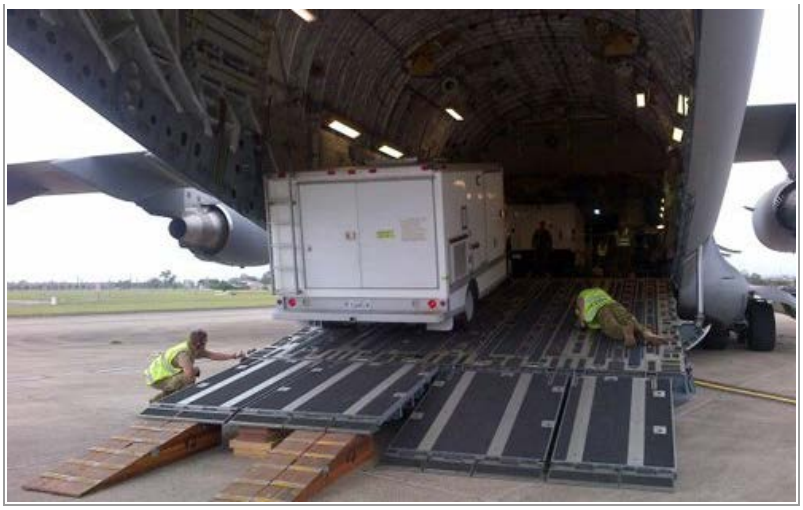
"We meet for lunch every week at the Tied House, a restaurant in Mountain View," Neff said. "This weekend a couple of folks are coming to my place for a house concert performed by some non-Aerospace friends who are folk singers."

Still, the time spent at the office surpasses the time away from it in many ways. The team views their work as researchers and engineers as part of the fun, too. Neff said he particularly enjoys the "creative aspect of engineering: developing new concepts and seeing them start to take shape."

"Like many people I wanted to be an astronaut when I was a kid. I guess I never grew out of it," he said.

To learn more about the projects or life at NASA Ames, check out http://www.nasa.gov/centers/ames.

Aerospace Laser Beacons Light Up U.S. Satellites Around the World



Aerospace Image

Royal Australian Air Force personnel carefully maneuver a mobile van equipped with an Aerospace laser beacon.

Posted March 27, 2013 · Feature · By Matthew Kivel

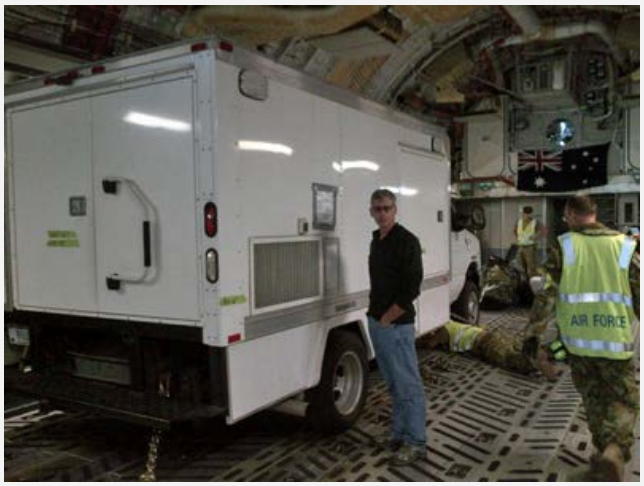
Aerospace scientist Steven Beck recently found himself aboard a Royal Australian Air Force (RAAF) C-17 headed for a remote region on the Indian Ocean coast of Australia. Seated behind two Australian pilots and next to his Aerospace colleague Michael Williams, Beck felt as though he was traveling to the farthest reaches of the Earth — and in many respects, he was.

As a leading researcher and developer of laser beacon technology, such excursions have grown more and more commonplace for Beck as the demand for on-orbit sensor calibration has increased. His initial trip involved the transportation of two of Aerospace's mobile beacons— via the RAAF C-17— from Sydney to the coastal testing location. The Aerospace laser beacons will be stationed for nearly three months of sensor testing in Western Australia.

Laser beacons are used to illuminate on-orbit infrared (IR) sensors such as those aboard Space Based Infrared System (SBIRS) satellites for calibration and testing purposes. Essentially, the beacon provides a static IR source on the ground at a precisely known location on the face of the Earth. As a result, when the beacon's narrow laser beam reaches the overhead persistent infrared (OPIR) sensor, the sensor can detect that point source on the ground and be calibrated by using that specific, known location as reference.

The Aerospace laser beacon program has operated since 1971— when it was originally developed to support the first Defense Satellite Program (DSP) sensor. "Early on, we spent a long time using hydrogen fluoride lasers, which were enormous — they occupied whole rooms," said Beck, who has worked at Aerospace for nearly 30 years. "Through the years, the need for mobile field-deployable beacon systems has driven technology developments … The current beacons are the most compact, rugged, and capable yet produced. They are housed in a mobile van and employ a diode-pumped solid-state laser designed in-house. The laser produces one watt of laser output power from a rugged package the size of a stick of butter."

Since the OPIR sensors are in geosynchronous orbit — an orbit synchronized with the Earth's rotational period— they are pinned to a specific location and only accessible in certain geographical locations. As a result, beacon mobility is essential to accessing the OPIR sensors regardless of their divergent, geosynchronous locations. The modern, transportable beacons allow for calibration trips to any number of locations around the globe. Western Australia is the most recent of these beacon-related journeys, but Aerospace is preparing for a number of new projects as well, including the first remotely operated beacon, which will be tested in the Mojave Desert at Edwards Air Force Base.



Steven Beck in the cargo bay of a Royal Australian Air Force C-17 next to an Aerospace mobile van equipped with a laser beacon. (Aerospace Image)

As cheaper and more efficient beacons are designed, the potential for new applications of the technology increases greatly. Beck is particularly enthusiastic about the role of laser beacons as potential quantifiers of carbon dioxide.

"Knowing how much carbon dioxide is in the atmosphere is important for measuring climate change and global warming," said Beck. "You can take a laser beacon, on the ground, and shine it up to a satellite on the other side of the atmosphere. And then if you can tune the laser frequency to either on or off the carbon dioxide absorption you can measure how much carbon dioxide lies in the path of that laser beam."

In a wider sense, Beck sees the carbon dioxide measuring application as a potential instrument for political enforcement. "If we can make these laser beacons very small and cheap, which we think we can do, they could be proliferated globally," said Beck. "And they could serve as monitors and potentially as devices which could be used to verify treaties that, in principal, may happen in the future for carbon production. This is a method that isn't easy to tamper with and is not expensive and not intrusive. We think that this is a possible concept for a global monitoring system for carbon dioxide in the atmosphere."

In fact, Beck and colleague Pat Smith have recently submitted a patent that proposes using laser beacons and on-orbit sensors to measure a variety of green house gases in the atmosphere.

The versatile nature of beacon technology lends itself to an ever-expanding amount of practical applications. Beck and his Aerospace team members seem determined to discover and push laser beacon technology to its next phase of widespread, technological relevance.

Aerospace Reaches Out to Cyber Patriots

Aerospace employees Brad Wilkins, straight ahead left, and John Nilles, help students prepare for the recent CyberPatriot national competition.

Posted March 25, 2013 · Feature · By Heather Golden

The Aerospace Corporation recently joined with the Los Angeles Unified School District's "Beyond the Bell" program to support four Los Angeles-area teams at this year's CyberPatriot final competition at the Air Force Association's CyberFutures Conference in National Harbor, Md., earlier this month.

Three employees, Bradford Wilkins, John Nilles, and Michael Jett, lent their expertise to the teams as mentors and worked alongside coaches provided by each individual school represented.

"We worked with four teams from the LAUSD as they prepared for the final competition," said Nilles, senior engineering specialist, Cyber Security Subdivision. "There were 12 finalists from a starting field of approximately 1,200 teams. Competition was stiff."

The teams were from the Edward Roybal Learning Center, Franklin High School, and two teams from North Hollywood High School. The corporation got involved through the efforts of board of trustees member retired Air Force Lt. Gen. George Muellner.

The CyberPatriot program's goal is to garner interest for and help prepare high school students for future careers in cyber security and other STEM-related fields. Participating students gain an understanding of how critical cyber security is to the nation's future. They also learn the basics of computer components, computer terminology and theory, networking, and computer forensics, through a series of college-level courses. There is a potential to have already earned up to 24 college credit hours by the time they graduate high school.

"It is incredible to think that the skills John (Nilles) and I had to learn in the workforce are now part of the curriculum in many schools," said Wilkins, a member of the technical staff, Space Cyber Software and Tools. "Students who choose careers in cyber security will be well prepared as a result of experiences like this."

Aerospace has an interest in helping with the long-term development of talent in these cyber security and STEM areas.

Members of the four teams supported by Aerospace mentors and their coaches. At far right is Aerospace board of trustees member retired Air Force Lt. Gen. George Muellner. Second from right is John Nilles.

"As a future employer of today's high school student, The Aerospace Corporation is acutely aware of the need to create a source of diverse, skilled professionals poised for success in the 21st century workforce," said Sabrina Steele, principal director, Corporate Communications Directorate. "Through our interactions with the BTB students, we have observed that they gain critical foundational computing skills … that will ultimately enhance their employability."

The CyberPatriot's annual competition is the largest national high school cyber defense competition. Each of the competing teams consists of five students, and up to five alternates, and must include one coach from the school. All students must be at least 13 years old, and enrolled in grades 9-12. Mentors or technical advisors may also be utilized, as was the case with Wilkins, Nilles and Jett.

"We had a great time working with the teams," Nilles said. "The students were impressive and clearly enjoying themselves."

Get an inside view of the competition by checking out USA Today's profile of Franklin High School's team at http://www.youtube.com/watch?v=yMTPXmKU8L8.

Go Atlas!

Posted March 20, 2013 · Feature

Slicing through a clear late-afternoon Florida sky, the second Space Based Infrared System Geosynchronous satellite (SBIRS GEO-2) rode a 19-story Atlas V rocket into orbit on Tuesday, March 19.

"I'm very pleased to announce the successful launch of the Atlas V and its SBIRS GEO-2 payload," said Ray Johnson, Aerospace vice president of Space Launch Operations, reporting from Cape

Photo courtesy of United Launch Alliance, LLC.

An Atlas V rocket lifts the SBIRS GEO-2 satellite to orbit on March 19.

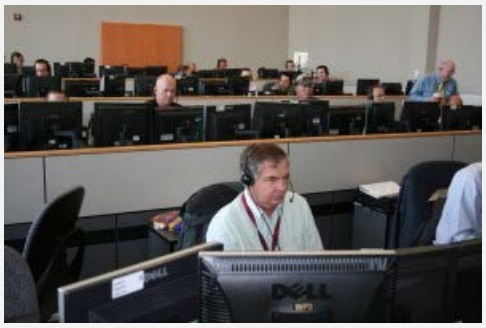
Canaveral on Tuesday evening. “After a nearly flawless countdown, the vehicle lifted off of Space Launch Complex 41 here at the Cape right at the opening of the launch window at 5:21 p.m. Eastern time. We have completed the quick-look data review, and there were no significant launch vehicle issues. I want to congratulate the Atlas team and the SBIRS team for this outstanding success.”

It was the fourth Atlas V launch in four months, the fastest launch pace in the history of the Atlas V program. Each of the four Atlas V missions since December have lifted off in the opening seconds of their launch windows.

About a hundred people from the Air Force Infrared Space Systems Directorate gathered in the Gordon Conference Center to watch the liftoff. A captain in the directorate led the crowd in the “infrared cheer,” shouting “Go Big Red.” The crowd responded “Overhead! Infrared!”

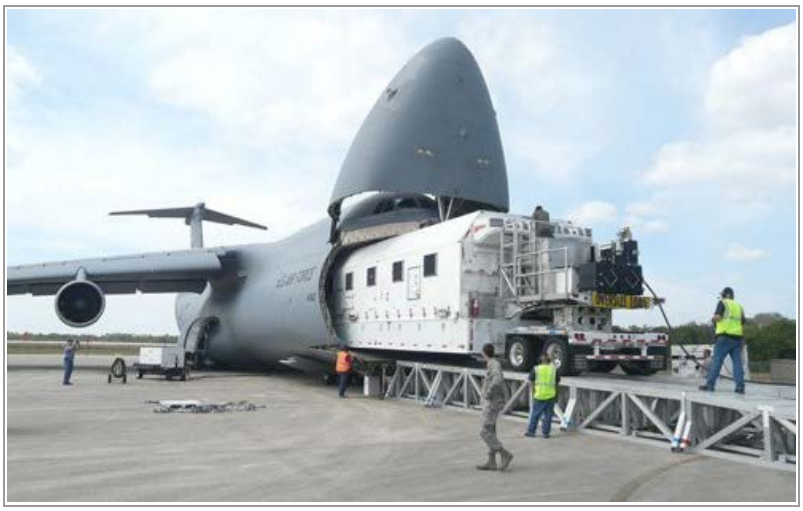
The SBIRS satellites, equipped with staring and scanning sensors, will upgrade the U.S. military’s infrared surveillance system that continuously scans the globe looking for the heat signature of missile launches.

Aerospace provided complete mission assurance support for the spacecraft and launch vehicle.



Aerospace employees worked alongside Air Force and United Launch Alliance representatives in the Eastern Range launch control support center during the Atlas V launch on March 19. (Photo by Bill Uttenweiler.)

WGS Takes Its Last Ride on a C-5



Thomas Hopp

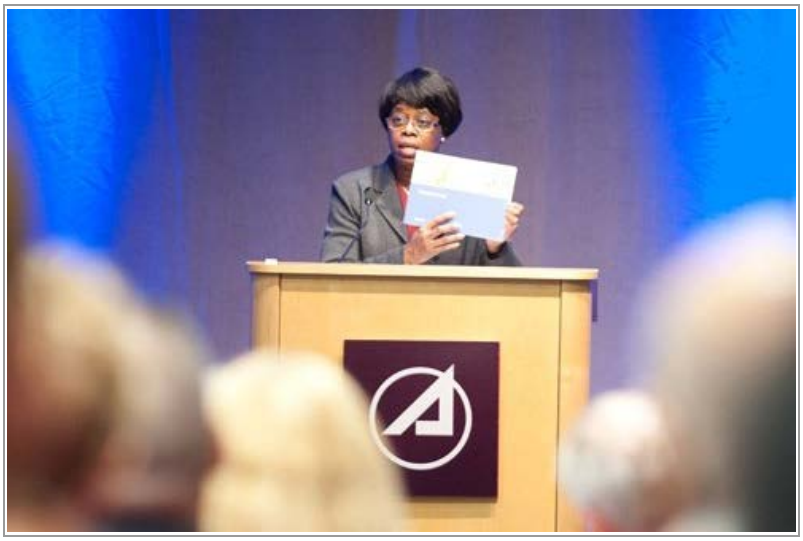
Posted March 14, 2013 · Feature

The WGS-5 satellite was successfully shipped to the Cape on board a C-5 aircraft, arriving on March 9, to begin its processing for a planned May 8 launch on a Delta IV (5,4) rocket from Cape Canaveral AFS. The Wideband Global Satellites are high-capacity military communications satellites built in El Segundo by Boeing Satellite Systems.

WGS-5 was the last WGS satellite scheduled to fly from Los Angeles International Airport to the Cape on a C-5. The next five WGS will take the cross-country trip aboard the Long Beach-built C-17.

Workers unload the WGS-5 satellite from a C-5 transport at Cape Canaveral on March 9.

CEO'S Report Addresses Sequestration



Eric Hamburg

Dr. Wanda Austin shows the new annual report during her CEO's Report to Employees from Chantilly.

Posted March 12, 2013 · Feature · By Lindsay Chaney

In her second CEO's Report to Employees of the fiscal year, Dr. Wanda Austin reassured employees that the company is well-prepared to manage through sequestration.

Speaking from the Campbell auditorium in Chantilly, Austin returned time and again to the subject of sequestration — the across-the-board federal budget cuts that went into effect on March 1 — during her 40-minute address. Her message was consistent — "We're not sure yet what effect sequestration might have on specific programs. However, we are in a strong position due to our advance planning."

Specifically, Austin said there are no plans at this time for another companywide reduction in force. She also addressed the recent merit increase, stating that all merit increases have been issued except for non-supervisory members of the technical staff (MTS). She reported that negotiations with the Aerospace Professional Staff Association (APSA) are complete and that non-supervisory MTS increases will be effective March 16.

"Our focus now is to redouble our efforts to provide the very best support we can to our customers, as they deal with their own sequestration issues," she said.

Austin announced two new board of trustee members, who took office on March 7. Dr. Bonnie Dunbar is the M.D. Anderson Professor of Mechanical and Biomedical Engineering at the University of Houston. She is also a former NASA astronaut, and a veteran of five space shuttle flights with more than 50 days in space. Keith Hall retired as a senior vice president at Booz Allen Hamilton in 2009, prior to which he served as director of the National Reconnaissance Office from 1996 to 2001. Concurrently with his NRO service, he was assistant secretary of the Air Force for space.

The Aerospace president and CEO recapped three successful launches during the quarter for which Aerospace had considerable involvement, but not full mission assurance accountability responsibilities. She noted that between now and the end of the fiscal year, the company will be involved with eight more launches.

The audience applauds during the March 12 CEO's Report to Employees. (**Photo by Eric Hamburg**)

In other news, the Navy and the Missile Defense Agency conducted a successful missile intercept test on Feb. 13 using data from the Space Tracking and Surveillance System (STSS). Aerospace has provided support to every phase of the STSS program since its inception.

The Feb. 13 test was the first demonstration of space-based sensors providing mid-course fire-control tracking data to the Aegis weapon system to enable target destruction.

In news from Civil and Commercial Operations, Austin announced that the Department of Energy has asked for Aerospace support on two projects for the National Nuclear Security Administration (NNSA). The first is to define what a systems engineering and integration organization should look like, incorporating government workers, contractors, and FFRDC personnel. Aerospace is expected to play a major role as the organization develops.

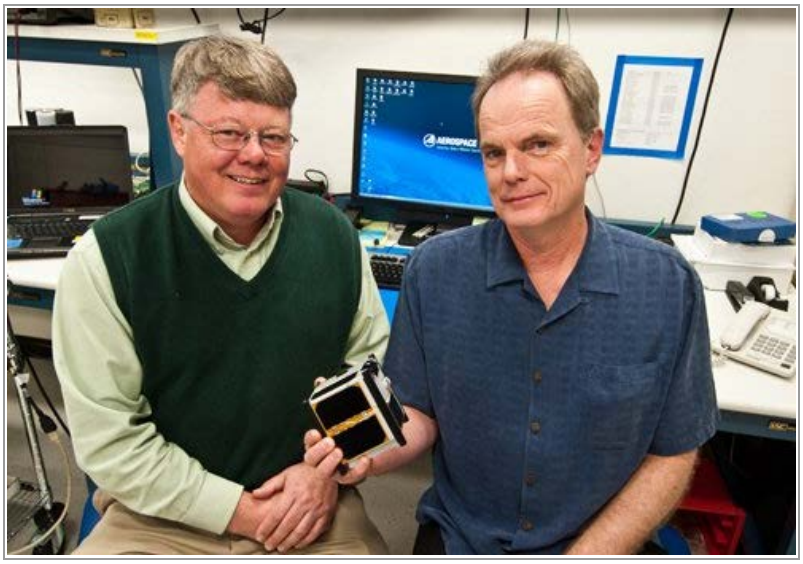
On the second project, the NNSA has asked Aerospace, along with the Lawrence Livermore National Laboratories and the Air Force Institute of Technology, to provide independent verification, validation, and accreditation for a new simulation capability. The simulation will assess the relative performance of new space-based nuclear detection sensors and associated spacecraft constellation architectures.

Following her address, Austin answered questions posed by employees, both live and those that had been submitted ahead of time. A separate Orbiter story contains all questions and answers.

Click below to view a video of the complete CEO's Report to Employees.

Click here
to read a transcript of the CEO's Report to Employees.

Cruise Control for Small Satellites



Elisa Haber

Dr. Siegfried Janson, left, and Dr. Richard Welle, with a CubeSat similar to those they will launch in 2015.

Posted March 5, 2013 · Feature · By Matthew Kivel

An Aerospace proposal is one of three selected by NASA for its Edison Small Satellites Demonstration Missions Program. The proposal, submitted by Dr. Siegfried Janson and Dr. Richard Welle, is entitled "Integrated Optical Communications and Proximity Sensors for Cubesats," and was awarded $3.6 million for design, development, and a launch in 2015.

The proposal focuses on three performance upgrades to traditional CubeSats: a high-speed laser communications system, a low-cost automotive radar normally used in adaptive cruise control, and optical flow sensors for cross-track motion detection, utilizing the chip in an optical computer mouse.

CubeSats are small, cube-shaped spacecraft, a little larger than a Rubik's cube, that are used for various types of space research and benefit from relatively low production and launch costs. The Aerospace Small Satellites team has been at the forefront of CubeSat innovation over the past decade and Janson and Welle's winning proposal benefited greatly from the extensive research the team had previously conducted at Aerospace. "We were the cheapest of the three [proposals], which makes me a little nervous," laughs Janson. "But that's based on the fact that we have a lot of experience and all the work we've done already … all the flights we've had."

Two Satellites

In terms of the proposed space mission, Janson and Welle are planning for the development of two, nearly identical CubeSats, which will be outfitted with a laser communications system, automotive radars and optical flow sensors. By launching two CubeSats, the Aerospace team will have an extra layer of redundancy in case of technical malfunctions or in-space anomalies. The CubeSats will also be able to observe and document one another while performing crucial maneuvers in orbit. Redundancy hasn't been the norm in the development of traditional spacecraft systems, but with the low cost of CubeSat production, it simply isn't much more expensive to fly two spacecraft.

Janson and Welle's innovative proposal is anchored by its development of a laser communications system that will allow CubeSat data to be retrieved at a substantially faster rate than current radio frequency (RF) systems allow. "One of the bottlenecks with CubeSats, and actually all satellites in general now, is that you can store far more information on a satellite than you can download from it," says Janson. "You could fit 10 terabytes on a CubeSat and it would take you probably one hundred years to download from orbit using our current CubeSat communications schemes … it's only when you go up to the higher frequencies that you can get higher data rates. With laser com, we're going to light, which is many orders of magnitude higher than any RF communications." The improved communication system will allow for complex data collection to take place in a timely and efficient manner. In addition, Janson and Welle's CubeSats will be the smallest to make use of such a system in orbit.

Another enhancement that the Aerospace team plans to implement is a radar system that will aid the CubeSats in proximity operations while on orbit. The radar system is based on a sensor that is currently being used in automobiles for adaptive cruise control. "They [automotive radars] haven't been flown in space, but they'd be great for space," says Janson. "These things will track 32 objects in front of you, up to a range of 250 meters and tell you what angle they're at, how far away they are, and what the closing speeds are." By implementing the radar system, a CubeSat can maneuver with a much higher degree of relative precision than with the current GPS systems. "We realized that one of the tricks to proximity operations is being able to know, with some degree of precision, where you are relative to a nearby satellite," says Welle. "We can use GPS to get close and then we can use the automotive radar to really pin it down."

Radar System

The use of an off-the-shelf device like automotive radar for complex procedures in space shows the versatility of the CubeSat model. By taking existing technology and recontextualizing it, scientists are able to make upgrades and innovations without the financial strain and initial costs that come with ground-up development. For the third component of their proposal, Janson and Welle will make new use of a simple, home computer optical mouse chip (i.e. the mousepad sensor found on the bottom of a computer mouse). By using a larger lens, removing the chip's illuminator and reprogramming the chip to recognize Earth as its "mouse pad," Janson and Welle were able to discern a CubeSat's direction of travel merely by recognizing cloud and land formations. For the Edison proposal, the optical sensors will be used by each CubeSat to track one another while on orbit. This simple optical tracking system was invented at Aerospace by Janson and Jerry Fuller.

With each passing year, more CubeSats are flown for a host of different reasons. In the short term, Janson sees small spacecraft serving primarily as technology test beds and auxiliary units for larger spacecraft. As a tool for research, the CubeSat has become an invaluable commodity. “We can make mistakes and learn from them and do it again,” says Welle. “The consequences aren’t dire and the turnaround time is very short. We can fly something, make a mistake and re-fly it in a year.” For the space tech community, CubeSats are simply too convenient to ignore.

March Obituaries

Posted March 1, 2013 · In Memoriam

Sincere sympathy is extended to the families of:

- **Bernadette Lister,** secretary admin, hired July 11, 1970, retired June 1, 2012, died Feb. 19.
- **Kenneth Ludlow,** engineering manager, hired April 9, 1962, retired June 1, 1987, died Feb. 15.
- **Garmt Melles,** member of the technical staff, hired Oct. 15, 1979, retired May 1, 1993, died Feb. 9.
- **Ralph Parks,** office of the technical staff, hired May 6, 1963, retired Jan. 1, 1972, died Jan. 22.
- **Erwin Retzlaff,** member of the technical staff, hired Jan. 9, 1962, retired Aug. 1, 1985, died Feb. 8.
- **Jerry Smith,** administrative assistant, hired Feb. 23, 1982, retired July 1, 1994, died Jan. 29.

To notify Aerospace of a death and have it included in the Orbiter, please contact Cynthia Evans in Human Resources at 310-336-5806.

March Notes

Posted March 1, 2013 · In Appreciation

Notes of appreciation to fellow employees and Aerospace for thoughtfulness and sympathy have been received from:

- **Shelly Brosnan,** for the recent passing of her husband, Michael Brosnan.
- **Howard Carver,** for the recent passing of his partner, John Rowlands.
- **Patricia Green,** for the recent passing of her mother, Pauline Green.
- **Anthony Salvaggio,** for the recent passing of his father, Anthony Salvaggio.
- **Frank Wong,** for the recent passing of his father, Frank L. Wong.
- **Linda Yarbrough and Sharon Whitehead,** for the recent passing of their brother, Donald Sharpley.

To submit a note of appreciation to Aerospace, please contact Valerie Jackson in Human Resources at 310-336-0891.

March Anniversaries

Posted March 1, 2013 · Anniversaries

30 YEARS

Engineering and Technology Group: April Gillam, Richard Mahoney, John Nocerino

National Systems Group: Mary-Alice Cohen, Ross Kobayashi

Space Systems Group: Alfred Britting, Mark Byers

25 YEARS

Engineering and Technology Group: Celina Gomez, Carmelita Johnson

Space Systems Group: John Bohlson

20 YEARS

Engineering and Technology Group: Kim Bell

National Systems Group: John Maguire

Space Systems Group: Kristine Maine, Sushila Menezes

Systems Planning, Engineering, and Quality: Wayne Bobak

15 YEARS

Engineering and Technology Group: Edgar Barnachea, Mary Coyle, Thanh Hoang, Coreen Moncrief

National Systems Group: Steven Frimel, Hae Sim Park, Janet Spotts

Operations and Support Group: Brenda Hardy, June Moton-Anderson

Space Systems Group: Teresita Almacen, Michael Odaka

10 YEARS

Civil and Commercial Operations: Guy Thayer

Engineering and Technology Group: John Desain, John Evans, Robert Feeley, Daniel Hernandez, Mark Lange, Anh Tu

National Systems Group: Joseph Brady, Steven Pearson

Space Systems Group: Timothy Abel, Donald Davies, Hamid Haque, Matthew Ogan, Rebecca Reines, Anthony Salvaggio

5 YEARS

Engineering and Technology Group: Catherine Allen, William Coonce, Lisa Drexinger, Gregory Henning, Mai Lee, Holleh Neyestanki, David Nguyen, Frederick Roberts, Joel Schulman, Gregory Scott, Amelia Thomas, David Vargas, Hon Fai Vuong

Operations and Support Group: Edward Diamond, Joseph Hidalgo

Space Systems Group: Dennis Lileikis

Systems Planning, Engineering, and Quality: Ronald Jackson, James Skinner

End of Archive