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# Spaceport News

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

# Pad B flame trench upgrades ignite new era

*By Linda Herridge*
*Spaceport News*

NASA/Jim Grossmann

At Launch Pad 39B, construction workers continue to remove the flame trench deflector that sits below and between the parallel crawlerway tracks June 12. Kennedy Space Center is preparing the pad to support NASA''s Space Launch System rocket and a variety of other commercial launch vehicles.

For the first time since NASA's Apollo-era rockets and space shuttles lifted off from Kennedy Space Center's Launch Complex 39, one of the launch pads is undergoing extensive upgrades to support the agency's 21st century space launch complex.

At pad B, construction workers are removing the legacy flame deflector that sits below and between the parallel surface crawlerway track panels, along with Apollo-era bricks from both walls of the flame trench. A contract to perform the work was awarded earlier this year to Vanguard Contractors in Paducah, Ky.

"A new universal flame deflector is being designed that will support NASA's Space Launch System (SLS) rocket and a variety of other commercial launch vehicles," said Jose Perez Morales, the pad element project manager in the Ground Systems Development and Operations Program. "The bricks will be removed due to their age and because they are debonding from the flame trench structure."

Dr. Bruce Vu, the Gas and Fluid Systems lead in the Design and Analysis Branch in Kennedy's Engineering Directorate, with assistance from NASA's Ames Research Center at Moffett Field, Calif., worked with three different design concepts and used several computational methods to analyze each design's performance.

"We spent almost a year working with other NASA centers and the commercial space partners to come up with several concepts," Vu said. "The three primary objectives we focused on while evaluating these concepts were plume containment, surface pressure and thermal performance."

For several weeks, Vu and his team ran simulations of a single launch vehicle over a flame deflector concept, using Ames' supercomputer. They were looking for a deflector design that could withstand the high heat from plume exhaust that did not result in plume blow-back and whose surface pressure was within design margin limits.

"At the end of the simulations, we selected the best design, which actually is closer to that of Apollo rather than space shuttle," Vu said.

The firm Reynolds, Smith and Hills, with offices in Merritt Island, is designing the new flame deflector and will manage the refurbishment of the flame trench.

"The goal is to create a deflector design that will be less costly to construct and more efficient," Vu said.

The new flame deflector and flame trench designs are scheduled to be completed in early 2014. The construction of the flame trench and deflector is scheduled to start in early 2015.

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

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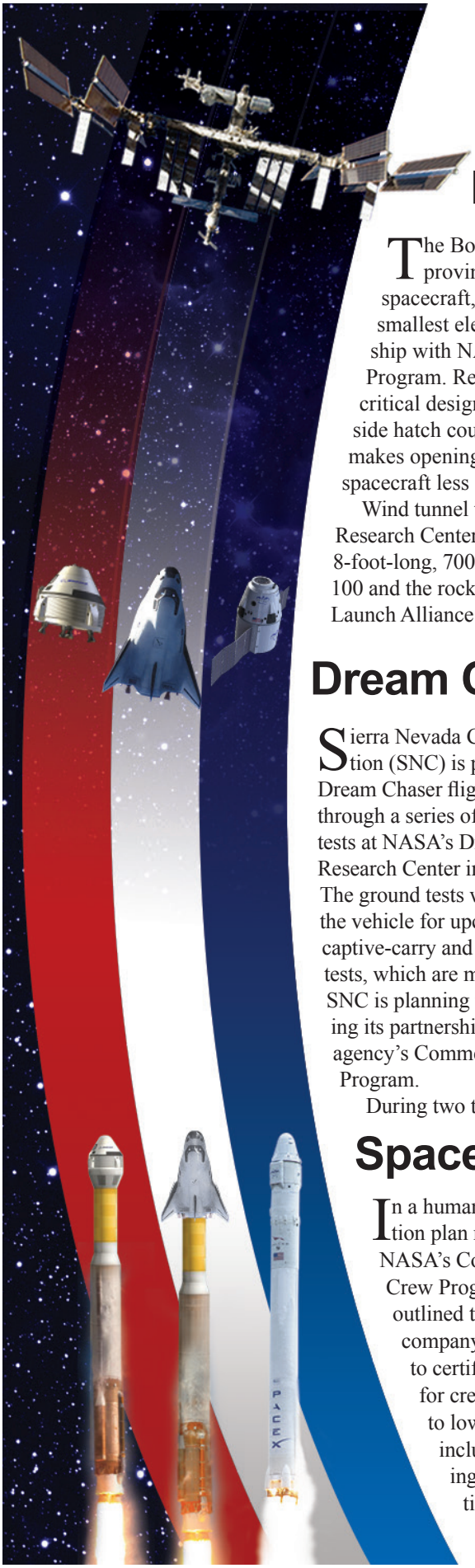


# CCP Update

*By Rebecca Regan and Steven Siceloff*

For the latest Commercial Crew Program news, go to ***http://www.nasa.gov/commercialcrew***

## Focus on details pay off for CST-100

The Boeing Company is focused on proving the designs of its CST-100 spacecraft, from the big picture to the smallest element, throughout its partnership with NASA's Commercial Crew Program. Recent progress includes a critical design review for the spacecraft's side hatch counterbalance, a device that makes opening and closing the door to the spacecraft less strenuous.

Wind tunnel testing at NASA's Ames Research Center in California evaluated an 8-foot-long, 700-pound model of the CST-100 and the rocket it will fly on, a United Launch Alliance Atlas V. It experienced winds simulating flight at speeds from Mach .4 to Mach 1.3, well above the speed of sound. In addition to the sophisticated hardware under development, engineers are making strides on the complex software needed to operate the spacecraft through every phase of flight.

A scale model of a Boeing CST-100 on a United Launch Alliance Atlas V.

## Dream Chaser rolls through ground tests

Sierra Nevada Corporation (SNC) is putting its Dream Chaser flight vehicle through a series of ground tests at NASA's Dryden Flight Research Center in California. The ground tests will prepare the vehicle for upcoming captive-carry and free-flight tests, which are milestones SNC is planning to meet during its partnership with the agency's Commercial Crew Program.

During two tow tests, a pickup pulled the Dream Chaser flight vehicle on Dryden's concrete runways to validate the performance of the spacecraft's nose skid, brakes, tires and other systems. The company has performed the tests at 10 and 20 mph, and is working toward 40 and 60 mph tests later this month. Range and taxi tow tests are standard for vehicles that touch down on a runway to prove the overall spacecraft handling post-landing.

Sierra Nevada Corporation's Dream Chaser undergoes one of two tow tests May 31.

## SpaceX completes two critical reviews

In a human certification plan review with NASA's Commercial Crew Program, SpaceX outlined the steps the company plans to take to certify its system for crewed missions to low-Earth orbit, including testing, demonstrations, analyses, inspections, verifications and training events.

SpaceX also presented its plans for a pad abort test, targeted for later this year or early next year from Cape Canaveral Air Force Station's Space Launch Complex 40. During the test, SpaceX will perform a recovery operation following a simulated Falcon 9 anomaly. Plans call for the company to put one of its Dragon capsules on a launch pad test stand, count down to T-0, ignite the system's SuperDraco abort engines and initiate a separation command. At around 5,000 feet, the spacecraft's parachutes will deploy, resulting in a splashdown in the Atlantic Ocean.

An artist concept of SpaceX's Dragon launch abort system in flight.

# Fit check sets stage for Orion recovery test

*By Linda Herridge*
*Spaceport News*

Engineers and technicians at Kennedy Space Center, Langley Research Center in Virginia and Lockheed Martin Space Operations in Denver, Colo., prepared unique hardware used June 25-28 in a fit check of equipment to recover Orion upon splashdown in the Pacific Ocean. The recovery operations are led by Kennedy's Ground Systems Development and Operations Program.

After traveling 3,600 miles above the Earth for its Exploration Flight Test-1 (EFT-1) mission in September 2014, Orion will splash down for a landing in the Pacific Ocean, where it will be recovered with the help of the United States Navy. A test of the recovery equipment and procedures will take place in August at the Naval Station Norfolk port facility in Norfolk, Va. To be ready for that test, a fit check of the hardware was conducted at the "Trim Pad" near Langley.

The crew module recovery cradle designed by Lockheed Martin, the boilerplate handling fixture bumper assembly designed by Kennedy, and the Orion boilerplate test article (BTA) -- a life-size test version of the spacecraft designed and built by Langley -- were assembled and tested in one place for the first time.

The BTA originally was used for water impact testing at Langley's hydro impact basin for the Orion Structural Passive Landing Attenuation for Survivability of Human-crew (SPLASH) project. Langley redesigned, analyzed, and modified the BTA to simulate the EFT-1 crew module's mass properties and improve its water resistance for recovery operations.

"One of the goals of this fit check was to practice putting together and taking apart the recovery hardware," said Mike Generale, Orion recovery operations manager and recovery test director at Kennedy. "It's a chance to learn how to operate the newly developed hardware and confirm that it is compatible."

The "Trim Pad" is a large area of concrete near the hangar where the hardware was stored for the fit check. Prior to checkout, the team painted the outline of a ship's well deck onto the concrete in order to confirm that the configuration of the recovery hardware will fit.

The one-of-a-kind handling fixture assembly was developed at Kennedy's Prototype Laboratory and manufactured at the center's Launch Equipment Test Facility by several Engineering Services contractors. It is the first piece of landing and recovery hardware to be completed and delivered to Langley in May.

NASA/Jeremy Parr

The boilerplate handling fixture bumper assembly, shown here April 25, was designed and manufactured at Kennedy Space Center for Orion recovery testing.

Jeremy Parr, a mechanical design engineer in the center's Prototype Laboratory, led the efforts to create the handling fixture using computer-aided design programs.

"We started with an initial design using computer modeling," Parr said. "As the requirements were refined, we kept working toward a final design. The design portion took about one month to achieve."

Essentially, the handling fixture is a steel beam frame about 17 feet wide and 19 feet long. The fixture has a bolt-on bumper assembly with cushions, or bumpers, that float up and down on guide rails. The assembly frame and bumper will be used to guide the Orion test article into the proper orientation over the handling fixture.

"The handling fixture allows NASA to move the test article into and out of the Navy recovery ship," Generale said. "It also will serve as a fixture for storing the test article securely on board the recovery ship."

The crew module recovery cradle then will be used to secure the Orion crew module in the recovery ship and to move it out of the ship after returning to port.

The fit check also gave the team the opportunity to see how NASA procedures and hardware mesh with procedures and hardware developed by the Navy.

SPLASH operations and integration manager Lisa Hawks said, "The collaboration between the Navy and NASA during the fit check ensured operational success and will benefit the Orion EFT-1 mission."

CLICK ON PHOTO NASA/Jim Grossmann

The boilerplate test article seen here Nov. 21, 2011, was modified at Langley Research Center in Virginia for Orion recovery testing. To watch a video of the fit check, click on the photo.

# Robotic gardens will aid deep-space missions

*By Bob Granath*
*Spaceport News*

Future space travelers on long missions may be aided by robotic farmers. Students from the University of Colorado Boulder recently demonstrated how such a system could work at Kennedy Space Center. The group is developing remote plant production technology for use on the space agency's deep-space habitat prototype.

The team of 11 students from the University of Colorado and one from Colorado State University developed the Robotic Gardening System as part of a graduate course sponsored by NASA and the National Space Grant eXploration Habitat, or X-Hab, Academic Challenge.

"We're involved in a one-year project management class that implements the systems engineering approach to complete the production of actual hardware," said Heather Hava, who is working on a doctorate in aerospace engineering sciences with a focus in bioastronautics at the University of Colorado. "Our focus is on an automation strategy -- building the robotic hardware and developing demonstration concepts."

The Academic Innovation Challenge is a university-level activity designed to engage and retain students in STEM disciplines -- science, technology, engineering and math. NASA benefits from the effort by sponsoring the development of concepts from universities which may result in new approaches that could be applied to future exploration habitats.

NASA/Jim Grossmann

Heather Hava, who is working on a doctorate in aerospace engineering sciences at the University of Colorado, describes her team's Robotic Gardening System to Tracy Gill of NASA's Center Planning and Development Directorate at Kennedy Space Center on June 21.

On June 21, the Colorado X-Hab team showed how their Remote Plant Production System works during a demonstration at Kennedy's Swamp Works where NASA scientists work on developing rapid, innovative and cost-effective exploration mission solutions through partnerships across NASA, industry and academia.

"We want to engage university teams in developing new technologies," said Tracy Gill of Kennedy's Center Planning and Development Directorate. "This innovation challenge is in its third year. While based at NASA's Johnson Space Center in Texas, Kennedy is one of the supporting centers."

Gill added that the team is benefiting from working with Kennedy plant biologists such as Wheeler and Gioia Massa, Ph.D., of the International Space Station Ground Processing and Research Project Office.

"Both scientists are key contributors to payload development efforts at Kennedy for plant studies aboard the space station including a vegetable production unit called Veggie and the experimental growth chamber called Advanced Plant Habitat (APH)," he said.

The group from the University of Colorado is developing the capability to grow a variety of plants, both for consumption and for oxygen-carbon dioxide recycling on long-term spaceflights.

"Their system is a stand-alone project focusing on what future hardware should look like," Gill said. "They are path-finding the kinds of technologies we need to evolve systems such as Veggie and APH and pave the way to bio-regenerative environmental control systems that will enable long-term, deep-space missions."

A robotic probe in another position can check the soil to determine its moisture content and then can add water and nutrients.

"Software is also being developed to allow a robotic arm to grip and cut leaves, as well as harvest fruit," Hava said.

Hava noted that her team also is studying both the physiological and psychological benefits of growing plants in space.

"We want to see what parts of plant care people enjoy and use this data to develop an automation strategy to maximize the plant interaction benefits for astronauts," she said.

NASA/Jim Grossmann

Students from the University of Colorado demonstrate a robotic capability for growing a variety of plants in space as part of the eXploration Habitat, or X-Hab, Academic Innovation Challenge, at Kennedy's Space Life Sciences Laboratory on June 21.

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

# Scenes Around Kennedy Space Center

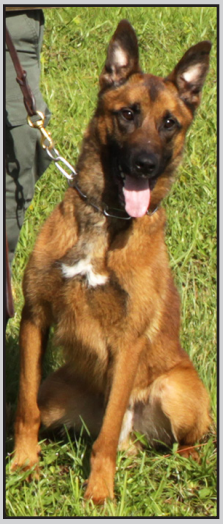
## Latest additions to Security Police happily patrolling Kennedy

Two Belgian Malinois dogs who arrived at Kennedy Space Center a year ago and completed training in November are eagerly patrolling the center.

At left is LJ (Loetje), who is 2½ years old. At right is DJ (Django), who is 3.

Both dogs have been trained to detect explosives, track lost or wanted people, and apprehend violent criminals.

*Photos by NASA/Jim Grossmann*



*For NASA*

Children of Lockheed Martin and United Launch Alliance employees enjoyed a full day of mind-expanding activities through a program called Young Minds At Work (YMAW) on July 9, at Cape Canaveral Air Force Station. The various YMAW sessions included a ULA Atlas V and Delta IV mock launch countdown, Captain Orion and His Amazing Flying Machines, and several tours

*CLICK ON PHOTO* *NASA/Jim Grossmann*

Camp Kennedy Space Center participants get an up-close look at the space shuttle Atlantis during a week-long summer program for students entering second through ninth grades at the visitor complex June 21. The new $100 million facility includes interactive exhibits that tell the story of the 30-year Space Shuttle Program and highlight the future of space exploration. For more, click on the photo.

*CLICK ON PHOTO* *NASA*

Kennedy Space Center's Pathway Intern Employment Program welcomes new and returning Pathways interns for their 2013 summer rotation in front of Headquarters on June 17. There currently are 109 Pathways interns at Kennedy. For more about the program, click on the photo.

# Technology may breathe life, safety into mines

Photos by NASA/Daniel Casper

Representatives from Kennedy Space Center, BCS Life Support, LabTech and URS demo a Cryogenic Refuge Alternative Supply System, or CryoRASS, and a smaller liquid-air filled backpack called CryoBA, short for Cryogenic Breathing Apparatus, in Titusville, Fla. on June 13.

***By Rebecca Regan***
*Spaceport News*

A technology used by NASA to protect crews working around hazardous gases soon could be called on for a number of life-saving applications as well as the agency's new human spaceflight endeavors.

The Cryogenic Refuge Alternative Supply System (CryoRASS) and a smaller liquid air-filled backpack under development in Kennedy Space Center's Biomedical Lab have the potential to store more than twice the amount of breathable air than traditional compressed gas systems.

Lead NASA engineer David Bush and teams from BCS Life Support, URS Corp. and InoMedic Health Applications began working on the two systems in September 2012.

The National Institute for Occupational Safety and Health (NIOSH) is funding both projects in the hopes that the liquid air-based systems could change the way coal miners seek refuge or flee from underground disasters. Bush and his team see far more potential for the cryogenic technology in terms of rescue operations, ranging from commercial applications to future crewed missions to space.

"We're excited about this cryogenic technology because it has the potential to save lives and improve safety in mines," Bush said. "Currently mines use big tube banks of compressed air with no cooling. Our solution uses smaller, lower pressure dewars of liquid air with cooling."

The agency has used the cryogenic technology in its rescue crew SCAPE suits, short for Self-Contained Atmospheric Protective Ensemble, since the Mercury Program in the 1960s.

The way CryoRASS and the backpack, called CryoBA, work is by drawing air into a closed environment, then vaporizing and circulating it back to the user. Bush describes the systems as "passive air conditioners" and said initial demos show a drop in temperature by about 15 degrees. Since many refuge chambers stand no more than 30 inches tall, cooling likely would be a welcome feature.

"When you get about 10 men in a small confined space, essentially laying down in tin cans, with their body heat, it can get really hot in there," Bush said.

Another advantage to the liquid air systems is improved safety.

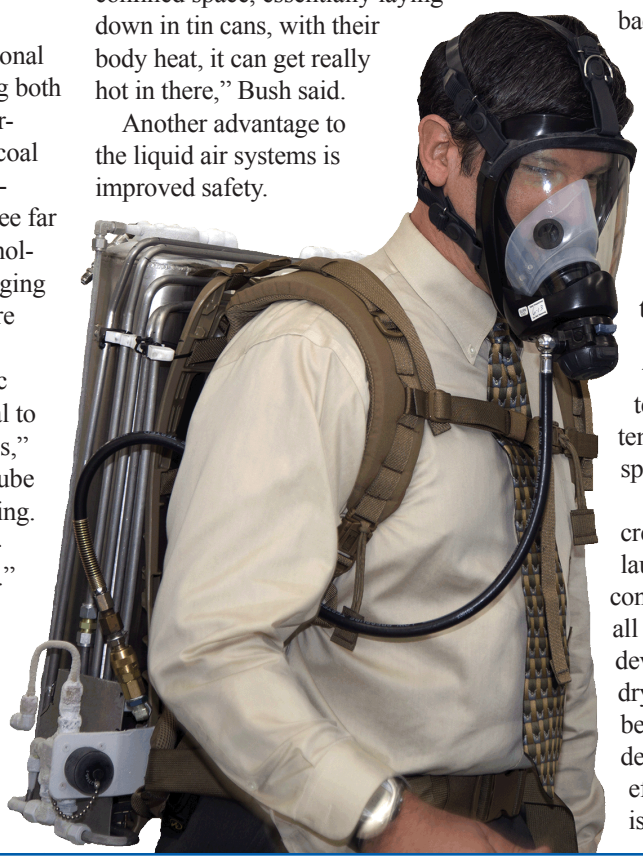
"Compressed air has its own hazards because it's stored at a high pressure. It's also heavy and takes up a lot of space," Bush said, "Compressed 100 percent oxygen can present potential fire hazards."

Many refuge chambers are designed to provide up to 96 hours of breathable air, but Bush said CryoRASS could easily exceed the minimum requirements allowing more time for the miners to be rescued. Another plan being discussed is to build refill stations in mines spaced about 90 minutes apart, so that crews could walk out of a disaster situation with their personal CryoBA backpacks.

"NIOSH asked us to develop prototypes that we will test to their standards," Bush said. "The idea is that once we successfully test them, we can demonstrate the technology to commercial life-support providers for use in other applications, such as firefighting and military rescue operations."

As Bush and his team continue to advance and refine the cryogenic technology, they are gaining some attention from the agency's newest human spaceflight programs.

"In an emergency situation, rescue crews will have to go up some sort of launch structure, pull a crew out of a confined capsule, and get them to safety all within the span of their breathing device," Bush said. "We did a rescue dry run with a mock Orion capsule and, because the entryway is small, having a device with a smaller profile that is more efficient with the weight-to-space ratio is helpful."



At right, Kennedy Space Center lead engineer David Bush demos a small liquid air-filled backpack called CryoBA, short for Cryogenic Breathing Apparatus, at BCS Life Support in Titusville, Fla.

NASA/Tim Jacobs

Black Employee Strategy Team (BEST) co-chairman DeAntae Cooper shares the new initiative and goals during the BEST Town Hall Meeting at the Kennedy Learning Institute on June 20.

# BEST looks forward to next two years

*By Brittney Longley*
*Spaceport News*

Bill Gates, known for his leadership in technological innovation, once said, "As we look ahead into the next century, leaders will be those who empower others." Empowering others is exactly what the Black Employee Strategy Team (BEST) is looking forward to over the next two years, as the leadership and direction of the Employee Resource Group (ERG) has changed.

BEST's goal is to support Kennedy through activities that foster relationships and communication among all employees and to encourage leadership and career growth, particularly among African-American employees.

BEST selects new officers every two years, giving new officers a chance to bring new ideas and foster new goals for the organization. The new members of the BEST executive committee are Anthony Harris, chair; DeAntae Cooper, co-chair; Gerrard Abraham, treasurer; Amber Allen, secretary; and Brittney Longley, marketing. The executive committee created new initiatives and goals for BEST and presented those ideas to the membership at their townhall meeting on June 20 at the Kennedy Learning Institute.

NASA

Black Employee Strategy Team (BEST) officers shown here June 20 are, from left, DeAntae Cooper, co-chair; Anthony Harris, chair; Amber Allen, secretary; and Gerrard Abraham, treasurer. Not pictured is Brittney Longley, marketing.

"We want to focus on goals that will encourage the members of BEST to grow and develop in order to remain competitive and serve at a high level in the workplace," said Anthony Harris, an energy engineer and new member of BEST's executive committee.

Some of the goals touched on during the town hall meeting were professional development, embracing generation Y, partnering with fellow ERGs, understanding BEST history and embracing it for the future, and increasing the number of fundraisers and events.

"We want to bridge the gap between seasoned employees and new employees and interns, said DeAntae Cooper, student trainee for Launch Services Program. "The seasoned employees become more excited about life from the interns and new employees, and in turn, the new employees and interns become excited for their future."

*"It's always exciting to see that the membership is behind you and what you plan to accomplish."*

Anthony Harris, chair,
Black Employee Strategy Team

The focus of BEST is not only to grow within the walls of Kennedy, but also to build relations within the community with their annual Evelyn Johnson scholarship.

"We hope this year that we can raise more money for the scholarship and are able to either give recipients more money or to increase the number of recipients that receive the scholarship," Gerrard Abraham, program analyst for the Launch Services Program, said, "The BEST executive committee and its members are enthusiastic of the future that the ERG holds."

"It's always exciting to see that the membership is behind you and what you plan to accomplish," said Harris. "The momentum they have is monumental and we look forward to the future of BEST."

## 2013 BEST BBQ

The KSC Black Employee Strategy Team (BEST) is hosting its annual 2013 BEST BBQ on Friday, July 26, at KARS Park 1, Area 1. All Kennedy employees, CCAFS employees, interns, co-ops, and their family and friends are invited. This year's celebration will feature delicious barbecue, a homemade dessert contest, and door prizes.

## NASA Employees of the Month: June

NASA/ Tom Farrar

Employees of the Month for June are, from left, Rutha M. Williams, Safety and Mission Assurance; Janet C. Thodos, Procurement; Sheryl D. Koller, Education and External Relations (Employee of the Quarter); and Michael A. Dupuis, Engineering and Technology. Not pictured are Matthew A. Bzura, Human Resources (Employee of the Quarter); Nicholas S. Reinert, Office of the Chief Financial Officer; Jeffrey S. Thon, Engineering and Technology; Daniel K. Clark, Ground Processing; Michael T. Barth, Center Operations; and Jeerapong Wongchote, Launch Services Program.

# 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. 25**
**Mission:** Expedition 37/38
**Launch Vehicle:** Soyuz 36 (TMA-10M)
**Launch Site:** Baikonur Cosmodrome, Kazakhstan
**Launch Time:** TBD
**Description:** Soyuz TMA-10M will carry three Expedition 37/38 crew members to the ISS. They are NASA astronaut Michael Hopkins and Russian Cosmonauts Oleg Kotov and Sergey Ryzansky.

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

## *NASA Spinoffs: Did You Know?*

# NASA technology keeps temps in comfort zone

***By Kevin Ball***
*Spaceport News*

Cookouts, vacations, and swimming pools are synonymous with this time of year. Contrasting summertime fun is the heat that comes with it, but temperatures on Earth seem cozy when compared to the International Space Station (ISS), which endures heat up to 250 degrees Fahrenheit.

To combat this immense heat, NASA and Mainstream Engineering Corp. created the Thermal Control System (TCS). The TCS actively cools the ISS interior, which keeps the astronauts cool and comfortable.

The NASA technology has been refined for products such as PuraClean liquid spray and QwikShot acid flush that enable air conditioning systems here on Earth to perform more efficiently.

These two products are examples of how technological advances at NASA benefit everyone on Earth and in space.

NASA

NASA technology led to the development of the QwikShot acid flush under a NASA Small Business Innovation Research (SBIR) award. It is designed to improve the performance of any type of air filter, such as those used in a household, laboratory, hospital, automobile or school, without leaving a residue.

NASA

Thanks to the advanced control systems aboard the International Space Station, NASA astronaut Karen Nyberg enjoys a comfortable environment while in orbit June 3.

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

John F. Kennedy Space Center

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