

# Spaceport News

John F. Kennedy Space Center - America's gateway to the universe



## Boeing unveils CST-100 mock-up

**By Rebecca Regan**  
*Spaceport News*

Two NASA astronauts conducted flight suit evaluations inside a test version of The Boeing Company's CST-100 spacecraft July 22, the first time the world got a glimpse of the crew capsule's fully outfitted interior.

"The astronauts always enjoy getting out and looking at the vehicles and sharing their experiences with these commercial providers," said Kathy Lueders, deputy manager of NASA's Commercial Crew Program (CCP).

Boeing is one of three American companies working with CCP to develop safe, reliable and cost-effective crew transportation systems during NASA's Commercial Crew Integrated Capability (CCiCap) initiative, which is intended to make commercial human spaceflight services available for government and commercial customers.

During two four-hour sessions, astronauts Serena Aunon and Randy Bresnik put on launch-and-entry suits and then individually tested their maneuverability inside the capsule. Meanwhile, Boeing engineers monitored communications,



*CLICK ON PHOTO*

NASA/ Robert Markowitz

The Boeing Company's CST-100 spacecraft features LED lighting and tablet technology. To watch NASA astronauts Serena Aunon and Randy Bresnik as they maneuver in the spacecraft, click the photo.

equipment and ergonomics.

"These are our customers. They're the ones who will take our spacecraft into flight, and if we're not building it the way they want it, we're doing something wrong," said Chris Ferguson, director of Boeing's Crew and Mission Operations and a former NASA astronaut.

The CST-100 test vehicle was optimized to seat five crew members, but the spacecraft could accommodate up to seven or a mix of crew and cargo. While the spacecraft may resemble Boeing's heritage Apollo-era capsules from an exterior perspective, its interior is a reflection of modern technology. From the ambient sky blue LED lighting and tablet technology, the company ensured the CST-100 is a modern spacecraft.

"What you're not going to find is 1,100

or 1,600 switches," said Ferguson. "When these guys go up in this, they're primary mission is not to fly this spacecraft, they're primary mission is to go to the space station for six months. We don't want to burden them with an inordinate amount of training to fly this vehicle, we want it to be intuitive."

Other innovative elements of the CST-100 is its weld-free design, modern structures and upgraded thermal protection techniques. The company said its spun-formed shell reduces the overall mass of the spacecraft, as well as the time it takes to build the crew capsule.

"I'm looking forward to the day when we bring our Expedition crew members home, and I won't need a passport or a visa to go to the landing site and greet them as they come off the vehicle," Lueders said.

## VAB turns 50



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# Robotic base in space not far-fetched plan

**By Steven Siceloff**  
Spaceport News

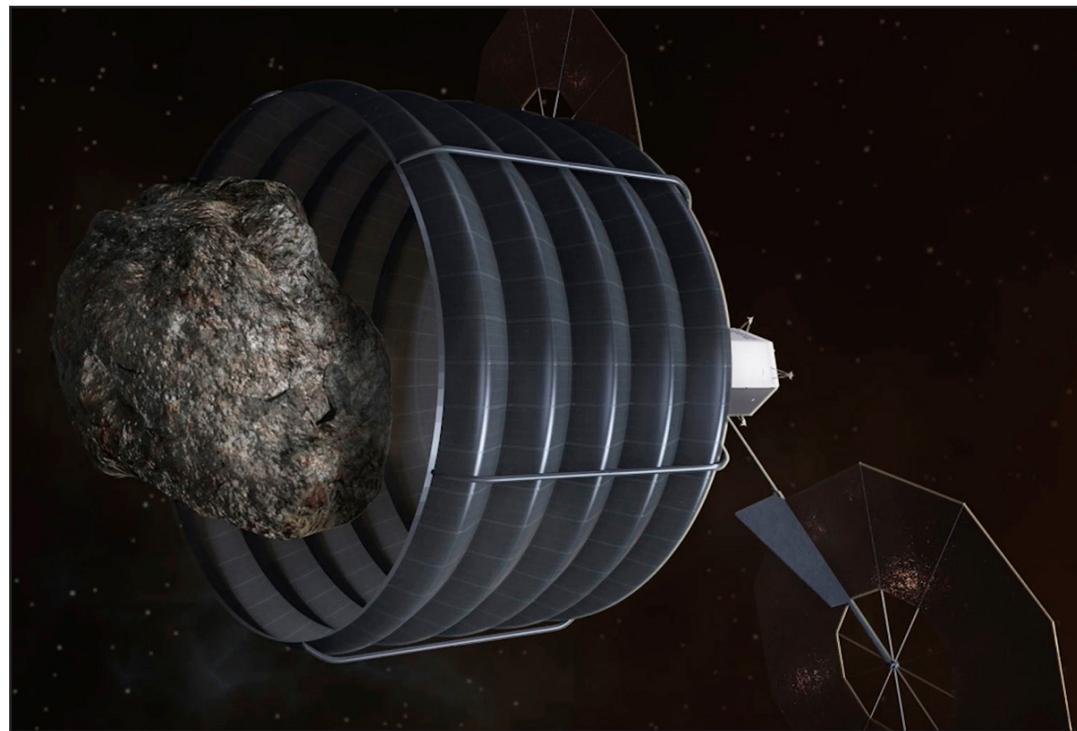
The prospects of a robotic manufacturing base operating off Earth is not as far-fetched as it used to be according to a study published by researchers at Kennedy Space Center.

Advances in robotics and remote manufacturing in the form of 3-D printing offer some tantalizing prospects for future designers to consider as they map out the ways to explore and use resources in the solar system. Also, private companies are establishing goals and abilities to utilize resources available near Earth.

In their paper titled, "Affordable, Rapid Bootstrapping of the Space Industry and Solar System Civilization," published in the June issue of the Journal of Aerospace Engineering, Phil Metzger and James Mantovani of Kennedy's Granular Mechanics and Regolith Operations Lab, Anthony Muscatello of the center's Applied Chemistry Lab and Robert Mueller of the Kennedy Surface Systems Office detail one potential path toward developing a self-sustaining, space-based industry that would use resources from asteroids and other celestial bodies to meet the needs of Earth.

A fully functioning, remote system of robotic excavators and simple machinery is still years away from reality, and much research on asteroids needs to be undertaken. The building blocks of a successful system, however, appear to be in place, the study concluded.

"Robots and machines would just make the metal and propellants for starters," Metzger said. "The first generation of robots makes the second generation of hardware, except the comparatively lightweight electronics



CLICK ON PHOTO

NASA image

NASA's FY2014 budget proposal includes a plan to robotically capture a small near-Earth asteroid and redirect it safely to the Earth-moon system, where astronauts can visit and explore it. Click on the photo to view a video.

and motors that have to be sent up from Earth. It doesn't matter how much the large structures weigh because you didn't have to launch it."

Metzger said the researchers developed a basic computer model to judge the viability of what would be possible. Their data showed six generations of development to "close the loop," meaning robots and automated machines would be able to build and operate themselves without any materials from Earth. Basically, they found that prospect was not as daunting as they thought it would be.

Because asteroids are loaded with minerals that are rare on Earth, near-Earth asteroids and the asteroid belt could become the mining centers for remotely operated excavators and processing machinery. In the future, an industry could develop to send refined materials, rare metals and even free, clean energy to Earth from asteroids

and other bodies.

Two significant developments make this prospect possible: robotics and the discovery of fundamental elements needed to make plastic, rubber and various metals existing throughout space.

"Now that we know we can get carbon in space, the basic elements that we need for industry are all within reach," Metzger said. "That was game-changing for us."

Another critical technology also is developing at just the right time: 3-D printers producing hardware that can be assembled into ever-more-complex machinery and potentially in the future, increasingly capable robots.

"The idea is you start with resources out of Earth's gravity well in the vicinity of the Earth," Metzger said. "But what we argued is that you can establish industry in space for a surprisingly low cost, much

less than anybody previously thought."

The finished minerals could be returned to Earth or used in space to build new machinery or as supplies for astronauts as they explore the solar system.

So where to start?

As part of NASA's recently announced asteroid initiative, the agency is searching for an asteroid of about 500 tons that can be moved into a path within the Earth-moon system so astronauts can visit it as early as 2021 to take samples of the space rock.

"There are some types of asteroids that would be fantastic for space resources," Metzger said. "It's primordial solar system material. You can make plastics and you can make rubber by combining the carbon and the hydrogen."

For the complete story, go to  
<http://www.nasa.gov/kennedy>

# BRS Aerospace leases parachute facility

**By Linda Herridge**  
Spaceport News

A parachute development company will utilize a facility where space shuttle-era parachutes once were processed and prepared for missions.

Kennedy Space Center has signed a new partnership agreement with Ballistic Recovery Systems Inc., or BRS Aerospace, of Miami, for use of the Parachute Refurbishment Facility (PRF) beginning Sept. 3. The 10-year lease agreement will allow BRS Aerospace to operate and maintain the facility at its own expense.

"Kennedy continues working with the commercial community to bring new partnerships to the center, and this latest agreement is a great example of pairing a NASA facility having a previously specialized focus with a U.S. company that has a similar engineering and manufacturing focus," Kennedy Director Bob Cabana said.

According to BRS Aerospace President and CEO Larry Williams, the company will establish an engineering center of excellence at the PRF.

"We will work on new development programs, research, prototyping and



NASA/Jim Grossmann

Center Director Bob Cabana, right, shakes hands with Larry Williams, president and CEO of Ballistic Recovery Systems Inc of Miami, Fla., after signing a new partnership agreement July 19 for use of the Parachute Refurbishment Facility.

engineering specific applications for our customers, which include civilian aircraft, unmanned aerial systems, cargo delivery systems and commercial space applications," Williams said.

BRS Aerospace specializes in whole-airframe emergency recovery parachute systems, personnel parachute systems, low-cost aerial delivery systems, and precision-guided aerial delivery systems.

"We are excited about this opportunity," Williams said. "It's a unique situation where we can repurpose the facility into a commercial use and provide additional, specific capability to commercial space customers. We see a long-term future with NASA and the Kennedy Space Center."

BRS Aerospace also will have access to the Dragonfly wastewater treatment system inside the PRF, where parachutes recovered from saltwater can be decontaminated, and then repaired and repacked for reuse. During the Space Shuttle Program, the PRF was used to manufacture and refurbish solid rocket booster parachutes.

Initially, the company plans on 34 full-time positions, with possible expansions depending on how the commercial space and unmanned aerial systems programs develop.

Kennedy's center planning and development team and the Economic Development Commission of Florida's Space Coast worked with BRS Aerospace to establish the agreement.

Cabana said, "We welcome BRS Aerospace to Kennedy and look forward to a long-standing partnership."

***"It's a unique situation where we can repurpose the facility into a commercial use and provide additional, specific capability to commercial space customers."***

**Larry Williams,**  
President and CEO  
BRS Aerospace



NASA/Jim Grossmann

A worker repairs solid rocket booster parachutes recovered from sea in November 2008 inside the Parachute Refurbishment Facility. BRS Aerospace will begin utilizing the facility Sept. 3 under a 10-year lease agreement.

# VAB remains pillar of America's premiere spaceport



Three large cranes readied for VAB construction.



Pile driving in progress.

**By Bob Granath**  
Spaceport News

**C**onstruction of the Vehicle Assembly Building (VAB) at Kennedy Space Center began a half-century ago this summer. After serving through the Apollo and Space Shuttle Programs, the mammoth structure now is undergoing renovations to accommodate future launch vehicles and to continue as a major part of America's efforts to explore space for another 50 years.

Construction began with driving the first steel pilings on Aug. 2, 1963. It was part of NASA's massive effort to send astronauts to the moon for the Apollo Program. Altogether, 4,225 pilings were driven down 164 feet to bedrock with a foundation consisting of 30,000 cubic yards of concrete. Construction of the VAB required 98,590 tons of steel.

When completed in 1965, the VAB was the largest building in the world with 129,428,000 cubic feet of interior volume. The structure covers eight acres, is 525 feet tall and 518 feet wide.

To accommodate moving, processing and stacking rocket stages, 71 cranes and hoists, including two 250-ton bridge cranes were installed. On the east and west sides are four high-bay doors, each designed to open 456 feet in height, allowing rollout of the Apollo/Saturn V moon rockets mounted atop launch umbilical towers.

The VAB was built 3.5 miles from Launch Pad 39A and 4.2 miles from Launch Pad 39B. A pair of crawler-transporters, among the largest machines ever built to move on land, carried the assembled rockets to the pads.

After the conclusion of Apollo in the 1970s, the building was refurbished to accommodate the space shuttle. Inside the VAB, the shuttle solid rocket boosters were stacked atop a mobile launcher platform. The external fuel tank was attached between the two boosters and the shuttle mounted to the tank. Following three decades of flight, the shuttle was retired in 2011.

Modifications of the VAB are un-

derway to support the Space Launch System (SLS) and Orion spacecraft, which also will result in the ability to process multiple launch vehicle types. SLS will be the agency's advanced heavy-lift launch vehicle, providing a new capability for human exploration beyond Earth orbit. However, NASA also is partnering with private industry on launch vehicle and spacecraft development options for taking astronauts to low-Earth orbit and the International Space Station.

Last year shuttle-era work platforms were removed from the VAB's High Bay 3 as a project of Ground Systems Development and Operations, or GSDO, to accommodate the SLS.

According to Jose Lopez, the VAB senior project manager in the Vehicle Integration and Launch Support Branch of GSDO, the changes are part of a centerwide modernization and refurbishment initiative in preparation for the next generation of human spaceflight.

Lopez noted that some of the utilities and systems scheduled for replacement at the VAB have been used since the facility was built. This initial work is required to support any launch vehicle operated from Launch Complex 39 and will allow NASA to begin modernizing the facilities while vehicle-specific requirements are being developed.

Plans for 2014 include awarding the construction contract for new access platforms, including structures and systems required for the SLS.

Some of the current work has included removal of over 150 miles of obsolete Apollo- and shuttle-era cabling. This will make room for installation of more efficient, state-of-the-art command, communication, control and power systems needed to perform testing and verification prior to the SLS and other rockets being rolled out to the launch pad.

As plans move ahead to outfit the VAB with the new infrastructure, code upgrades and safety improvements, the building will continue in its role as a central hub for the Florida spaceport well into the future.



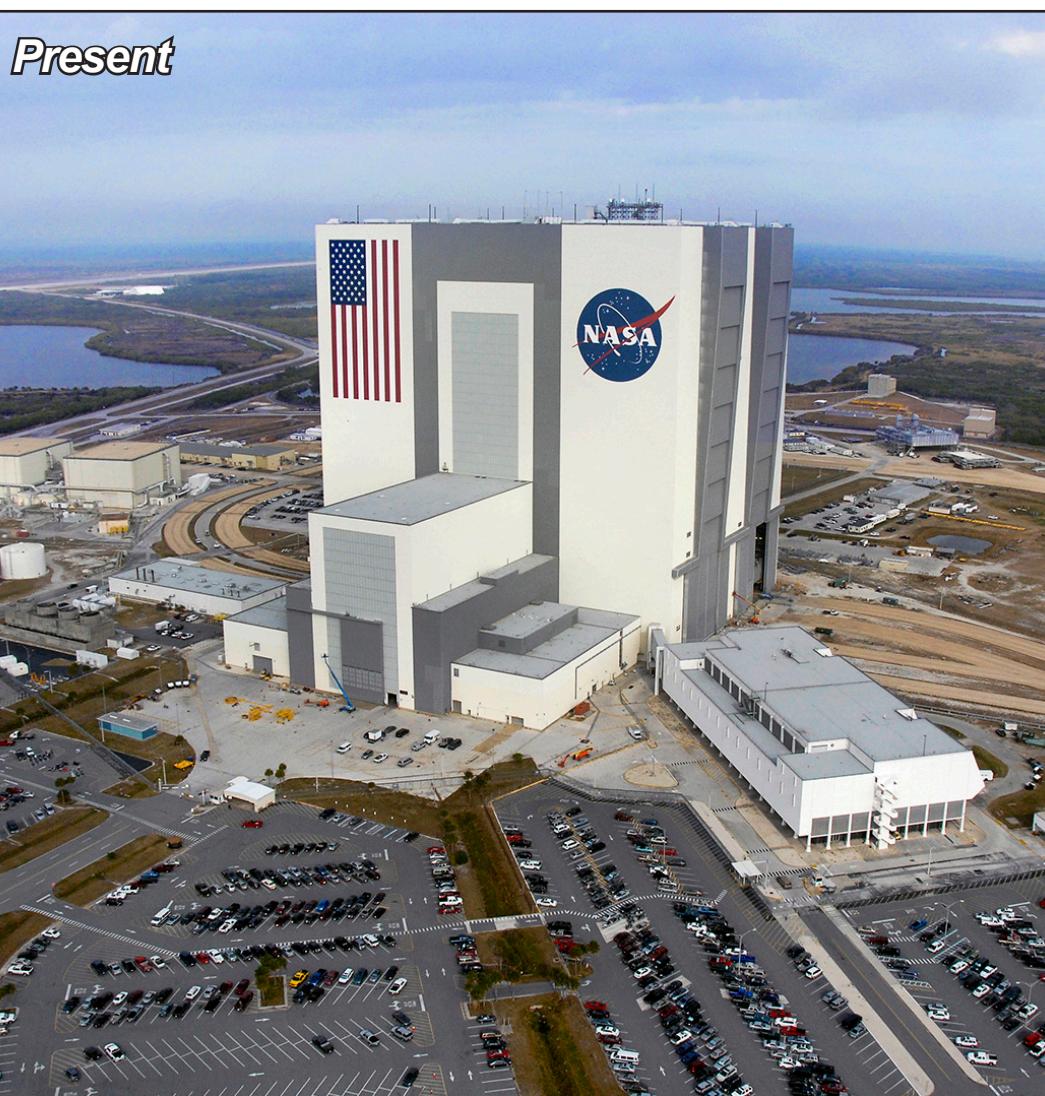
Eight months into construction.



Nearly one year old.



A year and a half after construction start.

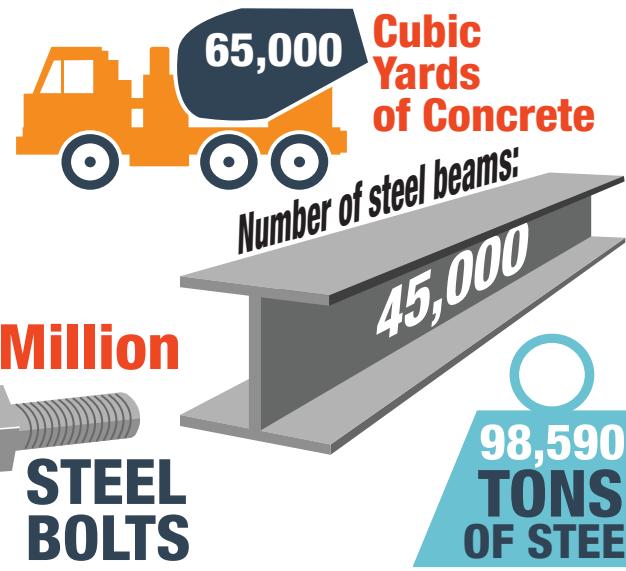


The VAB at 50 and counting.

NASA file photos

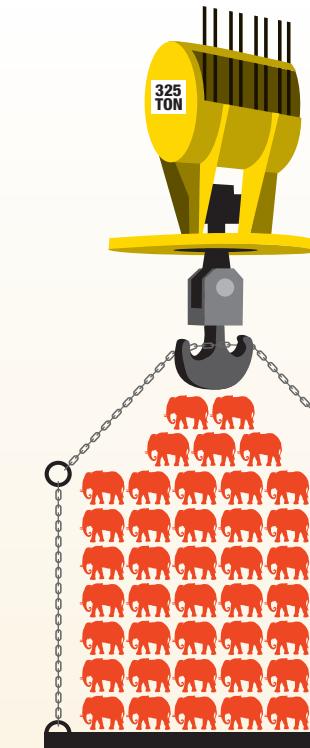
# Did you know...

NASA's Vehicle Assembly Building was constructed using:

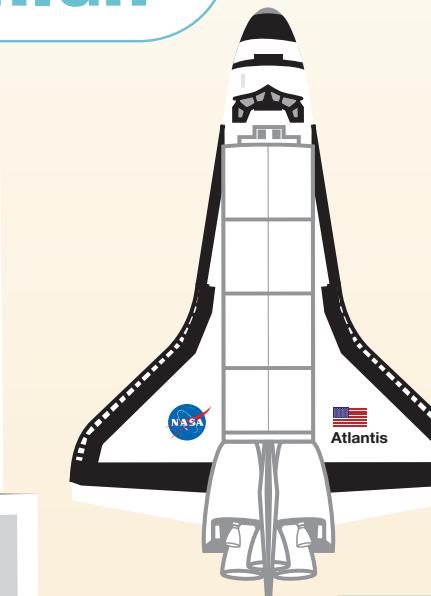


The VAB high bay doors are the largest doors in the world and take about 45 minutes to completely open or close.

The VAB high bay doors are **456 FEET HIGH**

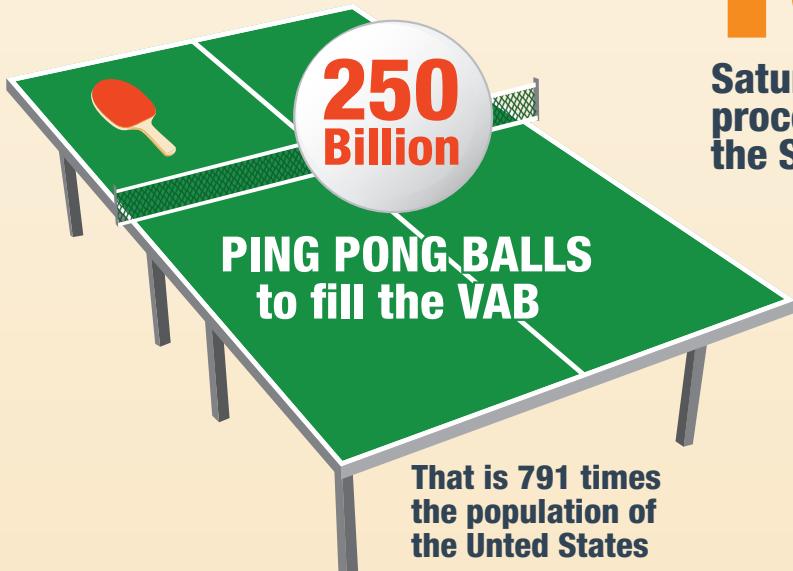


The VAB's 350 TON crane can lift **47** Full grown AFRICAN ELEPHANTS



Space shuttles were prepared in the VAB for **135 MISSIONS**

It would take



**13**

Saturn V rockets were processed for Apollo and the Skylab space station

The American Flag on the front of the VAB is **209 FEET HIGH**  
**110 FEET WIDE**

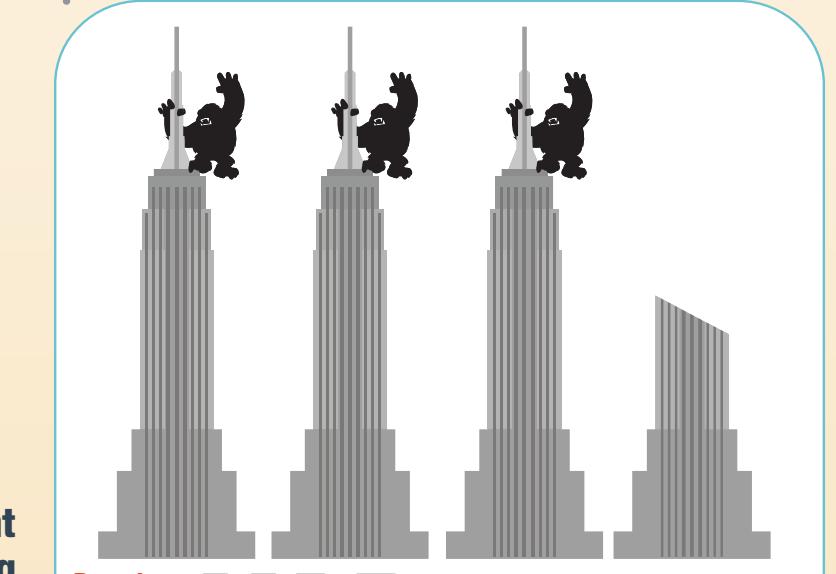
The blue field is the size of an NBA regulation basketball court



Each star is **6 FEET ACROSS**  
Each stripe is **9 FEET WIDE**



It took **6,000** gallons of paint to originally paint the American flag and bicentennial logo on the VAB



By volume the **VAB = 3 1/2 EMPIRE STATE BUILDINGS**

# Scenes Around Kennedy Space Center



Children from the Child Development Center were treated to educational presentations inside the NASA Exploration Station at the Kennedy Space Center Visitor Complex June 26.



[CLICK ON PHOTO](#)

NASA/Jim Grossmann

A technician builds up a movable launch platform for the Project Morpheus lander at the midfield of the Shuttle Landing Facility (SLF) July 25. Testing of the prototype lander has been ongoing at NASA's Johnson Space Center in Houston in preparation for the lander's free flight. The SLF will provide the kind of field necessary for realistic testing, complete with rocks, craters and hazards to avoid. For more information on Project Morpheus, click on the photo.



## Ice cream raises funds for DAAWG, LGBT network

Workers beat the heat and helped raise money during an ice cream social fundraiser sponsored by the Disability Awareness and Action Working Group (DAAWG), and the Lesbian, Gay, Bisexual and Transgender (LGBT) Employees and Allies Network July 23 in Room 2229 at Headquarters. Among the treats offered were root beer floats and home-made baked goods.



Photos by NASA/Charisse Nahser



NASA/Jim Grossmann

The Kennedy Space Center team made up of workers from The Boeing Company, United Space Alliance, Jacobs Technology and NASA civil service personnel were given the Silver Dollar Award July 17 at the Space Station Processing Facility. The team provided outstanding support in processing and delivering 20 "flight configured" LiOH canisters in support of HTV-4 to Johnson Space Center earlier than the originally requested delivery date.

# Health, Fitness Day targets personal goals

**By Rachel Hojnacki**  
Spaceport News

The National Employee Health and Fitness Day returned to Kennedy Space Center July 24 after a three-year absence. Organized by the KSC Fitness Center, employees had the chance to participate in a foam rolling clinic, cardio dance class, yoga, boot camp, or attend the vendor expo.

According to Lindsey Fisher, wellness specialist at the KSC Fitness Center, the goal of Kennedy's National Employee Health and Fitness Day is to promote "health education and wellness, stress management, nutrition and fitness."

To achieve the National Employee Health and Fitness Day goal, Fisher teamed up with Wellness program manager Jessica Sapp and interns Alyssa



NASA/Daniel Casper

Mark Hiebert, of the Running Zone, talks to a NASA employee in the O&C Mission Briefing Room during the National Employee Health and Fitness Day event July 24. Employees also had the opportunity to be tested for diabetes, enter a raffle for prizes and get a five-minute massage. Other vendors shown in the background are Sunseed Co-op's Marcia Cooney, center, and Bridget Griffin from the YMCA of Titusville.

Handeland and Austin Howlett. Together they recruited organizations for the vendor expo that represent the seven dimensions of wellness: physical, social, spiritual, environmental, occupational, emotional and intellectual.

"Our long-term goal is to increase employee participation, make employees aware of what we offer and to know that with our help we can increase their well-being," said Fisher. The National Employee Health and Fitness Day acted as a kick

start for this long-term goal by giving employees the opportunity to tour the facility and sign up for a membership.

The four group fitness classes were offered throughout the day and were open to all Kennedy employees. The cardio dance class was a one-time opportunity, brought to Kennedy by the Titusville YMCA. Classes similar to those featured at the National Employee Health and Fitness Day have been offered throughout the summer at the KSC Fitness Center, as have personal training opportunities by appointment with Howlett.

With help from interns, the KSC Fitness Center has been able to offer personal training, group exercise classes and outreach on health and wellness programs this summer.

Membership to the KSC Fitness Center is free to all employees.

## BEST BBQ fires up scholarship fundraising efforts

**By Brittney Longley**  
Spaceport News

With summer comes fun in the sun at the beach, fireworks and barbecues.

And for the past 13 years, Kennedy Space Center's Black Employee Strategy Team (BEST) has served some of the best barbecue around.

BEST hosts the barbecue as a fundraiser for the Evelyn Johnson Scholarship, which is handed out every year to students who exemplify significant achievement both academically and in their community. The scholarship is in honor of Evelyn Johnson, a founding member of BEST and former deputy director of Kennedy's Diversity and Equal Opportunity office. Johnson was highly regarded for her work with students enrolled in the educational programs at Kennedy. The scholarship was established to continue Johnson's legacy of helping others to attain their personal and career goals.

"It is important to give back to our students and help them grow," BEST chairman



NASA file/2012

Betty Lee Williams, left, and Lorene Williams change out food trays during the 2012 BEST BBQ as Lisa Zuber looks on.

Anthony Harris said.

This year's event is Friday, July 26, from 3 to 6 p.m. at KARS Park I, Area 1. The event offers workers, families and friends the opportunity to mingle and network while enjoying great food, fun and entertainment. It also provides an opportunity to welcome new students and employees to the center.

"Giving back to the community is always important, and the barbecue is a great way to give back," Alphonso Jenkins, BEST barbecue committee head said. "This barbecue also allows the interns to meet members within the BEST community."



NASA file/2012

Thomas Cooper works the grill during the 2012 BEST BBQ.

## NASA Employees of the Month: July



NASA/Rick Wetherington

Employees of the Month for July are, from left, Nicole F. Dufour, Engineering and Technology; Jennifer E. Van Den Driessche, Ground Processing; Thomas "Rich" Lundgren, Ground Systems Development and Operations; Herschel "Grady" McCoy, Center Operations; William J. Hill, Engineering and Technology; Dana M. Hutcherson, Commercial Crew Program; Sabrina M. Yedo, Launch Services Program. Not pictured is Hung (John) M. Nguyen, Safety and Mission Assurance.

## Looking up and ahead . . .

**\* All times are Eastern**

**July 27**

**Mission:** ISS Resupply

**Launch Vehicle:** ISS Progress 52

**Launch Site:** Baikonur Cosmodrome, Kazakhstan

**Launch Time:** TBD

**Description:** Progress 52 will carry supplies, hardware, fuel and water to the International Space Station (ISS).

**Aug. 3**

**Mission:** ISS Resupply

**Launch Vehicle:** ISS HTV-4

**Launch Site:** Tanegashima Space Center, Japan

**Launch Time:** TBD

**Description:** The HTV-4 will deliver 3.6 tons of dry cargo, water, experiments and spare parts to the International Space Station.

**Sept. 6**

**Mission:** Lunar Atmosphere and Dust Environment Explorer (LADEE)

**Launch Vehicle:** Minotaur V

**Launch Site:** Wallops Flight Facility, Va.

**Launch Time:** 11:27 p.m.

**Launch Pad:** Mid-Atlantic Regional Spaceport Pad 0B

**Description:** LADEE will gather detailed information about conditions near the surface and environmental influences on lunar dust. A thorough understanding of these influences will help researchers understand how future exploration may shape the lunar environment and how the environment may affect future explorers.

**Sept. 14**

**Mission:** Orbital Sciences Demonstration Flight

**Launch Vehicle:** Antares

**Launch Site:** Wallops Flight Facility, Va.

**Launch Time:** TBD

**Launch Pad:** Mid-Atlantic Regional Spaceport Pad 0A

**Description:** Orbital Sciences will launch a demonstration mission to the International Space Station, testing out the Cygnus cargo vehicle as part of NASA's Commercial Orbital Transportation Services program.

To watch a NASA launch online, go to <http://www.nasa.gov/ntv>.

## NASA Spinoffs: Did You Know?



NASA file photos

## VAB technology continues to keep things running smooth

By Kevin Ball

Spaceport News

As the Vehicle Assembly Building (VAB) celebrates its 50th anniversary, innovations developed to support its operations continue to be used today. Initially contracted by Lockheed Martin Space Operations in 1994, Sun Coast chemicals created an environmentally friendly lubricant spray called Crawler Track Lubricant (right).

This cutting-edge product

was used to lubricate the six-million-pound Mobile Launch Platform which hauled various spacecraft from the VAB to the launch pad.

Train Track Lubricant, Penetrating Spray Lube, and Biodegradable Hydraulic Fluid were all spinoff products of the lubricant.

The X-1R Tackle Pack, which was developed for fishing fanatics, protects fresh and saltwater reels from the elements.

For more about NASA Spinoffs, go to <http://www.nasa.gov/spinoffs>.



John F. Kennedy Space Center

## Spaceport News

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Managing editor . . . . .	Chris Hummel
Editor . . . . .	Frank Ochoa-Gonzales
Assistant editor . . . . .	Linda Herridge
Copy editor . . . . .	Kay Grinter

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